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CASE REPORT

Grisel's syndrome caused by *Mycoplasma pneumoniae* infection: a case report and review of the literature

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Abstract

Background Grisel's syndrome is a non-traumatic subluxation of the atlantoaxial joints, which is caused by an inflammatory process involving the upper neck. Torticollis, neck pain, and reduced neck mobility are the main clinical signs of presentation. Predisposing factors are trauma, hyperlaxity of the transverse and alar ligaments of the atlantoaxial joints, and surgical interventions carried out in this area. Several viral and bacterial pathogens have been reported as causative events of Grisel's syndrome, including Epstein-Barr virus, Kawasaki disease, *Streptococcus pyogenes*, *Staphylococcus aureus*, and other infectious agents. Grisel's syndrome linked to *Mycoplasma pneumoniae* infection as the trigger has not previously been reported. *Mycoplasma pneumoniae* is a small prokaryotic microbe and a frequent etiologic factor of respiratory tract infections and, less frequently, of extrapulmonary body organs. The recognition of the Grisel's syndrome is based on clinical and neuroradiological investigations, and early diagnosis and specific treatment are crucial to the successful outcome of the disease.

Results We report the case of an 8-year-old girl with Grisel's syndrome caused by an upper respiratory tract infection due to *Mycoplasma pneumoniae*. Diagnostic suspicion and treatment of Grisel's syndrome were established quickly by anamnestic and clinical data and confirmed by radiological findings. The girl was immediately treated with specific antibiotic therapy and cervical immobilization, thus preventing the most dangerous complications of the disorder.

Conclusion Mycoplasma pneumoniae, among the other infectious agents, may be cause of scute torticollis and Gresel's syndrome.

Keywords Torticollis · Non-traumatic subluxation · Atlanto-occipital joint · *Mycoplasma pneumoniae* · CT scan

Introduction

Grisel's syndrome (GS) is a rare non-traumatic rotatory subluxation of the atlantoaxial joint, characterized by subluxation of the first cervical vertebra (C1) on the second vertebra (C2), which is caused by an inflammatory process [1–3].

Inner ear and upper respiratory tract viral and bacterial infections are the most frequent pathogenetic events [4, 5]. Retropharyngeal abscesses, adenotonsillectomy, and head-neck operative surgery have also been implicated in the disorder as causative events [6, 7]. It is hypothesized that the infection might produce hyperemia and pathological laxity of the transverse and alar ligaments of the atlantoaxial joint. The septic emboli from such infection via the pharingovertebral veins to the periodontal venous plexus might provide a route for septic exudates [2–6]. Torticollis, neck pain upon neck movements, and reduced neck mobility are the presenting symptoms of GS. Diagnosis is based on the signs related to the underlying infections, clinical presentation, and CT scan investigation, which continues to be the best diagnostic tool. MRI can also be useful during diagnosis of GS, showing inflammatory changes in the localized area. Diagnosis of the GS is difficult but worthwhile since delayed treatment can result in a spinal cord compression, leading to tetraplegia and sudden death.

Here, we report the case of an 8-year-old girl with Grisel's syndrome secondary to infection of *Mycoplasma pneumoniae*, a diagnosis confirmed by clinical signs and

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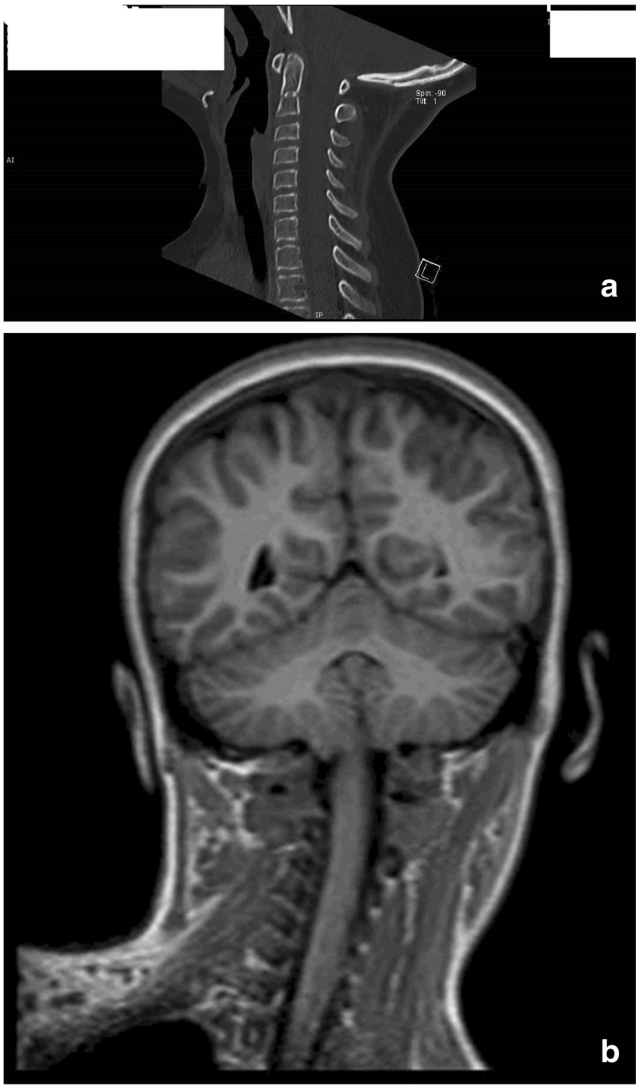

