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Case Report

Grisel's syndrome and Down syndrome: a case report

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Abstract: Grisel's syndrome is a non-traumatic subluxation of the atlantoaxial joint following an inflammatory process in the upper respiratory tract. Patients with Down syndrome have higher risks of developing atlantoaxial instability. This issue is mainly due to low muscle tone, loose ligaments, and alterations to the bone in patients with Down syndrome. Accompaniment of Grisel's syndrome and Down syndrome was not perused in recent investigations. To our knowledge, only one case of Grisel's syndrome in an adult patient with Down syndrome has been reported. In this study, we present a case of Grisel syndrome in a 7-year-old boy with Down syndrome following lymphadenitis. A 7-year-old boy with Down syndrome was admitted to the orthopedic ward of Shariati hospital with a possible diagnosis of Grisel's syndrome and treated with mento-occipital traction for ten days. In this case report, we represent a child with Down syndrome with Grisel's syndrome for the first time. We also imitated a simple and applicable non-surgical treatment for Grisel's syndrome.

Keywords: Grisel's syndrome, Down syndrome, atlantoaxial joint

Introduction

Grisel's syndrome is a non-traumatic subluxation of the atlantoaxial joint following an inflammatory process in the upper respiratory tract. Diagnosis of Grisel's syndrome is primarily based on suspicion of the patient who has recently undergone surgery or a history of infection in the head and neck region. Diagnostic aids include physical examination and imaging methods [1]. Grisel's syndrome is related to pharyngitis, nasopharyngitis, adenotonsilitis, tonsillar abscess, parotitis, cervical abscess, and otitis media [2].

Grisel's syndrome is mainly diagnosed among pediatrics [1]. Different hypotheses were proposed for Grisel syndrome pathology. These hypotheses describe that joint laxity in the cervical ligament is seen more frequently in the children. Moreover, spasms of cervical muscles could be detected more often in children because of the inflammatory process [3].

Patients with Down syndrome have higher risks of developing atlantoaxial instability. Atlantoaxial instability is caused mostly due to low muscle tone, loose ligaments, and alterations to the bone that are more frequent among patients with Down syndrome compared to normal population [4]. Atlantoaxial instability has been reported in up to 27% of the Down syndrome population [5].

Ligamentous laxity and skeletal anomalies in the cervical region, such as Os odontoideum, have been suggested as the predisposing factors for atlantoaxial instability in patients with Down syndrome [6]. Accompaniment of Grisel's syndrome and Down syndrome was not perused in recent investigations. To the best of our knowledge, only one case of Grisel's syndrome in an adult patient with Down syndrome has been previously reported [7]. In this study, we present a case of Grisel syndrome in a 7-year-old boy with Down syndrome following lymphadenitis.

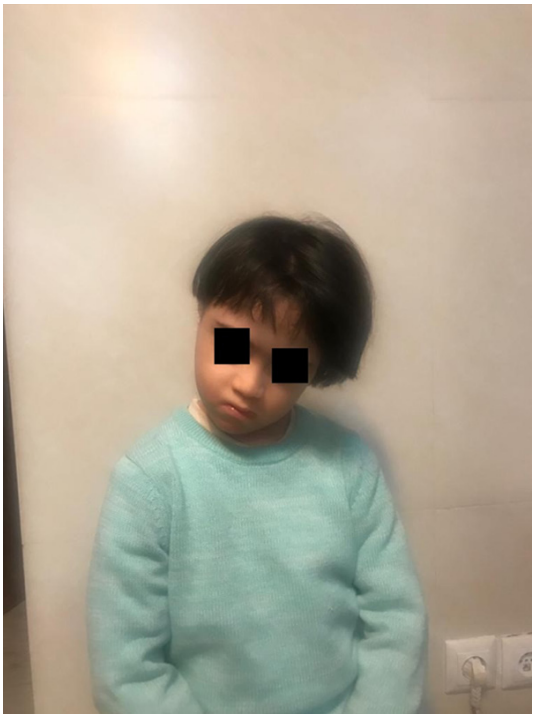

Figure 1. A seven years old boy referred to our clinic by torticollis.

