A RARE CASE OF ACUTE MOTOR AXONAL NEUROPATHY IN A ONE-YEAR-OLD MALE CHILD

Solanki BS[1], Bishoyi BS[1], and Patel JL[2].
[1]Department of Pharmacy Practice, Parul Institute of Pharmacy, Parul University, Waghodia, Vadodara-391760, Gujarat, India
[2]Clinical Research Department, Parul University, Waghodia, Vadodara-391760, Gujarat, India

Correspondence
Jignesh Laxmanbhai Patel,
Clinical Research Department,
Parul University,
Waghodia, Vadodara-391760,
Gujarat, India.
E-mail: jigneshkumar.patel24313@paruluniversity.ac.in

Abstract

Acute Motor Axonal Neuropathy (AMAN), a major subtype of Guillain Barre's Syndrome (GBS), is a rare non-inflammatory disease where the axons of motor neurons are selectively targeted by the immune system. This report describes the case of a one-year-old male suffering from this rare condition. The patient presented with complaints of bilateral lower and upper limb weakness, accompanied by fever. Clinical and electromyographic investigations confirmed the diagnosis as AMAN. Treatment included intravenous immunoglobulin (IVIg), antibiotics, multivitamins, zinc, and physiotherapy, which led to significant improvement in the patient's condition. Early diagnosis, along with prompt initiation of IVIg and physiotherapy, may greatly enhance recovery from GBS-AMAN in pediatric patients.

Keywords: Acute Motor Axonal Neuropathy, Guillain Barre's Syndrome, Intravenous Immunoglobulin, Pediatric

Introduction

Guillain Barre's Syndrome (GBS) is a rare, acute-onset inflammatory polyneuropathy, characterised by rapidly progressive, symmetric, ascending weakness with areflexia in a previously normal child. Its prevalence is notable, with an estimated 30.0% to 65.0% of cases occurring in Asia, Central America, and South America (1), and an estimated 0.3 to 1.3 cases per 100,000 population in India (2). Acute Motor Axonal Neuropathy (AMAN), a rare form of the GBS, is a paralytic disorder of abrupt onset characterized pathologically by motor nerve fibre degeneration of variable severity and by sparing of sensory fibres. Notably, little demyelination or lymphocytic inflammation is also observed in AMAN. Its clinical presentation is progressive and essentially symmetric, featuring prickling sensation in fingers, toes, ankles, and wrist; and muscle weakness in legs that eventually spreads to the upper parts of the body. Unsteady walking or inability to walk, difficulty with eyes or facial movements, including speech, chewing, or swallowing; severe pain that may be aching or cramping and may worsen at night; difficulty in controlling bladder or bowel function, rapid heart rate, low or high blood pressure, difficulties in breathing, muscle weakness, loss of reflexes and numbness or tingling in arms, legs, face and other parts of the body. AMAN can also cause paralysis and may lead to death (3).

GBS typically emerges following an infectious disease, where the body's immune response produces antibodies that cross-react with gangliosides on nerve membranes. This autoimmune response leads to nerve damage or functional blockage of nerve conduction. The type of previous infection and the specificity of the antiganglioside antibodies play a major role in determining the subtype and clinical progression of GBS. Over the past decade, new studies have significantly expanded our understanding in highlighting the role that Infection and antiganglioside antibodies play in the immunopathology of GBS. It is now known that *Campylobacter jejuni* is the most common pathogen causing the antecedent infection associated with GBS-AMAN (3). The clinical features, diagnostic parameters, differential diagnosis, and complication of GBS are shown in Figure 1, and the subtypes of GBS are shown in Table 1. During clinical investigations, the infection may be identified by elevated cerebrospinal fluid cell count, spinal abnormalities, radicular pain, activity-induced pain, a physical state of consciousness, intolerable headache, and a loss of motor and sensory actions. Spinal tapping or lumbar puncture is carried out to identify infections, elevated protein levels, or other related features. Electromyography and nerve conduction studies help confirm the diagnosis of GBS and its subtypes (4, 5).

