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CASE REPORT

Guillain-Barre Syndrome with Acute Lymphoblastic Leukemia: Case Report

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Abstract: Guillain-Barré syndrome (GBS) is a rare complication in children with acute lymphoblastic leukemia (ALL). This case report explores the presentation and management of GBS in a 16-year-old male with a history of ALL, who developed GBS during maintenance therapy. The patient exhibited progressive symmetrical weakness, sensory loss, and autonomic dysfunction. Diagnostic workup, including nerve conduction studies and lumbar puncture, confirmed the diagnosis of GBS. Differentiating GBS from vincristine-induced neuropathy, a common challenge in this population, was crucial for appropriate management. The patient responded well to intravenous immunoglobulin and supportive care. This case highlights the importance of considering GBS in the differential diagnosis of neurological complications in children with ALL and emphasizes the need for prompt diagnosis and treatment.

Keywords: acute lymphoblastic leukemia, pediatric oncology, neuropathy, immune-mediated disease

Introduction

Guillain-Barre syndrome (GBS) is an immune-mediated disease affecting the peripheral nervous system that can affect both children and adults. The body's immune system mistakenly attacks peripheral nerves. The classic presentation of GBS is characterized by progressive symmetrical, ascending muscle weakness.[1] GBS is rarely reported in children with acute lymphoblastic leukemia (ALL) and may be difficult to differentiate from vincristine-induced neuropathy.[2] In children undergoing maintenance therapy for B-cell precursor acute lymphoblastic leukemia (BCP-ALL), GBS can be particularly concerning. Maintenance therapy for BCP-ALL typically includes chemotherapy agents such as methotrexate and mercaptopurine, which suppress the immune system to prevent leukemia relapse. This immunosuppression increases the risk of infections, autoimmune reactions, and other complications, which may contribute to the onset of GBS.

In addition, ALL could theoretically trigger GBS through paraneoplastic mechanisms, where aberrant immune responses target the nervous system. In addition to that, ALL patients are susceptible to infections due to neutropenia, which might trigger GBS.

This case report explores the occurrence of Guillain-Barre syndrome in a 16-year-old male with a history of B-cell lymphoblastic leukemia.

Case Report

A 16-year-old male with a history of ALL in maintenance therapy presented to the hospital with increasing numbness in the left cheek, left arm, and lower limbs. He also reported dizziness and could walk only with support against the wall. His symptoms worsened, resulting in numbness throughout his body, including his face, along with dysarthria, severe headache, and neck pain.

The patient's history indicated a diagnosis of B-cell lymphoblastic leukemia since 2022. His cerebrospinal fluid (CSF) was clear of blasts, and his cytogenetics were normal. He completed an induction chemotherapy course as per the UK-ALL Regimen B protocol and subsequently shifted to maintenance therapy under the more intensive UK-ALL Regimen C protocol due to poor

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bone marrow biopsy (BMB) result and no minimal residual disease (MRD) marker. Chemotherapy was temporarily halted for 4 days because he had experienced neutropenia and developed septicemia Staphylococcus Aureus (S. aureus). He was treated intravenously with Tazocin, Clindamycin, and Vancomycin. While GBS is typically linked to pathogens like *Campylobacter jejuni* or viruses (eg, cytomegalovirus), cases related to S. aureus are rare.

Additionally, he had detected atrial thrombus twice and was on a daily dose of 20 mg oral anticoagulant (Rivaroxaban).

On general physical examination, the patient was conscious with a Glasgow Coma Scale (GCS) score of 15/15, mild left upper motor neuron facial palsy, intact facial sensation, normal deep tendon reflexes in the lower limb, and diminished reflexes in upper limbs. No orthopedic or organic findings were noted. Blood tests, coagulation profile, CT scan (head), MRI, MRA, and MRV results were all normal (Figures 1 and 2).

