



Gastroparesis in geriatrics population: A United States population study

Saad Saleem,¹ Zahid Ijaz Tarar,² Muhammad Aziz,³ Rizwan Ishtiaq,⁴ Patricia Guzman Rojas,⁵ and Thomas L. Abell⁶

¹Department of Internal Medicine, Sunrise Hospital and Medical Center, Las Vegas, NV, United States; ²Department of Internal Medicine, University of Missouri, Columbia, MO, United States; ³Department of Gastroenterology, University of Toledo, Toledo, OH, United States; ⁴Department of Internal Medicine, St. Vincent Mercy Medical Center, Toledo, OH, United States; ⁵Department of Internal Medicine, University of Louisville, Louisville, KY, United States; ⁶Department of Medicine, University of Louisville, Louisville, KY, United States

ABSTRACT

Background: Older patients with upper gastrointestinal diseases may lack disease-specific symptoms that are required to make the correct diagnosis. This study aimed to compare the gastroparesis demographics, clinical presentation, and surgical management between the older adult and young populations.

Methods: The National Inpatient Sample database was used between the years 2012 and 2014 with the primary diagnosis of gastroparesis. Patients were further divided based on their age into two groups: 70 years or older and younger than 70 years.

Results: The older adults were more likely to have early satiety and bloating compared to younger population with an odds ratio (OR) = 3.79; 95% Confidence Interval (95%CI) 2.80–5.11, $p < 0.0001$ and OR = 2.80, 95%CI 2.07–3.78, $p < 0.0001$ respectively. Older adults had low odds of having nausea with vomiting (OR = 0.86, 95%CI 0.76–0.95, $p = 0.003$), or abdominal pain (OR = 0.56, 95%CI 0.50–0.63, $p < 0.0001$).

Conclusions: Older adults had more early satiety and bloating, whereas younger patients had more nausea with vomiting and abdominal pain.

Key Indexing Terms: Gastroparesis; Older population; Difference; Symptoms; NIS-HCUP. [Am J Med Sci 2022; ■(■):1–6.]

INTRODUCTION

The average life expectancy has increased from 47 years in 1900 to 79 years in 2014,¹ which has led to dramatic increases in the geriatric population over the last century. By 2030, it is expected that the percentage of the population over 65 years of age will exceed 20 percent, or over 70 million people.¹ Those 65 years and older are hospitalized three times more than 45 to 65 year old individuals.²

In 2015, gastrointestinal (GI) diseases contributed significantly to health care use in the United States, with approximately \$135.9 billion dollars more spent annually compared to other common diseases.³ Gastroparesis is a chronic gastric motility disorder causing considerable distress,⁴ which has cardinal symptoms of nausea, vomiting, early satiety, belching, and/or upper abdominal pain.⁵ Once a gastroparesis diagnosis is suspected, a mechanical obstruction should be excluded by means of an upper endoscopy. The presence of delayed gastric emptying usually establishes the diagnosis of gastroparesis.

A prospective study with 146 subjects showed that gastroparesis could present with nausea (93%), vomiting (68–84%), abdominal pain (46–90%), early satiety (60–86%), postprandial fullness and bloating.⁶ There were 81% of females in the study with a mean age of 45 years.⁶ Gastroparesis can also present with weight loss.⁷

Several epidemiological and clinical studies suggest that the prevalence of upper gastrointestinal diseases is high in the elderly population.⁸ It has been shown that older adults with upper gastrointestinal disorders may not report specific symptoms or could even be asymptomatic, leading to a late diagnosis or severe complications.^{9,10}

Several clinical and functional disorders may influence the perception and referral of symptoms to the doctor, especially in the older adults.¹¹ Hence, it is troublesome to diagnose gastroparesis in older adults based solely on the typical symptoms. To our knowledge, there has been no study performed solely in the older adults to evaluate gastroparesis symptoms. This study aimed to compare the gastroparesis

demographics, clinical presentation, and surgical management between older and younger adults.