Fig. 1 **a** CT scan of the child showing rotary articular subluxation of the C1-C2 cervical tract. **b** Cervical and brain MRI showing rotary articular subluxation of the C1-C2 cervical tract, and signs of inflammation of the adjacent neck tissues

laboratory analysis. To our knowledge, *Mycoplasma pneumoniae* infection has not yet been reported as an infective cause of this disorder. A review of the main causes of GS is also reported.

Case report

An 8-year-old girl was seen at the Pediatric Unit and Pediatric Emergency Department University Hospital, Policlinico-Vittorio Emanuele, Catania, Italy, for torticollis and neck pain, which started 1 week before. At admission, the parents reported that the girl had been suffering from fever, cough, and pharyngodynia for the past 2 weeks. The family and personal history of the girl were uneventful. Her developmental stages were normally reached, and her scholastic performance was normal. She followed the normal Italian immunization calendar.

At the physical examination, the girl exhibited a painful aspect; the neck was painfully twisted and tilted. Neurological examinations, heart, thorax, and abdomen were normal.

Routine laboratory analysis detected an increase of antistreptolysin O titer (ASO, 900 mg/dl, n.v. < 250 U), C-reactive protein (CRP, 27 mg/l, n.v. 1–3 mg/l), erythrocyte sedimentation rate (ESR, 30 mm/h, < 15 mm/h), and increase of *Mycoplasma pneumoniae* antibodies (IgG 49, IgM 78, n.v. < 20 u/ml). Herpes simplex, *Varicella zoster*, Epstein-Barr, *Borrelia Burgdorferi*, enterovirus, adenovirus, and parvovirus B12, and serum antibodies were within normal range. The CT scan showed a rotary articular subluxation of the C1-C2 cervical tract (Fig. 1a), and cervical and brain MRI, which also displayed signs of inflammation of the adjacent neck tissues (Fig. 1b). Subluxation of C1-C2 cervical tract were obeserved at CT scan and CT scan 3D (Fig. 2a and b) The patient was started on antibiotic treatment (clarithromycin at 15 mg/kg/day) for 10 days. After a neurosurgical consultation, she was fitted with a halo vest for treatment of cervical spine subluxation (Fig. 3a and b). After 16 days of antibiotic treatment, control blood samples reached decreased values of inflammation index and *Mycoplasma* antibodies (IgG 45; Ig M 58). At the follow-up, gradual resolution of the clinical signs, including torticollis and neck pain, were obtained, and 3 months after treatment with the halo vest, a normal alignment of the cervical spine was observed by CT scan 3D, with complete resolution of the disorder.

Discussion

The girl presented with a history of febrile infections that started 2 weeks before admission and were followed by

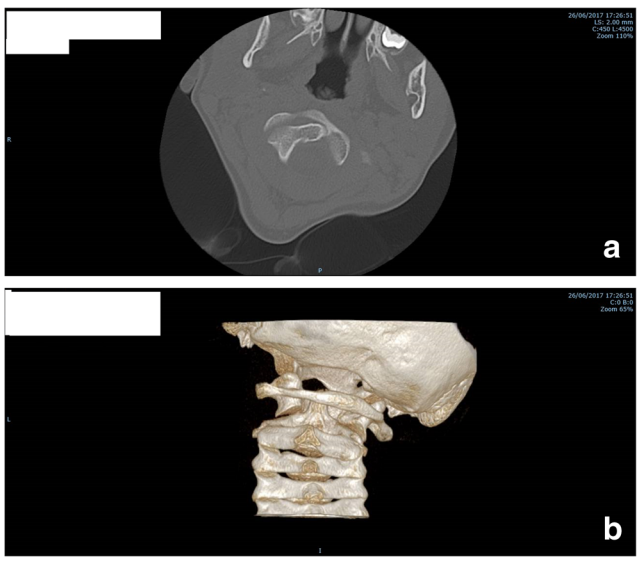

Fig. 2 **a** CT scan ax showing subluxation of the C1-C2 cervical tract. **b** CT scan 3D showing subluxation of the C1-C2 cervical tract