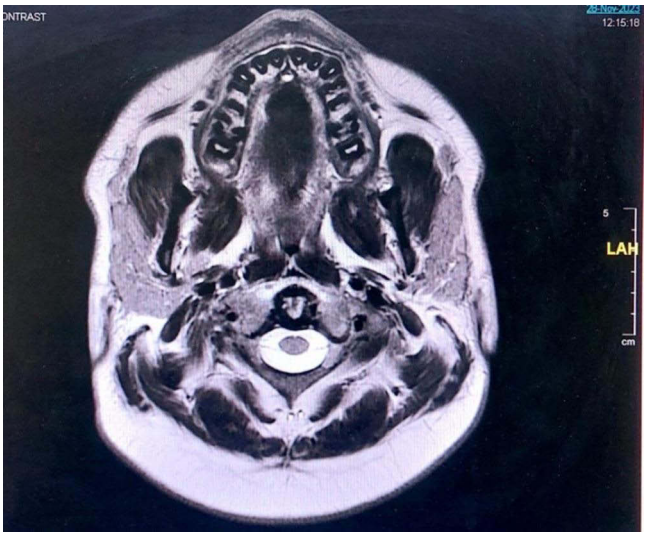

Figure 1 MRI Report. Normal brain parenchymal MR signal intensity with no focal lesion. No abnormal brain parenchymal or mennigeal enhancement. Normal signal, thickness and enhancement of both facial nerves. Normal size and configuration of the cerebral ventricles with no middle line shift or deformities. Normal gray- white matter differentiation. Normal cerebellum, brain stem and cervico- medullary junction. Both cerebellopontine angles are free. Normal cellar region. Normal extra axial spaces. Apart from variable degrees of para-nasal sinuses inflammatory changes with bubbly appearance in the sphenoid sinus and to a less extent the maxillary sinuses suggesting acute exacerbation.

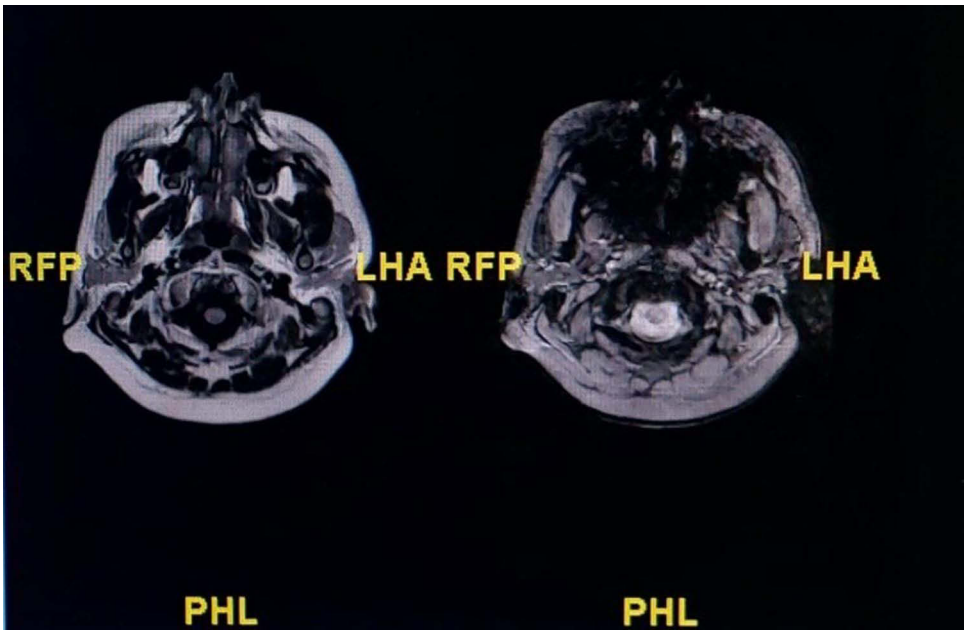

Figure 2 MRV Report. Normal MRV appearance of the major venous sinus and superficial veins with no evidence of thrombosis, obstruction, filling defects or infiltration.

The following day, the patient's condition worsened, with severe loss of sensation in the lower limbs and anal area, dysphagia, and choking. An immediate tests and examinations were done resulting in normal blood tests, coagulation profile, essential unremarkable non-enhanced CT study (brain) and normal MRI, MRA and MRV examination of the brain with para-nasal sinuses chronic inflammatory changes with features suggestive of acute exacerbation.

An urgent nerve conduction velocity (NCV) and electromyography (EMG) study was conducted to rule out Guillain-Barre Syndrome. The findings indicated demyelinating and axonal peripheral neuropathy with a significant proximal conduction block and very prolonged F waves. Motor conduction velocities were moderately slow, with low motor responses and a sural sparing pattern Figures 3 and 4. The patient also underwent MRI examination of the dorsal and lumbo-sacral spine for diagnostic purposes, and the analysis showed abnormal smooth thickening and enhancement of the intrathecal nerve roots, which are consistent with Guillain-Barre and very high protein levels and the presence of monoclonal antibodies in the CSF, confirming the diagnosis of Guillain-Barre syndrome.

A diagnosis of Guillain-Barre syndrome was made based on the criteria and findings that strongly supported the diagnosis.

