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AIMS AND SCOPE

The primary aim of World Journal of Gastrointestinal Surgery (WJGS, World J Gastrointest Surg) is to provide scholars and readers from various fields of gastrointestinal surgery with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

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ORIGINAL ARTICLE

Retrospective Study Study on the occurrence and influencing factors of gastrointestinal symptoms in hemodialysis patients with uremia

Dan Yuan, Xiao-Qi Wang, Feng Shao, Jing-Jing Zhou, Zhong-Xin Li

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Abstract

BACKGROUND

Gastrointestinal symptoms are common in patients with uremia undergoing hemodialysis, and these symptoms seriously affect patients' prognosis.

AIM

To assess the occurrence and factors influencing gastrointestinal symptoms in patients with uremia undergoing hemodialysis.

METHODS

We retrospectively selected 98 patients with uremia who underwent regular hemo -dialysis treatment in the blood purification center of our hospital from December 2022 to December 2023. The gastrointestinal symptoms and scores of each dimension were evaluated using the Gastrointestinal Symptom Grading Scale (GSRS). Patients were divided into gastrointestinal symptoms and no gastrointestinal symptom groups according to whether they had gastrointestinal symptoms. The factors that may affect gastrointestinal symptoms were identified by single-factor analysis. Multiple logistic regression analysis was performed to identify independent risk factors for gastrointestinal symptoms.

RESULTS

Gastrointestinal symptoms included indigestion, constipation, reflux, diarrhea, abdominal pain, and eating disorders, and the total average GSRS score was 1.35 \pm 0.47. This study showed that age, number of tablets, dialysis time, glucocorticoid, parathyroid hormone (PTH), combined diabetes mellitus and C-reactive protein (CRP) were independent risk factors for gastrointestinal symptoms in patients with uremia undergoing hemodialysis, whereas body mass index (BMI), hemoglobin (Hb), and urea clearance index were independent protective factors (P < 0.05).



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CONCLUSION

Gastrointestinal symptoms are mostly mild in patients with uremia undergoing hemodialysis, most commonly including dyspepsia, eating disorders, and gastroesophageal reflux. The independent influencing factors mainly include the BMI, age, number of pills taken, dialysis time, urea clearance index, Hb, use of glucocorticoids, and thyroid hormone level. PTH, CRP, and diabetes are clinically related factors influencing the occurrence of gastrointestinal symptoms, and targeted prevention can be performed.

Key Words: Uremic hemodialysis; Gastrointestinal symptoms; Influencing factors; Blood pressure dialysis; Chronic renal failure

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Core Tip: Gastrointestinal symptoms in hemodialysis patients with uremia seriously affects patients' quality of life. This study showed that the independent influencing factors related to the occurrence of gastrointestinal symptoms were mainly body mass index, age, number of tablets, dialysis time, urea clearance index, hemoglobin, use of glucocorticoid, parathyroid hormone, C-reactive protein, and diabetes mellitus. In clinical practice, variable factors can be controlled for prophylaxis.

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INTRODUCTION

The global incidence of chronic kidney disease (CKD) is as high as 13.4%, causing a significant economic burden[1]. With a delay in CKD management, the disease progresses and eventually develops into end-stage renal disease, also called uremia, requiring kidney transplantation or dialysis alternative therapies to maintain life[2]. The pathogenesis of uremia mainly involves the accumulation of urinary toxins such as urea, creatinine, parathyroid hormone (PTH), electrolytes, and body fluid, and hormonal imbalance caused by kidney injury resulting from many diseases in the body[3]. Uremia is a serious stage of kidney disease, with patients showing clinical manifestations of anorexia, vomiting, nausea, weight loss, fatigue, mental state changes, muscle spasms, and other symptoms^[4], inducing serious harm to the physical and mental health of patients.

Hemodialysis is the main treatment for uremia in clinical practice [5,6]. Although it can delay the development of uremia, patients undergoing long-term dialysis may have severe nutritional deficiencies and gastrointestinal reactions[7], which may lead to some complications^[8]. Gastrointestinal symptoms are common in patients with uremia undergoing hemodialysis, with an incidence rate as high as 63%-85% [9,10]. It seriously affects the quality of life and mental health of patients and often leads to poor prognosis.