METHODS

This study did not require ethics committee approval or institutional review board approval because the Nationwide Inpatient Sample and Healthcare Cost and Utilization Project (NIS- HCUP) database used for this study does not contain any patient identifiers. The NIS- HCUP database was used between 2012 and 2014. The HCUP contains the most extensive collection of the United States (US) hospital data. The NIS is the part of HCUP and has data regarding patient's demographics, healthcare access, utilization, charges, and outcomes. This database has more than seven million hospital stays each year. When it is weighted to create national estimates, it has 35 million hospital visits nationwide.

It contains information about patient's demographics (age, sex, race, median household income), principal diagnosis, and up to 29 secondary diagnoses using the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) coding system, severity, and comorbidity measures, expected payment source, hospital characteristics, hospital length of stay and total charges. The primary is the chief reason for the hospitalization of the patient. For this study, older adults are referred to patients with age 70 years or more, meanwhile younger adults are those aged 69 years or less.

Study population

Hospital encounters with the primary diagnosis of gastroparesis (ICD-9 code 536.3) were included in this study. Patients were further classified based on their age in two groups: 70 years or older (study group) vs. 69 years or younger (control group). The comorbid conditions were identified in the gastroparesis population using ICD 9 codes: nausea (787.02), vomiting (787.03), nausea with vomiting (787.01), persistent vomiting (536.2), early satiety (780.94), bloating/flatulence (787.3), and upper abdominal pain (789.00, 789.01, 789.02, 789.05, 789.06, 789.07 and 789.09).

Study outcomes and variables

The study aimed to determine if gastroparesis symptoms in older adults differ from those of younger patients. Symptoms, surgical procedures, and comorbidities were compared between the two groups. The secondary outcome was to assess independent determinants and surgical procedures for gastroparesis in geriatric patients. Multiple confounders were identified and accounted for in the analysis, such as sex, race, median household income and comorbidities.

Study analysis

Statistical analysis was conducted through the Statistical Package for the Social Sciences 27 (SPSS). The

data were weighted using the discharge-level weight variable (DISCWT) for the analysis. Chi square test was used for categorical factors; p-values less than 0.05 indicate a statistically significant association. Univariate analysis was performed to compare patients' demographics, morbidity, and surgical procedures. Weighted multivariable regression was conducted to identify independent variables associated with gastroparesis in the geriatric's population.

RESULTS

A total of 50,170 hospitalizations with a primary diagnosis of gastroparesis were included in this study. Of these, 6265 (12.5%) patients were 70 years or greater, whereas 43,905 (87.5%) were younger than 70 years. Sex, race, median household income and primary payer source were examined in both the groups (Table 1). In the older adults, there were more males in the study group compared to the control group with odds ratio (OR) = 1.22; 95% Confidence Interval (95%CI) 1.16 –1.30, $p < 0.0001$. Older adults had more Caucasians than the control group (76.9% vs. 64.1% respectively) (Table 1). On weighted multivariable analysis, race white and low median household income 0–25th were the great socioeconomic risk factor for gastroparesis in older patients (Table 2).

TABLE 1. Difference between demographic factors of gastroparesis between older and younger adults.

	Geriatrics patients	Younger patients
Sex		
Male	1895 (30.2%)	11,465 (26.1%)
Female	4370 (69.8%)	32,440 (73.9%)
Race/ethnicity		
White	4635 (76.9%)	26,945 (64.1%)
Black	700 (11.6%)	9580 (22.8%)
Hispanic	465 (7.7%)	3980 (9.5%)
Asian or Pacific Islander	90 (1.5%)	320 (0.8%)
Native American	20 (0.3%)	230 (0.5%)
Other	115 (1.9%)	1000 (2.4%)
	Missing 240	Missing 1850
Median zip code income quartile		
0–25%	1880 (30.6%)	13,940 (32.3%)
26–50%	1565 (25.5%)	11,440 (26.5%)
51–75%	1535 (25%)	9860 (22.9%)
76–100%	1160 (18.9%)	7865 (18.2%)
	Missing 125	Missing 800
Primary payer		
Medicare	5745 (91.8%)	13,825 (31.5%)
Medicaid	95 (1.5%)	10,250 (23.4%)
Private insurance	380 (6.1%)	15,325 (35%)
Self-pay	15 (0.25)	2795 (6.4%)
No charge		325 (0.7%)
Other	25 (0.45)	1325 (3%)
	Missing 5	Missing 60