Case presentation

A 7-year-old boy with Down syndrome was referred to our clinic with torticollis and neck deviation three weeks before the visit (**Figure 1**). He had suffered from cervical lymphadenitis four weeks earlier. Written informed consent was taken from the parents.

The patient was initially treated by a neurologist in an outpatient setting with the diagnosis of acute dystonia. He received Ibuprofen (10 mg per kg per dose every 8 hours) and Biperiden (2 mg every 12 hours) but the symptoms did not improve.

Then he was admitted to hospital in the service of infectious diseases with the diagnosis of acute lymphadenitis and received IV antibiotics (Clindamycin 150 mg every 6 hours). During the same time, he was treated with a cervical orthosis for one week, followed by cervicothoracic orthosis for two weeks.

As the symptoms persisted, he was referred to an orthopedic clinic. Cervical CT scans were obtained, which showed signs of C1-C2 subluxation. The patient was admitted to the orthopedic ward of Shariati hospital with a possible diagnosis of Grisel's syndrome and treated with mento-occipital traction for ten days. We followed Ciftdemir and colleagues protocols for mento-occipital halter traction [8]. The patient's characteristics, such as age and weight, determine the weights used for mento-occipital traction: 1 kg weights are used for patients younger than ten years of age and weighing less than 25 kg, and 2 kg weights are used for patients older than ten years and weighing more than 25 kg.

The patient was examined twice daily, and neurological condition, neck pain, and range of motion were examined and recorded twice daily. After two weeks, patient's symptoms vanished completely. He did not suffer from neck pain and torticollis anymore. Rotatory motions of the neck were in the normal range and painless. In addition, radiologic findings showed significant healing. We also followed our patient every two weeks for two months and after six months.

In our follow-ups, our patient did not have any sign or symptom of atlanto-axial rotatory instability. We also evaluated our patient in the sixth month by spiral CT scan, which showed normal range ADI and no evidence of subluxation (**Figure 2**).

Discussion

In this article, we reported a child with trisomy 21 who suffered from Grisel's syndrome and was treated with non-operative traction with an acceptable result. As far as we know, this is the first time Grisel's syndrome was reported in a child with trisomy 21.

Atlantoaxial instability

Atlantoaxial instability (AAI) characterize by the excessive motion of C1 relative to C2, often defined in children by an Atlanto-dental interval (ADI) of greater than 4.5 mm [9].

Only in the neutral position is the inferior aspect of the C1 articular process in full association with the corresponding part of C2. The predominant stabilizer of the atlanto-axial joint is the transverse ligament. Furthermore, Alar ligaments are crucial in holding stability [9].

Management of AAI is based on the amount of ADI. According to recent studies: If ADI is lower than 4.5 mm, treatment will be conservative and there will be no restriction of activities necessary. If ADI is 4.5 to 10 mm, depending on