Table 1: Variants of GBS

Type	Pathology	Associated Antibody	Features	Clinical Presentation
AIDP	Macrophages invade intact myelin sheaths and denude the axons	Antibodies directed against proteins P0, P2, PMP22	Accounts for about 90% of all GBS cases in Europe and United States	Localized followed by widespread muscle weakness, cranial nerve deficits, and autonomic
AMAN	Macrophages invade the nodes of Ranvier where they insert between the axon and the surrounding Schwann cell axolemma, leaving the myelin sheath intact	GM1a, GM1b, GD1a	More common in young Asians with a history of *Campylobacter jejuni* and predominantly occurs during summer as compared to other seasons	No sensory involvement Areflexia Most rapidly progressive subtype Cranial nerves rarely affected
AMSAN	Similar to AMAN but also involving ventral and dorsal roots	GM1, GD1a	Most severe form	Both sensory and motor involvement
Miller Fischer	Abnormality in sensory conduction, although the underlying pathology is not clear	GQ1b	Most common ocular manifestation is ophthalmoplegia	Ocular involvement with ataxia and areflexia

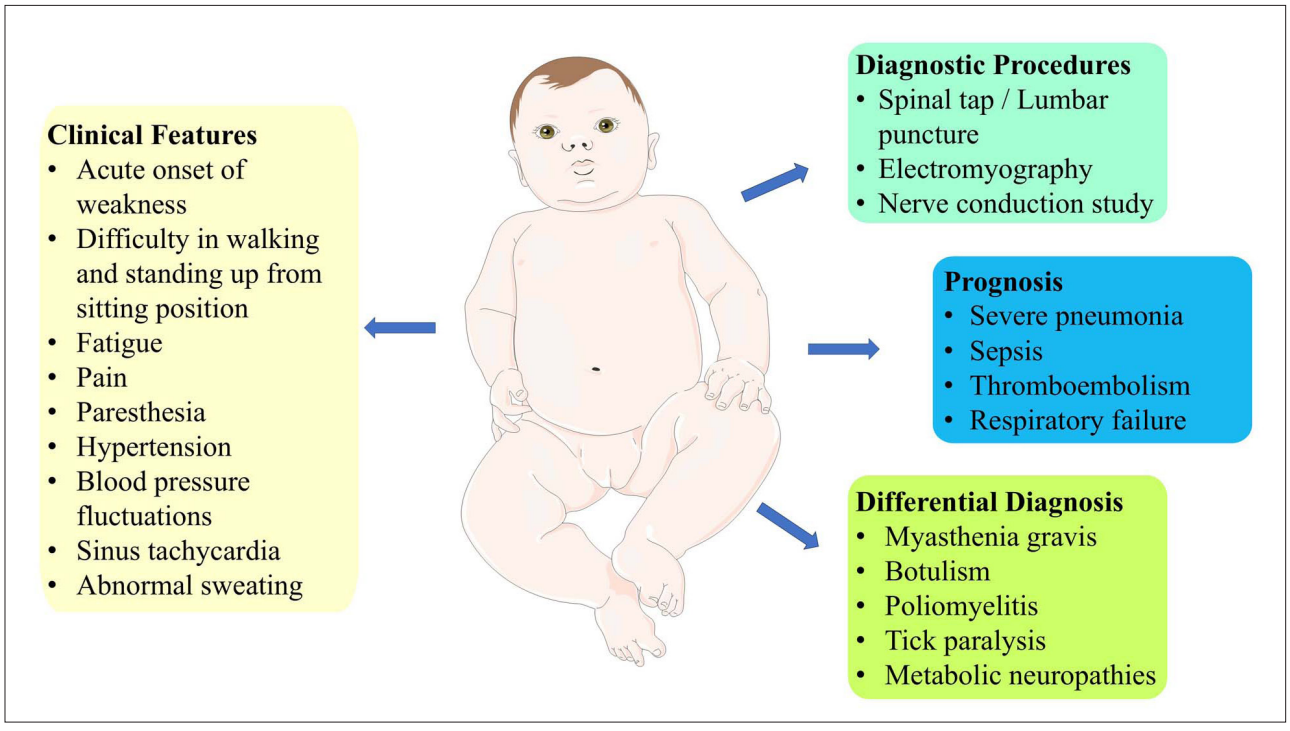

Figure 1: Clinical features, diagnostic procedures, prognosis, and differential diagnosis of GBS-AMAN