Features required to rule out diagnoses other than GBS include no history of hexacarbon abuse, no evidence of porphyria, no history or culture evidence of diphtheria, no history or evidence of lead intoxication, symptoms not purely sensory, and no evidence of poliomyelitis or toxic neuropathy.

Immediate therapeutic management included intravenous immunoglobulin (IVIG) at 50 g daily for five days a week and plasma transfusion. The patient chemotherapeutic plan was resumed under the UK- ALL Regimen C guidelines without vincristine. The patient developed tachypnea without respiratory distress (RD) and hypoxia, necessitating

NCS

Motor Nerve Results

Site	Latency (ms)	Amplitude (mV)	Duration ms	F-M Latency ms	Segment	Distance mm	Velocity (m/s)	Comment
Right Dp Branch Fibular (TA) Motor								
Fib Head	3.6	1.26	16.0					
Pop Fossa	5.5	0.19	17.0		Pop Fossa-Fib Head	65	34	
Left Fibular (EDB) Motor								
Ankle	7.2	1.13	9.0	61.0				
Bel Fib Head	14.4	0.76	11.6		Bel Fib Head-Ankle	330	46	
Pop Fossa	16.1	0.34	10.8		Pop Fossa-Bel Fib Head	65	38	
Right Fibular (EDB) Motor								
Ankle	5.1	1.69	9.3	62.0				
Bel Fib Head	12.7	0.94	10.8		Bel Fib Head-Ankle	360	47	
Pop Fossa	14.2	0.88	11.5		Pop Fossa-Bel Fib Head	65	43	
Left Tibial (AHB) Motor								
Ankle	5.5	1.66	12.2	62.1				
Right Tibial (AHB) Motor								
Ankle	6.1	0.89	15.5	63.0				
Left Median (APB) Motor								
Wrist	6.4	1.39	13.7	35.6				
Elbow	11.1	1.39	13.1		Elbow-Wrist	230	49	
Erb's Pt.	12.9	1.05	12.4					
Right Median (APB) Motor								
Wrist	6.5	2.4	13.4	36.0				
Elbow	11.5	2.1	12.4		Elbow-Wrist	250	50	
Axilla	13.7	2.00	12.3		Axilla-Elbow			
Erb's Pt.	17.9	1.68	12.1		Erb's Pt.-Axilla			
Left Ulnar (ADM) Motor								
Wrist	6.6	2.4	12.6	37.7				
Bel Elbow	11.4	1.24	13.2		Bel Elbow-Wrist	220	46	
Abv Elbow	14.3	0.74	13.6		Abv Elbow-Bel Elbow	90	31	
Right Ulnar (ADM) Motor								
Wrist	3.5	3.6	11.4	38.0				
Bel Elbow	7.6	3.2	11.7		Bel Elbow-Wrist	230	56	
Abv Elbow	11.3	1.35	11.9		Abv Elbow-Bel Elbow	100	27	
Erb's Pt.	11.9	1.32	11.7		Erb's Pt.-Abv Elbow			

Figure 3 EMG – NCV Study Report for Motor Nerve Results.