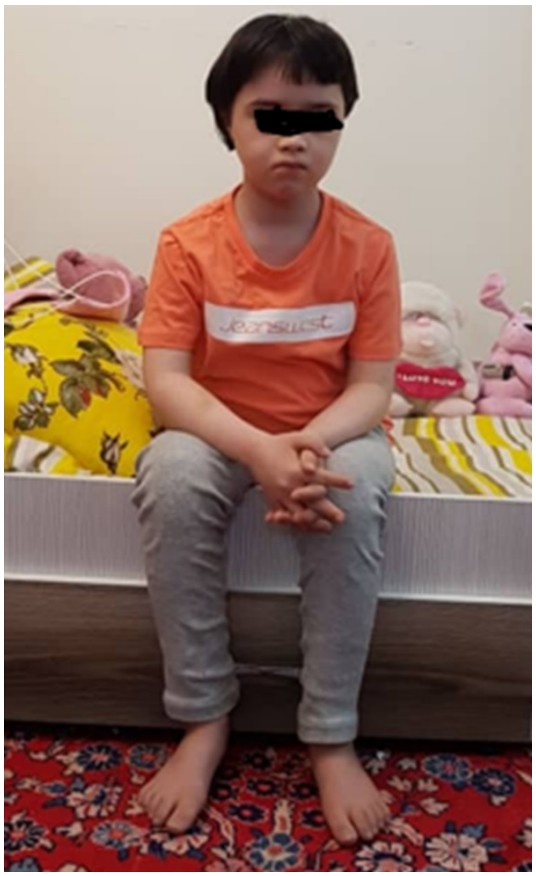

Figure 2. Patient neck appearance 6 months after treatment. No torticollis or neck pain and full neck range of motion.

the presence of neurologic symptoms, treatment will be high-risk activities limitation or C1-2 fusion. If ADI is greater than 10 mm, treatment will be posterior fusion and instrumentation [10] (**Table 1**).

Grisel's syndrome

Atlantoaxial subluxation (AAS), following an inflammatory process (e.g., infection or post-surgery conditions) in the head and neck region, is called Grisel's syndrome. A few explanations have been proposed for developing Grisel's syndrome [2]. The process starts with inflammation in the pharyngeal tissue. Then, the exudate extends to the craniovertebral junction hematogenously via the direct connection between the pharyngovertebral veins and the periodontal venous plexus.

Since no lymph node is present around this plexus, the exudate could directly extend to the C1-C2 joint. The infectious exudate damages the surrounding tissues. The exudate also triggers the spasm of the cervical muscles. On the other hand, hyperemia following the inflammation causes the abnormal loosening of the transverse ligament [11]. Altogether, the direct chemical damage, the abnormal spasm of the cervical muscles, and the loosening of the transverse ligament contribute to the occurrence of AAS [2, 9]. Several theories attempt to explain the exact physiopathology of C1-C2 subluxation and instability in Grisel's syndrome. One theory is that Grisel's syndrome happens due to the body's endeavor to decompress the inflamed tissue by spasm and consequent subluxation [12]. In other theories, the main reason for this pathology was a hyperemia state due to inflammation or infection. They inferred that hyperemia would cause decalcification of T1 and T2 and is the root of loosening of the transverse ligament and other ligaments, which have a role in atlantoaxial stability [13]. Results about ligamentous laxity due to inflammation are controversial [14].

Moreover, pharyngovertebral veins have a significant role in Grisel's syndrome pathology by transitioning pus from the upper respiratory tract to the paravertebral area [15]. One important theory is the two-hit hypothesis. In this hypothesis, prior cervical ligament laxity, which is more common in children, is the first hit. The second hit is the effect of inflammatory mediators, which were transferred to the paravertebral area by the pharyngovertebral vein plexus. These mediators cause cervical spasms and consequent subluxation [15]. According to fielding classification, there are four types of non-traumatic atlantoaxial rotatory subluxation. In type 1, there is no anterior dislocation; only the Atlas is rotated on the odontoid. In type 2, there is rotation of Atlas on one articular process and 3-5 mm anterior dislocation. In type 3, anterior displacement is more than 5 mm. Type 4 is defined when there is rotatory fixation and posterior displacement of Atlas. Usually, types 3 and 4 cause spinal cord compression and neurological symptoms [2] (**Table 2**).

Trisomy 21 and atlantoaxial instability

Spontaneous atlantoaxial subluxation occurs in 10 to 30 percent of trisomy 21 patients. Only 1 to 2 percent of patients are symptomatic [16]. The congenital skeletal anomalies such as Os-odontoideum, and pre-existing ligamentous laxity in the Down syndrome population may

Table 1. AAI management according to ADI

ADI	Treatment
<4.5 mm	Conservative treatment No restriction of activities
4.5-10 mm	Depending on the presence of neurologic symptoms Limitation of high-risk activities Or C1-C2 fusion
>10 mm	Posterior fusion and instrumentation

Table 2. Fielding classification

Type	Findings
Type 1	no anterior dislocation, only atlas is rotated on odontoid
Type 2	we have rotation of atlas on one articular process and 3-5 mm. anterior dislocation
Type 3	>5 mm. anterior dislocation
Type 4	rotatory fixation and posterior displacement of Atlas

put the patients with Down syndrome, like our patient, at higher risk for developing Grisel's syndrome after an infectious process [6]. Furthermore, in trisomy 21 patients, there is a possibility for malformation, hypoplasia, or complete absence of odontoid process, which can be a predisposing factor for atlantoaxial instability.