Treatment includes plasmapheresis or plasma exchange (PLEX), intravenous immunoglobulin (IVIg), pain-relieving medications, steroids, and treatment to prevent blood clots in immobile patients. In severe cases of GBS, initiating plasmapheresis therapy within 7 days of symptom onset can accelerate recovery, although it does not guarantee to reduce mortality. IVIg is favored for its ease of administration, safety, effectiveness, relatively mild side effects across all age groups and all kinds of severities.

Treatment decisions can be tailored to the severity and risk factors of the individual suffering from GBS (3-5). The cornerstone of GBS treatment lies in supportive care and physiotherapy rehabilitation. This can be determined based on the patient's disability level, degree of strength, and endurance to participate in the therapy. Initial evaluations of physical and occupational therapy help establish a baseline for designing the rehabilitation program by professionals. While rehabilitation therapies

do not accelerate nerve healing, it optimises the activities of nerve healing and improve its function. Muscle strength usually improves in a descending pattern, and fatigue and pain—common in the recovery process—can be managed through energy conservation strategies and carefully structured exercises. Thereafter, follow-up care is essential, every 4 to 6 weeks for 6 months, then every 6 months for a year, and annually thereafter. Patients should continue physical and occupational therapy, and the physicians are advised to instruct their patients to consult them if any symptoms such as weakness, numbness, bladder function, or dysphagia worsens. Recovery from GBS typically occurs within 2 months to 3 years (2, 3).

Case presentation

A one-year-old child was admitted to our tertiary care hospital with complaints of lower and upper limb weakness (LL > UL), a furuncle on the right gluteal region, which developed into an abscess, and low-grade fever for ten days that was relieved by medication. Upon admission, the patient was alert, conscious, and coherent but exhibited hypotonia. He had a positive gag reflex, and the deep tendon reflex was 2+. Neurological abnormalities were seen, including reduced strength in both lower and upper limbs, while cranial nerve function and body's sensory responses were normal. The child was born full-term via normal vaginal delivery and with a birth weight of 3.5 kg, had normal developmental history, and had never been hospitalised. All essential vaccinations were administered according to the standard vaccination schedule. He had no recent history of respiratory or gastrointestinal infections, exposure to toxins or poisons, recent vaccinations, or anorexia. The child was unable to walk without support and had marked difficulty in standing up from a seated position. He then gradually developed weakness in both the upper and lower limbs over ten days. The abscess in his right buttock raised the possibility of a connection with the onset of AMAN, but this correlation was inconclusive based on the available information. The patient was hemodynamically stable, but laboratory investigations indicated anemia, with abnormal findings including low hemoglobin (10 g/dL) levels, white blood cell counts (16250/microlitre), lymphocytes (52.0%), haematocrit (31.1%), and low iron levels (27.20 microgram/L). C-reactive protein was measured at 1.5 mg/L.

The patient was admitted to the paediatric ICU, where the treating paediatrician opted for consultations with neurology and surgery departments to address the neurological abnormalities and the abscess, respectively. The cerebrospinal fluid (CSF) laboratory test revealed elevated protein levels (68 mg/dL) with normal glucose levels (76 mg/dL). MRI of the spine showed no abnormalities, and the Nerve conduction studies (NCS) were performed. The patient's left median nerve's compound muscle action potential (CMAP) showed decreased amplitude. A final diagnosis of AMAN; a variant of GBS was made.

He was treated with antibiotics, multivitamins, and intravenous fluids for the first two days, with no need for ventilator support. Following the confirmation of the NCS results, IVIg therapy was initiated. The multivitamin injections were later replaced with oral vitamin syrups, and the antibiotic injection was discontinued on the sixth and seventh days of admission, respectively. He showed gradual improvement over 11 days with pharmacological management (Table 2) and physiotherapy. By the seventh day of admission, the child showed improved posture stability with normal movement, including the ability to sit unaided. So, physicians considered shifting him to the pediatric ward. On his discharge by day since hospitalisation, he was recommended to continue physiotherapy rehabilitation and oral vitamin supplementation.

