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Nondiabetic Gastroparesis Among Multiple Sclerosis Patients: A Retrospective Analysis of Patient Characteristics From the United States

Renuka Verma[1] | Kamleshun Ramphul[2] | Lily Liu[3] | Hemamalini Sakthivel[4] | Patrick Deladem Pekyi-Boateng[5] | Prince Kwabla Pekyi-Boateng[6,7]

[1]Department of Internal Medicine, Kirk Kerkorian School of Medicine at UNLV, Las Vegas, Nevada, USA | [2]Independent Researcher, Triolet, Mauritius | [3]Kirk Kerkorian School of Medicine at UNLV, Las Vegas, USA | [4]Department of Internal Medicine, One Brooklyn Health System/Interfaith Medical Ctr Program, Brooklyn, New York, USA | [5]Kwame Nkrumah University of Science and Technology, Kumasi, Ghana | [6]Department of Neurology, Korle Bu Teaching Hospital, Accra, Ghana | [7]Department of Internal Medicine and Neurology, University of Utah Health, Salt Lake City, USA

Correspondence: Patrick Deladem Pekyi-Boateng (patpekyiboateng.research@gmail.com)

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1 | Introduction

Multiple sclerosis (MS), an autoimmune condition, follows a progressive and chronic path accompanied by inflammation and demyelination, that triggers various neurological symptoms such as weakness, numbness, vision impairment, and cognitive impairment [1, 2]. Patients with MS are also prone to various gastrointestinal symptoms and manifestations, including constipation, diarrhea, incontinence, and bloating. While gastroparesis is typically linked with diabetes mellitus, cases have been reported due to demyelinating diseases [3]. Regardless of the cause, gastroparesis can impact the quality of life [4], and our study aims to understand the patient demographics and underlying comorbidities in nondiabetic multiple sclerosis (ND-MS) patients with and without nondiabetic gastroparesis (ND-gastroparesis) in the United States.

2 | Methods

This retrospective study relied on hospitalization data from the National Inpatient Sample (NIS), which was created by the Healthcare Cost and Utilization Project (HCUP) from 2016 to 2021 [5]. We extracted cases with an ICD-10 code for MS "G35". All patients younger than 18 years were excluded from our sample. The presence of gastroparesis was also identified via the ICD-10 code "K31.84" [6, 7]. We first estimated the prevalence of gastroparesis in patients with diabetes and among those without diabetes. Then, all cases with diabetes were excluded for the remaining statistical analyses of our study, to create a sample of ND-MS patients, adopting the methodology of past studies [7] via appropriate ICD-10 codes [8].

The baseline patient demographics of the gastroparesis and non-gastroparesis ND-MS groups were studied by running χ^2 tests for categorical groups and Mann–Whitney U tests for continuous data, through SPSS 29.0 (IBM Corp., Armonk, New York). Statistical significance was maintained at a p-value less than 0.05. The NIS was released in deidentified form. Users are not required to seek ethics and institutional board review and approval [9].

3 | Results

Initially, a total of 906,115 adult MS patients (with and without diabetes) were identified, with 10,580 cases of gastroparesis (diabetic and nondiabetic) (1.17%). Out of 199,615 MS patients with diabetes, 5630 (2.82%) had gastroparesis, while the ND-MS group consisted of 706500 MS patients amongst which 4950 (0.70%) had gastroparesis (Figure 1).

Further analysis of the ND-MS groups revealed that the ND-MS gastroparesis patients were younger, with a median age of

53.00 years (vs. 57.00, $p < 0.01$), while involving more females (87.6% vs. 72.3%, $p < 0.01$), Whites (82.6% vs. 76.1%, $p < 0.01$), current users of systemic steroids (2.8% vs. 2.1%, $p < 0.01$), cases with chronic kidney disease (7.5% vs. 6.6%, $p = 0.014$), previous stroke (6.4% vs. 5.7%, $p = 0.037$), liver cirrhosis (2.7% vs. 1.8%, $p < 0.01$), and COPD (14.2% vs. 11.8%, $p < 0.01$) than ND-MS patients without ND-gastroparesis. In addition, ND-MS gastroparesis patients also had a higher prevalence of other autoimmune conditions such as Systemic Lupus Erythematosus (SLE) (3.8% vs. 1.1%, $p < 0.01$), Celiac disease (0.9% vs. 0.2%), hyperthyroidism (1.0% vs.0.8%, $p = 0.035$), and hypothyroidism (20.4% vs. 13.7%, $p < 0.01$). Finally, we found fewer cases of hypertension(33.0% vs. 34.9%, $p < 0.01$) and alcohol abuse (1.6% vs. 3.0%, $p < 0.01$) in the ND-MS gastroparesis cohort (Table 1).

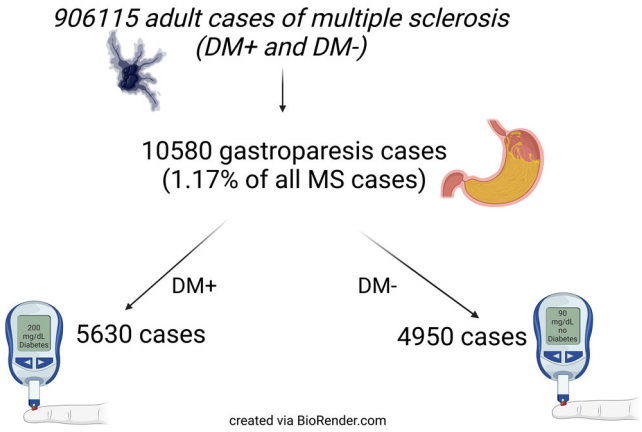

FIGURE 1 | Sample size of our study.