Various studies suggested serial examination and radiologic follow-ups (lateral neck radiology in flexion and hyper-extension positions) for trisomy 21 patients at least twice between the age of 5 to 15 [6]. On the other hand, Hengartner and others in their study indicated that routine radiologic follow-up in patients with Down syndrome is not beneficial for the detection of atlantoaxial instability [17]. Yamazaki reported the occurrence of AAS following a retropharyngeal infection in a 26-year-old male with Down syndrome. The patient presented with neck pain for two months and gait disturbance. He was treated with IV antibiotics and his cervical spine was immobilized with Halo-Vest for three months [18]. However, after the removal of the Halo-Vest, the symptoms returned. The recurrence of AAS necessitated surgical treatment.

Yamazaki and his colleagues believed that the ligamentous laxity and presence of Os odontoideum contributed to the failure of conservative therapy [19]. There was no study that represents Grisel's syndrome in a child with Down syndrome. In our study, the patient responded to conservative therapy. In this patient, we demonstrated that adequate and proper conservative treatment could be advantageous for children who suffer from Grisel's syndrome accompanied by Down syndrome. We are suggesting that the possibility of AAS, after an infectious process, needs special clinical attention in patients with Down syndrome.

Early diagnosis and start of treatment at the right moment could prevent the development of myelopathy and the need for surgical intervention. We suggest that the Down syndrome patients diagnosed with an infection in the pharyngeal region may benefit from assessment for AAS and follow-up imaging with cervical spine series. On the other hand, the ligamentous laxity in the Down syndrome population can contribute to a more severe presentation of the disease and increased risk of developing myelopathy compared with Grisel's syndrome in patients without trisomy 21.

Conclusion

In this case report, we represented a child with Down syndrome with Grisel's syndrome for the first time. Several studies indicated Down syndrome would increase the risk of Grisel's syndrome after any upper respiratory tract inflammation. As a result, after an upper respiratory tract or gastrointestinal infection or inflammation, there will be a high risk for the presentation of Grisel's syndrome in patients with Down syndrome. Close follow-up with an X-ray or CT scan will be valuable for early diagnosis of Grisel's syndrome in Down syndrome patients who suffer from infection. This study also imi-

tated a simple and applicable non-surgical treatment for Grisel's syndrome. Contrary to the tendency for surgical therapy of Grisel's syndrome, our case ultimately responded to an on-time conservative treatment. Consequently, conservative treatment for Grisel's syndrome may have acceptable results, and it is essential to be aware of these treatments.

Disclosure of conflict of interest

None.

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References

[1] Al-Driweesh T, Altheyab F, Alenezi M, Alanazy S and Aldrees T. Grisel's syndrome post otolaryngology procedures: a systematic review. Int J Pediatr Otorhinolaryngol 2020; 137: 110225.

[2] Iaccarino C, Francesca O, Piero S, Monica R, Armando R, de Bonis P, Ferdinando A, Trapella G, Mongardi L, Cavallo M, Giuseppe C and Franco S. Grisel's syndrome: non-traumatic atlantoaxial rotatory subluxation-report of five cases and review of the literature. Acta Neurochir Suppl 2019; 125: 279-288.

[3] Ahn AR, Park YH, Park EJ and Yim SY. A case of Grisel syndrome showing no underlying laxity of the atlanto-axial joint. Ann Rehabil Med 2017; 41: 511-515.