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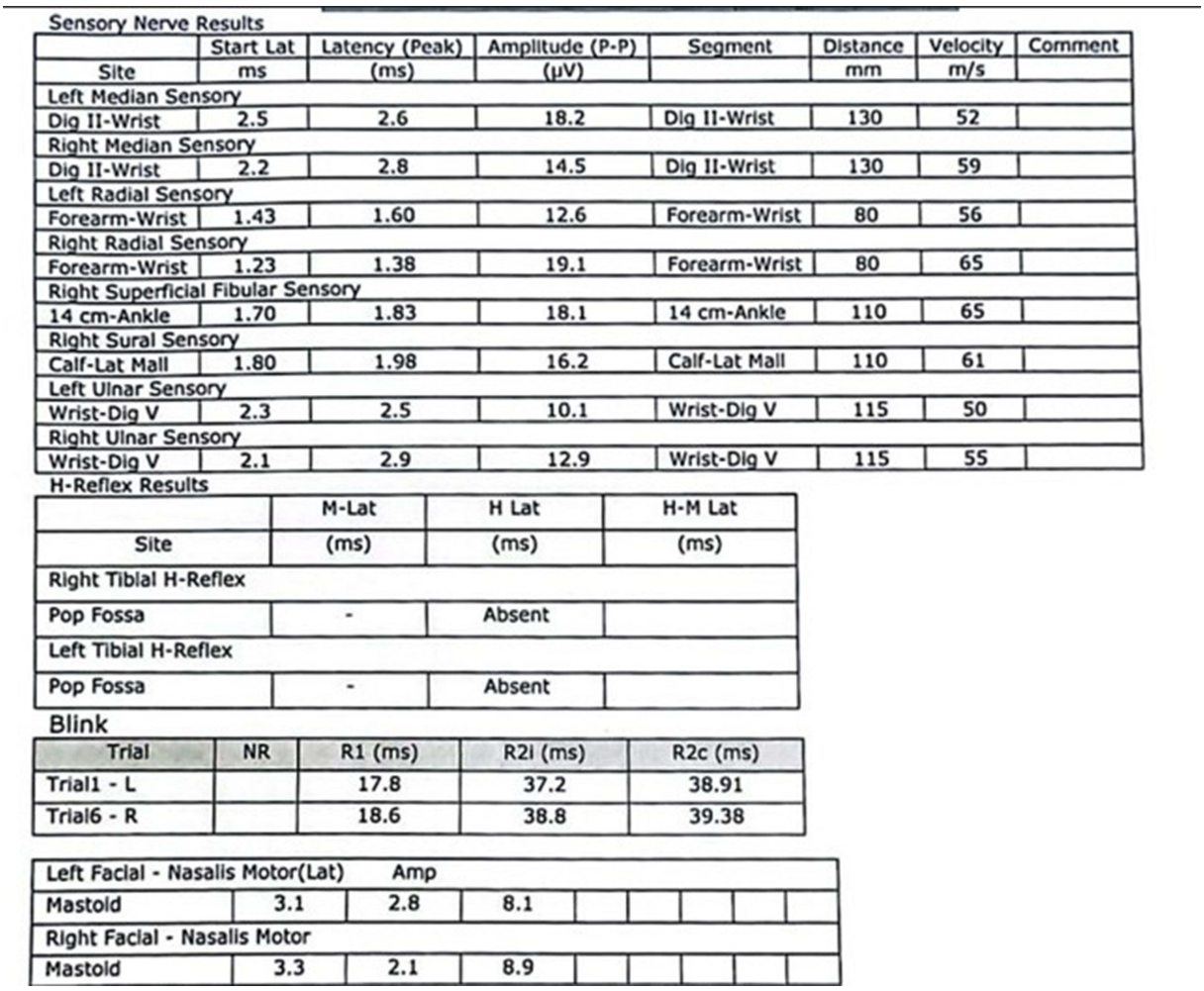

Sensory Nerve Results

Site	Start Lat ms	Latency (Peak) (ms)	Amplitude (P-P) (μV)	Segment	Distance mm	Velocity m/s	Comment
Left Median Sensory							
Dig II-Wrist	2.5	2.6	18.2	Dig II-Wrist	130	52	
Right Median Sensory							
Dig II-Wrist	2.2	2.8	14.5	Dig II-Wrist	130	59	
Left Radial Sensory							
Forearm-Wrist	1.43	1.60	12.6	Forearm-Wrist	80	56	
Right Radial Sensory							
Forearm-Wrist	1.23	1.38	19.1	Forearm-Wrist	80	65	
Right Superficial Fibular Sensory							
14 cm-Ankle	1.70	1.83	18.1	14 cm-Ankle	110	65	
Right Sural Sensory							
Calf-Lat Mall	1.80	1.98	16.2	Calf-Lat Mall	110	61	
Left Ulnar Sensory							
Wrist-Dig V	2.3	2.5	10.1	Wrist-Dig V	115	50	
Right Ulnar Sensory							
Wrist-Dig V	2.1	2.9	12.9	Wrist-Dig V	115	55	

H-Reflex Results

Site	M-Lat (ms)	H Lat (ms)	H-M Lat (ms)
Right Tibial H-Reflex			
Pop Fossa	-	Absent	
Left Tibial H-Reflex			
Pop Fossa	-	Absent	

Blink

Trial	NR	R1 (ms)	R2i (ms)	R2c (ms)
Trial1 - L		17.8	37.2	38.91
Trial6 - R		18.6	38.8	39.38

Left Facial - Nasalis Motor(Lat)		Amp						
Mastoid	3.1	2.8	8.1					
Right Facial - Nasalis Motor								
Mastoid	3.3	2.1	8.9					

Figure 4 NCV Study Report for Sensory Nerve Results: the findings of demyelinating and axonal peripheral neuropathy. There is significant proximal conduction block, very prolonged F waves, moderately slow motor conduction velocities, low motor responses and sural sparing pattern. The findings support the clinical diagnosis of Guillain-Barre syndrome. A follow-up after 3-4 weeks is recommended.

transfer to the ICU. The plasma exchange transfusion was started in the ICU after right femoral hemodialysis catheter was inserted.

