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Injudicious use of cranio-spinal imaging in Guillain-Barré syndrome in a low resource country

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Keywords
Guillain-Barre Syndrome; Neuroimaging; Peripheral Neuropathies

Abstract

Background: Many patients being investigated for Guillain-Barré syndrome (GBS) undergo unnecessary neuroimaging. The objective of this study was to determine the proportion of patients with GBS undergoing neuroimaging investigation, and to investigate any association with different GBS variants using the Brighton criteria.

Methods: This cross-sectional observational study was conducted in the leading tertiary care hospital in Pakistan; 148 patients being investigated for, and subsequently diagnosed with GBS between January 2017 and March 2020 were enrolled. Participants were asked if they had undergone neuroimaging of the craniospinal axis before or during hospital admission, and the purpose of any computed tomography (CT) scan was investigated. We enquired whether fundoscopy had been performed before lumbar puncture (LP) and determined the level of certainty based on the Brighton criteria.

Results: The majority of participants were men (n = 107, 73%), with a mean age of 42.85 ± 18.40 years. The mean waiting time to their first interaction with a neurologist was 5.20 ± 4.01 days, and the demyelinating variant of GBS was more common than the axonal variant (1.6:1). Most patients were diagnosed with level I certainty using the Brighton criteria (n = 113, 76%). Brain and spine magnetic resonance imaging (MRI) were performed ahead of admission in 48 (32%) and 59 (39%) patients, respectively. Brain CT scan was performed in 121 (82%) patients before LP, while 27 (18%) only underwent fundoscopic examination before LP.

Conclusion: Clinical examination is fundamental in the diagnosis of GBS. Neuroimaging may be inappropriate and unnecessary, and may detract attention from crucial peripheral neuropathy measures while misusing limited resources.

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Introduction

The Guillain-Barré syndrome (GBS) is characterized by acute or subacute weakness in muscles and limbs innervated by cranial nerves, as well as absent or sluggish deep tendon reflexes. In cerebrospinal fluid (CSF) analysis, albumin-cytological dissociation is observed, and neurodiagnostic studies support these findings.[1] It is believed that the pathophysiology of GBS is an aberrant immune-mediated process caused by autoimmune antibodies interacting with peripheral nerve epitopes, including nerve roots. This causes widespread demyelination or axonal degeneration in GBS.[2] Globally, the incidence is approximately 1-2 per 100000 people per year.[3] GBS is diagnosed based on the results of a clinical, physiological, and neurological examination. Since the advent of diagnostic imaging over the last two decades, physical examinations have been questioned.[4]

Clinical errors can result from incomplete or omitted neurological examinations, which make up the majority of physical examination components. Despite their limitations, clinical examinations were established when there were no alternative diagnostic methods for neurological disease. The disease was exclusively diagnosed and localized through clinical examination before any neurological or neurosurgical procedures were performed. However, in the case of GBS, their specific role is only theoretical and has no practical application.

During the crucial diagnosis stage, neuroimaging bypasses the need for clinical findings and contributes almost nothing to treatment planning. Once a diagnosis of GBS is made, neuroimaging will only deplete resources and may also distract from other clinical findings resulting in incorrect, or delayed, treatment.

The diagnosis of GBS is based primarily on clinical evaluation, which is later confirmed by neurophysiology and CSF analysis showing protein-cell dissociation. Clinical audits revealed that many patients with GBS referred to different hospitals and clinics underwent neuroimaging, which was unnecessary for diagnostic purposes. Thus, the purpose of this study was to investigate whether over-investigating patients during the diagnosis of GBS is a common practice, regardless of the results of the clinical examination.

Materials and Methods

Study design: This was a cross sectional observational study.

Ethical consideration: The ethical review board of Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan, approved this prospective study.

Patients' selection: The study recruited patients with acute flaccid paralysis (AFP) presenting to the neurology department of the teaching hospital at Shaheed Zulfiqar Ali Bhutto Medical University, Pakistan Institute of Medical Sciences (PIMS), Islamabad. The study recruited 148 participants over the age of 12 between January 2017 and March 2021.

Questionnaire: Our study investigated whether the participants who were admitted to the hospital had undergone neuroimaging during their stay in the hospital or before they were admitted to the hospital specifically related to this illness, and if so, what the purpose of this neuroimaging was. Participants were also asked if they had received a fundoscopy before undergoing a lumbar puncture (LP) according to the Brighton criteria. GBS is diagnosed and registered worldwide using the Brighton criteria,[5] which include relevant symptoms and diagnostic tools. The Brighton criteria provide different levels of certainty as shown in table 1.[6] Neuroimaging performed before and after admission to the neurology ward will also depend on the individual's condition and the neurologist's clinical judgment.