[4] Takeoka Y, Kakutani K, Miyamoto H, Suzuki T, Yurube T, Komoto I, Ryu M, Satsuma S and Uno K. Complications of posterior fusion for atlantoaxial instability in children with Down syndrome. Neurospine 2021; 18: 778-785.

[5] Zhang W, Mohammadi T, Sou J and Anis AH. Cost-effectiveness of prenatal screening and diagnostic strategies for Down syndrome: a microsimulation modeling analysis. PLoS One 2019; 14: e0225281.

[6] Sergeenko OM, Dyachkov KA, Ryabykh SO, Burtsev AV and Gubin AV. Atlantoaxial dislocation due to os odontoideum in patients with Down's syndrome: literature review and case reports. Childs Nerv Syst 2020; 36: 19-26.

[7] Yang BW, Hedequist DJ, Proctor MR, Troy M, Hresko MT and Glotzbecker MP. Surgical fixation using screw-rod construct instrumentation for upper cervical instability in pediatric Down syndrome patients. Spine Deform 2019; 7: 957-961.

[8] Zarei A, Saeb M and Zadeh AR. Comparative study of the outcome of McKay surgery with and without pin in clubfoot patients. Int J Burn Trauma 2022; 12: 114.

[9] Chandra PS, Bajaj J, Singh PK, Garg K and Agarwal D. Basilar invagination and atlantoaxial dislocation: reduction, deformity correction and realignment using the DCER (distraction, compression, extension, and reduction) technique with customized instrumentation and implants. Neurospine 2019; 16: 231-250.

[10] Goel A, Gore S, Shah A, Dharurkar P, Vutha R and Patil A. Atlantoaxial fixation for Chiari 1 formation in pediatric age-group patients: report of treatment in 33 patients. World Neurosurg 2018; 111: e668-77.

[11] Ruf M, Pitzen T, Meyer C and Drumm J. Atlantoaxial rotatory dislocation: delayed diagnose will result in more invasive treatment options. J Neurol Surg A Cent Eur Neurosurg 2021; 82: 1-8.

[12] Khodabandeh M, Shakiba S, Alizadeh S and Eshaghi H. Grisel's syndrome associated with tonsillitis. IDCases 2019; 15: e00470.

[13] Das S, Chakraborty S and Das S. Grisel syndrome in otolaryngology: a case series with literature review. Indian J Otolaryngol Head Neck Surg 2019; 71 Suppl 1: 66-9.

[14] Ismi O, Ozalp H, Hamzaoglu V, Bucioglu H, Vayısoglu Y and Gorur K. Grisel's syndrome accompanying a submandibular abscess. Braz J Otorhinolaryngol 2020; 86: 658-661.

[15] Anania P, Pavone P, Pacetti M, Truffelli M, Pavanello M, Ravegnani M, Consales A, Cama A and Piatelli G. Grisel syndrome in pediatric age: a single-center Italian experience and review of the literature. World Neurosurg 2019; 125: 374-382.

[16] Housni A, Rouijel B, Elakroud S, El Mostarchid M and Obam F. Spontaneous atlantoaxial subluxation in children: a case report and review of literature. J Med Case Rep Case Series 2021; 2: 17.

[17] Hengartner AC, Whelan R, Maj R, Wolter-Warmerdam K, Hickey F and Hankinson TC. Evaluation of 2011 AAP cervical spine screening guidelines for children with Down syndrome. Childs Nerv Syst 2020; 36: 2609-2614.

[18] Wenger KJ, Hattingen E and Porto L. Magnetic resonance imaging as the primary imaging modality in children presenting with inflammatory nontraumatic atlantoaxial rotatory subluxation. Children (Basel) 2021; 8: 329.

[19] Watanabe K, Hirano T, Katsumi K, Ohashi M, Shoji H, Hasegawa K, Ito T and Endo N. Radiographic outcomes of upper cervical fusion for pediatric patients younger than 10 years. Spine Surg Relat Res 2017; 1: 14-19.