After two days of therapeutic treatment, the patient showed gradual improvement in reverse chronological manner with the appearance of symptoms, including better swallowing of solid food, sensation and movement in the anal area and lower limbs, resolution of headaches and neck pain, and gradually regressing numbness. After four plasma exchange sessions and three weeks with physiotherapy, the patient reached near-complete recovery. His treatment plan includes the continuation of IVIG for long-term GBS management and physiotherapy to enhance quality of life.

Discussion

Guillain-Barre syndrome (GBS) is a critically acquired condition characterized by acute evolution, immune mediation, and inflammatory disorder of the peripheral nervous system, leading to demyelination and axonal loss. Clinical hallmarks include symmetrical flaccid muscle paresis, areflexia, increased cerebrospinal fluid protein content, and electrophysiologic evidence of evolving demyelination.[3]

GBS in children with ALL is rare, with few reported cases.[4–6] Out of the five cases reported, three were from a single center.[5] ALL is a hematologic malignancy, characterized by various genetic abnormalities, including chromosomal translocations, fusion genes, and other mutations, that lead to uncontrolled proliferation of lymphoid precursor cells.

These genetic abnormalities often align with specific subtypes of ALL and can influence disease prognosis, treatment response, and clinical trajectory.

Most patients develop weakness starting in the lower extremities, progressing due to peripheral nerve demyelination, resulting in ascending paralysis and loss of cranial nerve function.[7] Manifestations may be acute or chronic and temporary or permanent, depending on the degree of neuronal destruction.[8] Muscle stretch reflexes are typically depressed, and sensory loss is variable. Weakness is usually symmetric but can involve the upper extremities.[9–11] Elevated CSF protein in patients with ascending paresis is indicative of GBS.[11]

An important consideration in children with ALL developing neuropathy during chemotherapy is vincristine-induced neuropathy. However, the clinical and electrodiagnostic findings for vincristine-induced neuropathy are distinct.[12] Timely differentiation is important to initiate immunomodulatory therapies for GBS and avoid unnecessary withdrawal of vincristine, which could worsen ALL symptoms.

Treatment for GBS varies based on symptom severity. Common complications include ventilatory failure and cardiovascular instability, necessitating intensive care support. Ventilatory failure results from involvement of the airway and respiratory muscles, particularly the diaphragm.[13] Corticosteroids have shown no benefit.[14] Plasmapheresis is a well-investigated, efficacious immunomodulatory therapy, shown to decrease ventilator dependence in severe GBS cases.[3]

Conclusion

This case highlights the rare but serious complication of Guillain-Barré syndrome (GBS) in children with acute lymphoblastic leukemia (ALL), particularly during maintenance therapy. In children undergoing maintenance therapy for B-cell precursor acute lymphoblastic leukemia (BCP-ALL), GBS can be particularly concerning. The overlap in clinical presentation between GBS and vincristine-induced neuropathy underscores the importance of thorough diagnostic evaluation to ensure accurate diagnosis and prompt treatment. In this case, the patient responded positively to intravenous immunoglobulin and supportive care, demonstrating the efficacy of early intervention in managing GBS. This report emphasizes the need for healthcare providers to maintain a high index of suspicion for GBS in similar clinical settings, as timely differentiation and management can significantly impact patient outcomes. Further research is needed to better understand the pathophysiology of GBS in the pediatric ALL population and to develop targeted therapeutic strategies.

Human and Animal Guidelines

"Not applicable" as this patient was presented at the hospital as a regular patient.

Medical Writing Support

Medical Writing support was provided by Al Essa Medical and Scientific Group.

Abbreviations

GBS, Guillain-Barré syndrome; ALL, acute lymphoblastic leukemia; GCS, Glasgow Coma Scale; NCV, nerve conduction velocity; EMG, electromyography; CSF, cerebrospinal fluid; IVIG, intravenous immunoglobulin; RD, respiratory distress.

Ethical Approval

Ethical approval is not recommended in this case report because the patient was referred to the hospital for normal treatment. Patient was treated and discharged according to the hospital normal procedures. However, since such cases are rare in the medical literature, we decided to publish this case and got a written consent from the guardians of the pediatric patient.

Informed Consent

Written informed consent was obtained from legal guardians for the publication of any potentially identifiable images or data included in this article.

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Disclosure

The authors declare no conflict of interest in this work.

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