Table 2: Treatment given to the patient

No.	Drug	Route	Dose	Frequency	Duration
1	Inj. Multivitamins (Ascorbic Acid 150 mg + Folic Acid 0.7 mg + Niacinamide 12 mg + Vitamin B12 2500 mcg)	IV	½+½ +50 ml Normal Saline	1-0-0	6 days
2	Inj. Ceftriaxone	IV	(500/5) 4 ml+5 ml Normal Saline	1-0-1	7 days
3	Inj. IVIg	IV	2 g/kg	5 ml/hr 10 ml/hr	2 days
4	Iron drops	Oral	1.5 ml	0-1-0	5 days
5	Syp. Folic Acid +Vitamin B12	Oral	5 ml	0-1-0	5 days
6	Syp. Zinc	Oral	5 ml	0-1-0	5 days
7	Syp. Multivitamin	Oral	5 ml	0-1-0	5 days

Inj = Injection; IV = Intravenous; Syp = Syrup

Discussion

GBS is an acute onset inflammatory polyneuropathy, primarily characterised by rapidly progressing, symmetrical, ascending muscle weakness in a previously normal child. It is the most common cause of acute flaccid paralysis in children. GBS presents with acute onset of weakness, difficulty walking or rising from a sitting position, fatigue, pain, and paresthesias, all of which were observed in our present case. Weakness is often symmetrical in GBS and it begins distally in the lower extremities, progressively affecting the upper extremities, respiratory muscles, and cranial nerves. Respiratory complications and autonomic dysfunction may increase the risk of mortality in children with GBS, with reported mortality rates with GBS ranging from 3% to 10%. The risk of recurrence in GBS varies from 2% to 5%. In our case, physical examination and blood reports confirmed weakness and anemia. Based on the severity of symptoms, weakness and observed hypotonia, the NCS and CSF tests are usually recommended for further diagnosis. The NCS results helped confirm the diagnosis for GBS-AMAN. The reported mortality in patients with GBS ranged from 3.0% to 10.0%, with a recurrence risk of 2.0% to 5.0% (3).

About 40.0 to 50.0% of individuals with GBS experience facial weakness, and up to 30.0% may develop respiratory weakness. However, this was not observed in our case. Weakness in GBS typically progresses rapidly, reaching the lower limbs within two weeks in 80.0% of cases and overall within just four weeks (6, 7). In our case, physical examination and blood reports confirmed weakness and anemia. Given the observed symptoms, including hypotonia and severity of weakness, NCS and CSF tests were recommended. The NCS confirmed the diagnosis of GBS-AMAN and the CSF test revealed elevated protein levels. Nerve root inflammation, which can result in pain in the legs, thighs, buttocks, back, and neck is a common feature. Additionally, blood pressure fluctuations, sinus tachycardia, and abnormal sweating indicate autonomic dysfunction and may occur in approximately 50.0% patients with GBS (8, 9). However, this is not seen in our patient, as the condition had not progressed to that, leading to such clinical symptoms.

As per the Standard Treatment Guidelines (2), plasma exchange can be performed with 200-250 mL/kg body weight over five alternating days. However, plasmapheresis following IVIg is less effective than administering either treatment alone. IVIg is often preferred for its administering convenience and easy accessibility compared to plasma exchange, with both treatments having comparable side effects. Corticosteroids have shown no significant benefit in GBS patients and may even negatively impact outcomes when administered orally. The same was reflected in our approach to treatment. The standard dose for IVIg is 400 mg/kg/day for five days or 1 g/kg in two days as a total dose of 2 g/kg2. In our case, treatment primarily initiated with intravenous antibiotics and vitamin supplements, followed by IVIg at a dose of 2 g/kg. Physiotherapy was also initiated to improve the patient's ataxia. Plasma exchange (PLEX) therapy and corticosteroids were not administered due to patient's young age. Furthermore, PLEX therapy requires venous access and is effective only if initiated within seven days of symptom onset (10). By the time GBS-AMAN was diagnosed in our case, the critical seven-day period had already passed, and therefore, PLEX therapy was not given.