TABLE 2. Multivariable logistic regression analysis of factors associated with older adults admitted for gastroparesis.

Factor	Odds ratio	95%*CI	P-value
Sex			
Male	1.22	1.14–1.29	0.0001
Race			
White	2.38	2.20–2.56	0.0001
Black	R		
Hispanic	1.32	1.17–1.49	0.0001
Asian or Pacific Islander	3.47	2.70–4.47	0.0001
Native American	1.19	0.74–1.90	0.48
Other	1.41	1.14–1.73	0.001
Median zip code income quartile			
0–25%	1.11	1.03–1.20	0.01
26–50%	1.005	0.93–1.09	0.91
51–75%	1.09	1.01–1.19	0.02
76–100%	R		
Nausea	0.99	0.74–1.32	0.96
Vomiting	0.38	0.27–0.53	0.0001
Nausea with vomiting	0.86	0.76–0.95	0.003
Persistent vomiting	0.49	0.41–0.60	0.0001
Early Satiety	3.79	2.80–5.11	0.0001
Bloating/flatulence	2.80	2.07–3.78	0.0001
Epigastric abdominal pain	0.56	0.50–0.63	0.0001
Underweight	1.22	0.68–2.19	0.50
Loss of weight	1.61	1.44–1.80	0.0001
Obesity	1.97	1.72–2.25	0.0001
Smoking	0.23	0.21–0.26	0.0001
Alcohol	0.50	0.29–0.85	0.01
Cannabis	0.00	0.00	0.98
Opiate	0.18	0.13–0.25	0.0001
Gastrotomy	7.84	2.23–27.57	0.001
*PEG	1.57	1.27–1.93	0.0001
Pyloromyotomy	0.000	0.00	0.99
Pyloroplasty	0.63	0.47–0.84	0.001
*EPD	0.75	0.47–1.21	0.24
*GES	0.17	0.12–0.26	0.0001

* Confidence Interval (CI), endoscopic pyloric dilation (EPD), Gastric electrical stimulation (GES), Percutaneous endoscopic gastrostomy (PEG).

Older adults had low odds of having vomiting, nausea with vomiting, persistent vomiting, or abdominal pain; however, they were more likely to have early satiety and bloating/flatulence. Also, they had lower odds of smoking, alcohol or opiate use compared to the younger cohort. Moreover, older adults were more likely to have weight loss compared to the younger population (Table 3). A 61% increased likelihood of weight loss among older adults was found (Table 2).

Older adults were more likely to receive gastrotomy and percutaneous endoscopic gastrostomy (PEG) with OR=7.01, 95%CI 2.03–24.23, $p < 0.0001$ and OR=1.89, 95%CI 1.54–2.31, $p < 0.0001$ respectively. On the other hand, they were less likely to receive gastric electrical stimulator (GES) with OR=0.22, 95%CI 0.15–0.32, $p < 0.0001$ (Table 4). Similarly, on weighted multivariate

analysis, older adults were more likely to receive gastrotomy and PEG, whereas the younger group was more likely to receive pyloroplasty, endoscopic pyloric dilation and GES.