4 | Discussions

To the best of our knowledge, our analysis is, at present, the most extensive study that estimated the prevalence of ND-gastroparesis among MS patients via the use of a nationally representative sample and provided insights on their baseline characteristics. The presence of gastroparesis among MS patients (1.17%) was higher than the results by Syed et al. (0.16%), who studied a sample that was similar to the US population. Similarly, MS patients with diabetes (2.82% vs. 1.57%) or without diabetes (0.70% vs. 0.05%) also showed a higher prevalence of gastroparesis as compared to their study [10].

The higher prevalence of ND-gastroparesis in ND-MS females seen in our study could be related to the more severe autoimmune response that could contribute to the pathophysiology [11]. In addition, we also found a higher prevalence of multiple autoimmune conditions in the ND-gastroparesis cohort in our study. Several autoimmune diseases have been linked with gut

TABLE 1 | Characteristics of ND-MS patients with and without gastroparesis.

	Nondiabetic MS patients		
Variable	**No gastroparesis ($n = 701{,}550$) (%)**	**With gastroparesis ($n = 4950$) (%)**	***p* value**
Median age (IQR)	57.00 (45.00–67.00)	53.00 (44.00–62.00)	< 0.01
Sex			< 0.01
Males	27.7	12.4	
Females	72.3	87.6	
Race			< 0.01
White	76.1	82.6	
Black	15.3	10.1	
Hispanic	5.5	3.7	
Currently on long-term steroids	2.1	2.8	< 0.01
Hypertension	34.9	33.0	< 0.01
Dyslipidemia	24.4	25.1	0.294
Smoking	39.0	38.4	0.385
Chronic kidney disease	6.6	7.5	0.014
Previous stroke	5.7	6.4	0.037
Liver cirrhosis	1.8	2.7	< 0.01
Alcohol abuse	3.0	1.6	< 0.01
Obesity	14.5	15.5	0.061
COPD	11.8	14.2	< 0.01
SLE	1.1	3.8	< 0.01
Celiac disease	0.2	0.9	< 0.01
Hyperthyroidism	0.8	1.0	0.035
Hypothyroidism	13.7	20.4	< 0.01

motility disorders. The chronic inflammatory insult towards the enteric system, as well as the damage to the smooth muscles of the gastrointestinal tract, can increase the odds of gastroparesis among MS patients [12–15]. MS patients share the allelic susceptibility with other autoimmune conditions, and it is therefore essential to test them early for other autoimmune diseases and provide adequate care [16]. Further research should also be encouraged to evaluate the genetic and allelic influence and pathways of ND-gastroparesis among MS patients [17].

As gastroparesis can impact the quality of life of MS patients, a better understanding of the pathophysiology in ND-MS cases, as well as understanding other risk factors, and potential preventive measures and treatment plans, can help improve the short- and long-term outcomes of at-risk groups. Research via quality-of-life questionnaires can also help identify the various challenges MS patients with ND-gastroparesis might face and help bring forward adequate solutions.

There are several limitations to our study. The NIS does not include data regarding the duration of the disease or the time of diagnosis for MS. Moreover, we are unable to adjust for the treatment plans that the MS patients were on and adequately evaluate the nondiabetic causes of gastroparesis. Furthermore, future studies should be encouraged to better evaluate the differences in gastroparesis adults who suffer from MS and those who do not. Moreover, subgroups analyses among such studies, based on diabetes status, can also provide deeper insights into the differences in their characteristics. However, the big database estimate from our study provides the first step toward a more profound understanding of the role of MS in the risk of gastroparesis in the ND-MS patient groups.

5 | Conclusion

In conclusion, MS led to a higher prevalence of gastroparesis among the nondiabetic population. The ND-MS patients with gastroparesis were younger and had a higher prevalence of several autoimmune diseases, as well as exhibiting sex and racial disparities. Expanded studies involving ND-MS patients, taking into account the limitations of our analysis, will help set up effective healthcare initiatives that can screen for early symptoms of gastroparesis and bring about adequate measures to reduce its progression and improve their quality of life.

Author Contributions

Renuka Verma: conceptualization, investigation, writing – original draft, writing – review and editing, formal analysis, software, methodology, data curation, supervision, resources. **Kamleshun Ramphul:** supervision, conceptualization, investigation, writing – original draft, methodology, validation, visualization, writing – review and editing, project administration, formal analysis, data curation, software. **Lily Liu:** writing – review and editing, writing – original draft, visualization. **Hemamalini Sakthivel:** formal analysis, data curation, methodology, validation. **Patrick Deladem Pekyi-Boateng:** writing – original draft, writing – review and editing, conceptualization. **Prince Kwabla Pekyi-Boateng:** conceptualization, investigation, writing – original draft, writing – review and editing, supervision.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author.

Transparency Statement

The lead author Patrick Deladem Pekyi-Boateng affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.