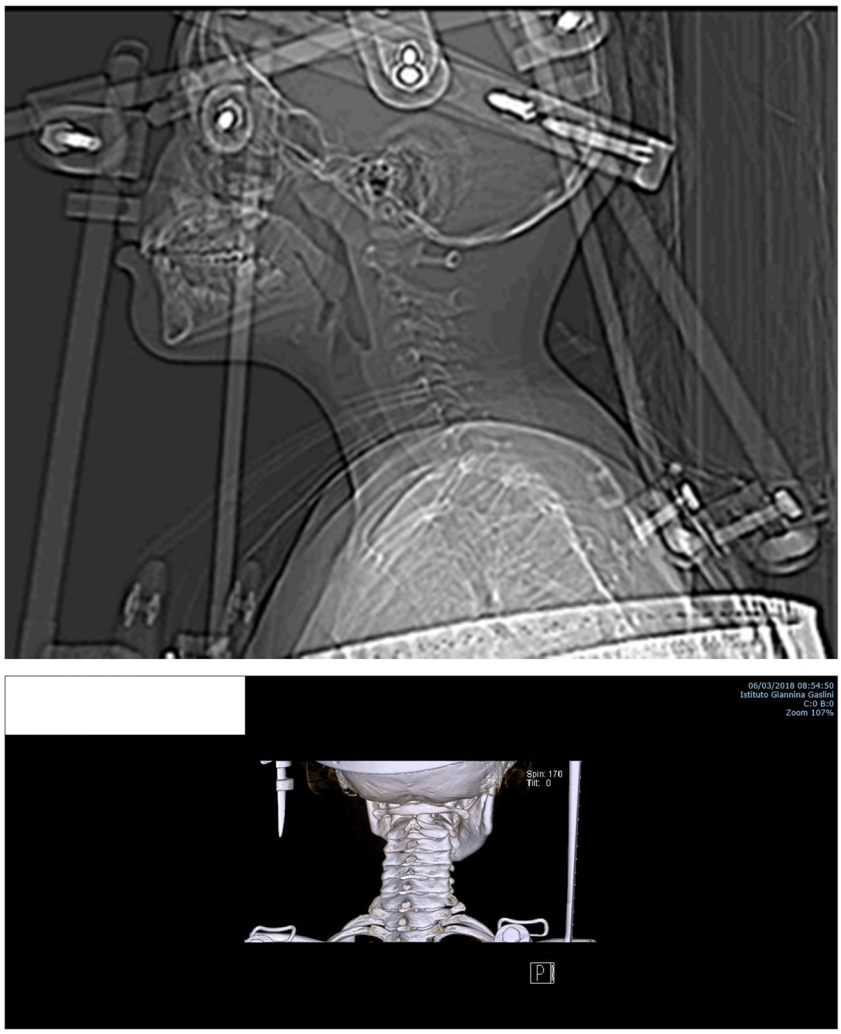

Fig. 3 **a** Feature of the halo vest treatment. **b** CT scan 3D in halo vest treatment

clinical signs of torticollis, neck pain, and reduced neck mobility. Positive laboratory markers of infections and, specifically, the presence of a high level of IgM anti-mycoplasma antibodies and CT scan showing rotary articular subluxation of the C1-C2 cervical tract allowed us to make a diagnosis of GS caused by *Mycoplasma pneumoniae* infection.

Acquired torticollis is uncommon in childhood and might be related to various causes, including ligamentous, muscular, osseous, ocular, psychiatric, and neurologic disorders, as well as infective agents [8]. Spiegel et al. [9] reported on 35 children affected by atlantoaxial rotatory displacement and, among these, minor trauma (20%), surgical procedure around the head and neck (29%), and GS (20%) were the causative events [9]. In the proband, the torticollis was preceded by a febrile infection, which was indicative of an infective diagnostic cause of the GS.

Three clinical signs are useful in formulating a diagnosis of GS: (a) deviation of the second cervical vertebra spinous process in the same direction, such as abnormal head rotation in which deviation occurs contralaterally; (b) contraction of ipsilateral sternocleidomastoid muscle, such as an antalgic reflex manifestation; and (c) inability to turn the head further than the midline toward the opposite direction of the lesion [5, 6]. In children with torticollis concurrent with upper respiratory tract infections, TC scan investigation is mandatory in particular when the upper mentioned signs of GS are present.