DISCUSSION

This study elucidates the clinical presentation of hospitalized gastroparesis patients and highlights the differences between the older and younger populations. The heterogeneity of symptoms among geriatric and young patients may be due to the difference in disease pathogenesis. The higher odds of early satiety and bloating/flatulence among older adults, might be due to impaired gastric motility. Some studies have shown that the rate of gastric emptying is slower in older individuals compared to younger persons.^{12–14} Shimamoto et al.¹⁵ demonstrated a significant decrease in postprandial peristalsis and gastric contractile force in the older population with delayed gastric emptying. The most plausible explanation could be the loss of enteric cholinergic neurons, causing decrease motility in the geriatric population, which could be due to enteric neurodegeneration that occurs with aging secondary to reactive oxygen species.¹⁶

The increase in early satiety felt in older adults could be secondary to different reasons: Firstly, the degree of antral distention is directly proportional to the development of satiation after a meal, as observed with functional dyspepsia.¹⁷ Secondly, reduced antral compliance also enhances gastric emptying of liquids leading to postprandial anorexia.¹⁸ Thirdly, delayed emptying of solids may also cause prolonged postprandial satiety.^{19,20} The purpose of nitric oxide (NO) production is to cause dilatation of the fundus of the stomach to allow it to act as a reservoir for food before passing to the antrum.¹⁸ Impaired fundic NO synthesis, cause reduced receptive and adaptive relaxation of the stomach's fundus, resulting in an earlier satiation feeling in older individuals.¹⁸ Early satiety results in reduced food intake hence associated with significant weight loss.²¹

Abdominal pain is associated with hypersensitivity to gastric distention,²² which is impaired in older adults. This could be the one of possible reasons behind the results of our study, where we showed that abdominal pain was less common in the older population.

A Parkman et al. study that had 416 gastroparesis patients showed that diabetic gastroparesis (DG) patients had more severe vomiting and retching than idiopathic gastroparesis (IG) patients, whereas IG had more severe early satiety and excessive fullness.²³ This study postulated that IG might be due to sensory or accommodative dysfunction with abdominal pain and fullness. In contrast, DG may be more motor dysfunction-induced symptoms with vomiting and delayed gastric emptying.²³ Like Parkman et al.,²⁴ in this study, it is hypothesized that early satiety was more common in the older adults due to the stomach's accommodative dysfunction. In

TABLE 3. Comparison of morbidity between gastroparesis patients based on age.

Factor	Geriatrics patients	Younger patients	Odds ratio	P-value
Nausea	60 (1%)	350 (0.8%)	1.20 (0.91–1.58)	0.19
Vomiting	35 (0.6%)	505 (1.2%)	0.48 (0.34–0.68)	0.0001
Persistent vomiting	145 (2.3%)	2235 (5.1%)	0.44 (0.37–0.52)	0.0001
Nausea with vomiting	510 (8.1%)	4250 (9.7%)	0.83 (0.75–0.91)	0.0001
Early Satiety	75 (1.2%)	140 (0.3%)	3.79 (2.86–5.02)	0.0001
Bloating/Flatulence	65 (1%)	160 (0.4%)	2.87 (2.15–3.83)	0.0001
abdominal pain	340 (5.4%)	4270 (9.7%)	0.53 (0.48–0.60)	0.0001
Diabetes Mellitus	1620 (25.9%)	8080 (18.4%)	1.55 (1.45–1.64)	0.0001
Smoking	285 (4.5%)	7920 (18%)	0.22 (0.20–0.24)	0.0001
Alcohol	15 (0.2%)	260 (0.6%)	0.40 (0.24–0.68)	0.0001
Opioid type dependence	35 (0.6%)	1595 (3.6%)	0.15 (0.11–0.21)	0.0001
Obesity	250 (4%)	3195 (7.3%)	0.53 (0.46–0.60)	0.0001
Loss of weight	485 (7.7%)	2210 (5%)	1.58 (1.43–1.75)	0.0001
Underweight	15 (0.2%)	75 (0.2%)	1.40 (0.81–2.44)	0.23
Constipation	1170 (18.7%)	6420 (14.6%)	1.34 (1.25–1.44)	0.0001
Parkinson disease	270 (4.3%)	125 (0.3%)	15.77 (12.74–19.53)	0.00001

TABLE 4. Comparison of surgical procedures between the gastroparesis patients based on age.