The patient's condition gradually improved over 12 days, leading the treating physicians to consider discharging him with continued oral nutritional supplements and physiotherapy rehabilitation. Although many children with GBS experience good clinical recovery, initiating an appropriate rehabilitation program is essential to reduce acute disability and mitigate long-term motor and sensory deficits as well as fatigue. In our case as well, the purpose of initiating physiotherapy was to reduce these long-term motor and sensory deficits and fatigue. At discharge, the functional motor impairment was assessed using the Hughes Disability Scale, which yielded a score of ≥2, indicating a reasonably good prognosis for discharge.

Conclusion

Although many children with GBS make a good clinical recovery, early initiation of an appropriate rehabilitation program is crucial in reducing both acute disability and long-term complications of motor and sensory deficits as well as fatigue (11). This case supports the same notion along with suggesting that early diagnosis, combined with timely initiation of IVIg and physiotherapy, can significantly aid in the early recovery and improvement of GBS-AMAN, especially in pediatric patients.

Acknowledgement

Author expresses gratitude to the Pediatric department and Superintendent of Parul Sevashram Hospital, Parul University, Vadodara, India for providing permission to access case records to make this case report.

Competing interests

The authors declare that they have no competing interests.

Ethical Clearance

We obtained a "No Objection Certificate" from the Parul University Institutional Ethics Committee for Human Research (PU-IECHR) that is registered under the Drug Controller General of India (DCGI), Govt. of India bearing Reg. No. ECR/702/Inst/GJ/2015.

Financial support

The authors received no financial support for this study.

References

1. Kuwabara S, Yuki N. Axonal Guillain-Barré syndrome: Concepts and controversies. Lancet Neurol. 2013; 12(12):1180-88.

2. Shah S, Suthar R. Guillain–Barré Syndrome: Standard Treatment Guidelines. India: Academy of Pediatrics (IAP). 2022.
3. Berg B, Walgaard C, Drenthen J, Fokke C, Jacobs B, Doorn P. Guillain-Barré syndrome: pathogenesis, diagnosis, treatment and prognosis. Nat Rev Neurol. 2014; 10(8):469-82.
4. Arora N, Govindarajan R, Kataria D, Chandrasekaran PN. Neuromuscular Urgencies and Emergencies. Switzerland AG: Springer Nature. 2020.
5. Hafer-Macko C, Hsieh ST, Li CY, Ho TW, Sheikh K, Cornblath DR, *et al*. Acute motor axonal neuropathy: an antibody-mediated attack on axolemma. Ann Neurol. 1996; 40(4):635-44.
6. Leonhard SE, Mandarakas MR, Gondim FA, Bateman K, Ferreira ML, Cornblath DR, et. al. Diagnosis and management of Guillain–Barré syndrome in ten steps. Nat Rev Neurol. 2019; 15(11):671-83.
7. Vihari J, Dalai SP, Uppu P, Aditya A. Tammineni Roja. Guillain–Barré Syndrome in a patient with systemic lupus erythematosus with underlying pituitary carcinoid: A rare presentation. J Assoc Med Sci. 2023; 56(1):101-5.
8. Dimachkie MM, Barohn RJ. Guillain-Barré syndrome and variants. Neurol Clin. 2013; 31(2):491-510.
9. Rangan RS, Tullu MS, Deshmukh CT, Mondkar SA, Agrawal M. Clinical Profile and Outcome of Guillain-Barre Syndrome in Pediatric Patients Admitted to a Tertiary Care Centre: A Retrospective Study. Neurol India. 2021; 69(1):81-4.
10. Al Hamdani S, Aljanabi FY, Abdulrasool MI, Salman AH. Child with Guillain-Barré Syndrome Responding to Plasmapheresis: A Case Report. Case Rep Acute Med. 2020; 3(1):4-11.
11. Parry GJ, Steinberg JS. Guillain-Barre Syndrome: From Diagnosis to Recovery. New York: Demos Medical Publishing. 2007.