Some congenital conditions involving ligamentous laxities, such as Down syndrome and Marfan syndrome, are associated with a higher risk of atlantoaxial subluxation [10, 11]. Furthermore, an increased incidence of GS has been observed in children submitted to adenoidectomy after monopolar suction electrocautery [12].

In the literature, patients affected by GS secondary to various infectious agents have been reported. Pathogens associated with GS include *Streptococcus pyogenes*, *Bacteroides ureolyticus* [13], *Mycobacterium tuberculosis* [14], *Pseudomonas aeruginosa*, *Staphylococcus aureus*, methicillin-resistant *Staphylococcus epidermidis*, and Epstein-Barr virus. Kawasaki disease has also been related to GS [15, 16]. It has been hypothesized that in these cases,

Table 1 The Fielding et al. overall classification for atlantoaxial subluxation (ref. [21])

Type 1	Most common and is characterized by a simple rotation without anterior displacement of the atlas and the transverse ligament is undamaged	Antibiotics, muscle relaxant, massage therapy, and immobilization with a soft collar
Type 2	The rotatory subluxation is associated with anterior displacement of the atlas ≤ 5 mm and transverse ligament deficit	Reduction and cervical traction with a rigid collar
Type 3	Anterior displacement of the atlas is > 5 mm, both lateral atlantoaxial joints are subluxated anteriorly, the transverse ligament and the articular facets are damaged	Both type 3 and 4 subluxation are highly unstable lesions and, in most cases, associated with neurological symptom. It is necessary cervical traction with "halo vest" and, in the event of neurological symptoms, decompression and arthrodesis of C1 C2
Type 4	Quite rare, more frequent in adults with rheumatoid arthritis characterized by rotation and posterior dislocation of atlas	

an indirect immune mechanism through the process of autoimmunity or formation of immune complexes might act as a trigger, causing the disorder in susceptible individuals.

To our knowledge, no cases of GS have been associated with *Mycoplasma pneumoniae* infection. *Mycoplasma pneumoniae* are the smallest prokaryotic microbes present in nature, and seven strains have been found to be pathogenic to humans [12, 17]. *Mycoplasma pneumoniae* play an important role in the etiology of respiratory tract infections in all pediatric ages [17, 18] and might affect other body organs with or without respiratory involvement [18]. Neurological complications of *Mycoplasma pneumoniae* infections are frequently reported in the literature, with estimates ranging from 13 to 25%, with muscular-articular manifestations accounting for 30–40% of cases [19, 20]. Based on our observation, GS can be included among the extrapulmonary complications of *Mycoplasma pneumoniae*.

In patients with GS, laboratory testing is required for confirmation of the etiological diagnosis, and soon after, a prompt treatment of the infections and atlantoaxial rotatory displacement is required to avoid severe complications. The primary management consists of treating the infectious process with a preferably targeted antibiotic therapy, and for children with poor therapeutic answer, concomitant use of immunomodulators, such as corticosteroids or immunoglobulin, in association also with antibiotics [18] and use of plasma exchange treatment in the infectious resistant form [18]. The treatment choice for atlantoaxial joint subluxation depends on the injury severity, with physiotherapy and manipulation applied when the condition is not severe [21, 22] and operative intervention for severe subluxation. Based on the Fielding et al. atlanto-occipital subluxation classification (Table 1) [21], in patients with type 1 and without neurologic deficits, antibiotic therapy, anti-inflammatory, myorelaxant drugs, and bivalve collar positioning are the advised treatment, whereas for patients in whom the subluxation is ingrained or neurological signs are present, the invasive procedure may be justified with halo vest positioning, subsequent reduction, and maintenance of the halo for at least 3 months. In the most severe cases with relapsing subluxation or difficulty in reduction it is worthwhile performing a C1-C2 posterior arthrodesis and even in some case C0-C1-C2 arthrodesis since the subluxation may also affect the condyle and the C1 articular facets [22]. Martinez-Lage [23] report on four patients with atlantoaxial rotatory subluxation, secondary to cervical trauma in three and in one affected by GS secondary to otitis. Among these, in three, cervical immobilization and physiotherapy were carried out, while in one, it was necessary to perform posterior cervical fusion. Pilge et al. [2] have obtained good results using manual repositioning under general anesthesia and subsequent temporarily immobilization with a cervical collar for 2 weeks.

In conclusion, in the proband the prompt etiological diagnosis, specific antibiotic treatment, and halo vest application led to good results, with rapid improvement and complete recovery within 3 months. Timely recognition of GS is worthwhile since the disorder may have a deleterious outcome with spinal cord compression and sudden death. Based on our observations, *Mycoplasma pneumoniae* should be included among the possible causative event of acute torticollis and GS.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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