	Geriatrics patients	Younger patients	P-value
Gastrotomy	5 (0.1%)	5 (0.0%)	0.0001
Pyloroplasty	55 (0.9%)	465 (1.1%)	0.185
Pyloromyotomy	0	50 (0.15%)	0.008
PEG*	120 (1.9%)	450 (1%)	0.0001
Endoscopic pyloric dilation	20 (0.3%)	170 (0.4%)	0.413
GES*	25 (0.4%)	800 (1.8%)	0.0001

Percutaneous endoscopic gastrostomy (PEG), gastric electrical stimulation (GES).

agreement with the current literature, older patients had more diabetes mellitus and Parkinson's disease than younger patients. These diseases seem to significantly impact the gastric emptying study in the older adults.

Clinical studies have only shown beneficial effects of GES on nausea and vomiting severity score.²⁵⁻²⁸ Similarly, in an open-label trial, transpyloric stent procedures led to a clinical response of 75% with greater efficacy in those with predominant nausea and vomiting than in those with predominant pain.²⁹ The possible explanation for lower odds of older adults receiving GES or pyloric intervention, could be the improvement in nausea and vomiting associated with these two surgical procedures. On the contrary, the most common symptoms of older individuals were early satiety and bloating.

This study had shown that older adults commonly received PEG or gastrostomy tube. Gastrostomy tubes can relieve the symptoms of motility disorders by venting gastric contents and reducing the need for hospitalization for acute exacerbation of dysmotility.^{30,31} The comorbid conditions increase with age, with 8% having at least one chronic illness, and 50% having at least two chronic conditions.¹ We hypothesize that the high burden of comorbid disease that accompanies the older

population may be a limiting factor for receiving disease-specific procedures like GES or pyloric intervention.

This study has several limitations. We used the national inpatient database that included data from all over the US, which provided an adequate sample size for the study. This database uses an ICD coding system, which carries the risk of bias due to the reporting system. We could not estimate the difference of delayed gastric emptying between the older and younger population as there are no specific ICD-9 codes for it. Since NIS contains hospitalized patients only, community-level studies could not be performed using this database.

CONCLUSIONS

This study involving gastroparesis patients highlights the symptomatology differences between older and younger adults. Geriatric patients had more early satiety and bloating, whereas younger patients had more nausea with vomiting and abdominal pain. We recommend for older adults that endoscopy should be considered first, due to the possible increased likelihood of structural abnormalities.

We found the difference between the surgical intervention performed in the two groups; older patients mainly received PEG and gastrotomy tubes, whereas younger patients received mostly GES and pyloric intervention. More community-level prospective randomized clinical trials are needed to determine if these differences in symptoms and surgical interventions influence the natural history and response to these patients' treatment.

KEY POINTS

1. Gastroparesis symptomatology might differ among geriatric patients compared to younger adults.
2. Older adults had more early satiety and bloating, whereas younger patients had more nausea with vomiting and abdominal pain.
3. There was difference between the surgical intervention performed in the two groups; older patients mainly received PEG and gastrotomy tubes, whereas younger patients received mostly gastric electrical stimulation and/or pyloric intervention.

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CONFLICTS OF INTEREST

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Investigator: Censa, Cindome, Vanda, Allergan, Neurogastrx

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ADEPT-GI: IP for autonomic/enteric and bioelectric diagnosis and therapies

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AUTHOR CONTRIBUTIONS

SS, MJW, and PR conceived and designed the analysis; SS, MA, and ZT collected the data; SS, MA, and ZT contributed data or analysis tools; SS, MA, and ZT performed the analysis; SS, MA, ZA RI, PR, and TLA wrote the paper.

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Corresponding author at: Thomas L. Abell, Department of Medicine, University of Louisville, Louisville, KY, United States. (E-mail: thomas.abell@louisville.edu).