Table 1. Brighton criteria

Diagnostic criteria	Level of diagnostic certainty			
	I	II	III	IV
Absence of alternative diagnosis for weakness	+	+	+	+
Diminished or absent deep tendon reflex in weak limbs	+	+	+	+/-
Monophasic course and time between onset and nadir, 12 hours to 28 days	+	+	+	+/-
Bilateral and flaccid weakness of limbs	+	+	+	+/-
CSF cell count < 50 cells/µl	+	+	-	+/-
CSF protein concentration > normal value	+	+/-	-	+/-
NCS findings consistent with one of the subtypes of GBS	+	+/-	-	+/-

CSF: Cerebrospinal fluid; NCS: Nerve conduction study; GBS: Guillain-Barré syndrome

Data were analyzed using SPSS software (version 23, IBM Corporation, Armonk, NY, USA). Frequencies were calculated for variables such as gender, variant, type of radiology performed, and level of certainty. Means and standard deviations (SDs) were calculated for age and time to interact with neurologists.

Results

The results of the study, which involved 148 participants, are presented in table 2. There was a predominance of men among these individuals, with 107 (72%). The mean age of the participants was 42.85 ± 18.40 years, with an age range spanning from 13 to 75. The mean duration of interaction with a neurologist was 5.20 ± 4.01 days, ranging from 1 to 14 days. 92 participants (62.0%) were diagnosed with demyelinating GBS, while 56 (38.0%) were diagnosed with axonal GBS. 113 patients (76.0%) presented at level 1, 30 patients (20.3%) at level 2, and 5 patients (3.7%) at level 3 as Brighton criteria. A pre-LP computed tomography (CT) was performed in 121 (82.0%) patients, while it was not performed in 27 (18.0%) ones. Magnetic resonance imaging (MRI) scans of the brain and spine were performed on 48 (32.0%) and 58 (39.0%) patients, respectively. A CT scan of the brain prior to LP was the only imaging test ordered after a neurologist saw the patient (82%).

Discussion

GBS is an uncommon condition. It can only be diagnosed with a comprehensive neurological examination and a thorough medical history. In cases of unclear or confusing clinical presentations, neuroimaging can be useful for ruling out a differential diagnosis. This costly diagnostic resource has been overused because of easy access and widespread availability of neuroimaging, as well as deficiencies in clinical evaluations. This study supports the assertion that unnecessary neuroimaging investigations are often performed on patients with GBS.

However, despite the influence of diagnostic imaging, the primary diagnostic component of a physical examination conducted by the referring doctor is still very significant. This gives patients a sense of satisfaction that they have been seen. Radiological services have become increasingly popular in recent years. Several mechanisms have led to overconsumption, resulting in unnecessary investigations: ordering imaging investigations inappropriately, ordering repeated investigations, and ordering investigations where none are needed.[4]

As a consequence of overutilization, healthcare costs, risks, and the provision of national healthcare services increase.[7] There are limited economic and health opportunities in Pakistan.[8] A study conducted by Javed et al. reported the failure to conduct a clinical examination and the absence of an adequate clinical history (P = 0.04) as one of the leading causes of false or inaccurate radiological reporting.[9] According to the Brighton criteria, GBS is conventionally diagnosed using neurophysiology and CSF analysis within the context of a thorough clinical history and examination. GBS diagnosis is minimally impacted by neuroimaging.

Table 2. Study questionnaire

Variable	Subheading	Value
Gender	Male/Female	107:41 (2.6:1)
Age (year) (mean ± SD)		42.85 ± 18.40
Variant of GBS [n (%)]	Demyelinating	92 (62.0)
	Axonal	56 (38.0)
Time to interact with neurologist (day) (mean ± SD)		5.20 ± 4.01
Brighton criteria [n (%)]	Level 1 certainty	113 (76.0)
	Level 2 certainty	30 (20.3)
	Level 3 certainty	5 (3.7)
Purpose of brain CT scan [n (%)]	Before LP (either inside or outside hospital including refusal of LP later)	121 (82.0)
	Relying on fundoscopy for LP	27 (18.0)
Brain plain MRI [n (%)]	Performed before admission	48 (32.0)
	Not performed before admission	100 (68.0)
Spine MRI (either with contrast or without contrast) [n (%)]	Performed before admission	58 (39.0)

GBS: Guillain-Barré syndrome; CT: Computed tomography; MRI: Magnetic resonance imaging; LP: Lumbar puncture; SD: Standard deviation

Unnecessary diagnostic imaging investigations waste substantial amounts of money. To assess intracranial pressure, a fundoscopic examination should be performed before the LP. Brain CT or MRI findings in cases of acute peripheral neuropathy are likely to be irrelevant. Neurological history and examination are considered more valuable than spine MRI.

Most patients (76%) in the present study met the Brighton criteria level 1 diagnostic certainty. Inadequate knowledge of the Brighton criteria makes it difficult for physicians to diagnose GBS clinically. Patients and their families are overburdened with unnecessary investigations, which exacerbates the shortage of healthcare facilities and resources. Physicians must maintain continuing professional development (CPD) to acquire up-to-date diagnostic and clinical tools to diagnose complex conditions like GBS. Increasing awareness will help clinicians order the right investigations in the first place, preventing unnecessary neuroimaging investigations where the results do not directly benefit the patient.

Conclusion

Clinical examination is a cornerstone in the GBS diagnosis. Neuroimaging may be irrelevant and represents a waste of resources and time, particularly in investigating peripheral neuropathy.

Conflict of Interests

The authors declare no conflict of interest in this study.

Acknowledgments

None.

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