Studies have shown that uremic toxin stimulation, anemia, drugs, depression, and anxiety can lead to gastrointestinal dysfunction[11]; however, the factors affecting the occurrence of gastrointestinal symptoms in hemodialysis patients and the correlation with other complications need further confirmation [8,12]. This study aimed to understand the occurrence and factors influencing gastrointestinal symptoms in hemodialysis patients with uremia and provide evidence for clinical prevention in advance.

MATERIALS AND METHODS

Research participants

We included 98 patients with uremia who underwent regular hemodialysis treatment in the blood purification center of our hospital from December 2022 to December 2023. The Gastrointestinal Symptom Grading Scale (GSRS)[13] score was selected when evaluating the gastrointestinal symptoms of the patients, and the patients were divided into two groups [with (78 cases) and without (20 cases) gastrointestinal symptoms], according to whether they had gastrointestinal symptoms. The daily drug-taking and general data of patients were collected, and the total GSRS score and scores of various dimensions, general data, and disease-related conditions of patients were compared and analyzed. Univariate and multivariate analyses were performed.

Inclusion and exclusion criteria

Inclusion criteria^[14] were as follows: (1) Age 18-80 years; (2) Clear consciousness, ability to answer questions correctly; and (3) Hemodialysis \geq 3 months.



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Exclusion criteria were as follows: (1) Previous history of gastrointestinal bleeding, gastrointestinal tumor, gastrointestinal ulcer, and other serious digestive system diseases; (2) Patients with neurological diseases; (3) Severe infection in the past 1 month; (4) Abdominal surgery in the past 6 months; (5) Patients using proton pump inhibitors; and (6) Positive stool occult blood and abnormal gastroenteroscopy within 1 month before and after gastrointestinal symptoms investigation.

Data collection

Clinical data such as patients' basic condition and blood biochemical test laboratory indexes in the past 2 wk were collected and comprehensively analyzed.

(1) General data collection: Basic information included complicated diabetes mellitus, dialysis time, glucocorticoid use, number of tablets, body mass index (BMI), age, type of kidney injury, sex, dialysis treatment method, etc; (2) Laboratory examination[15]: Fasting venous blood of patients was collected before hemodialysis. Serum albumin (ALB), total cholesterol (TC), triglyceride (TG), C-reactive protein (CRP), serum creatinine (Scr), hemoglobin (Hb), PTH, blood urea nitrogen (BUN) were assessed. Urea clearance index (kt/v) was calculated using the Daugirdas formula: Kt/V = -ln (postdialysis BUN/pre-dialysis BUN - 0.008 × treatment time) + (4 - 3.5 × post-dialysis BUN/pre-dialysis BUN) × ultrafiltration amount/post-dialysis body mass; and (3) GSRS[16]: It was used to evaluate the gastrointestinal symptoms of patients in the past 2 wk; it includes six dimensions and 18 items, including three items of abdominal pain, two items of reflux, four items of dyspepsia, three items of constipation, three items of diarrhea, and three items of eating disorders. According to Likert's 7-grade score, each item was divided into 1 = asymptomatic, 2 = mild, 3 = mild, 4 = moderate, 5 = moderately heavy, 6 = severe, and 7 = very serious. The average score of dimensions and total score was calculated, and the range of scores was 1-7. The higher the score, the more severe the gastrointestinal symptoms. The total score and the reliability of each dimension were 0.60-0.85[17].

Statistical analysis

All statistical analyses were performed using SPSS version 26 (IBM Corp., Armonk, NY, United States). Using a Pearson normality test, data was first checked for normality. Statistical analysis was carried out with two-tailed t-tests when data passed a normality test. When the data did not fit normal distribution, a non-parametric test was chosen instead. Measurement data were expressed as average and standard deviation, and the count data as frequency and percentage, and binary logistic regression analysis was used to determine the independent risk factors of gastrointestinal symptoms in patients with uremia undergoing hemodialysis. Statistical significance was defined as bilateral P < 0.05.

RESULTS

Baseline data

Figure 1 shows a flowchart illustrating the patient selection process. Among the 98 patients, 78 had gastrointestinal symptoms, with an incidence rate of 79.59% (78/98). Among the 78 patients with gastrointestinal symptoms, 36 were male and 42 were female, with an average age of 59.84 ± 9.56 years and average BMI of 18.84 ± 2.23 kg/m². Twenty-seven patients received glucocorticoids and forty-six patients had diabetes mellitus, and the duration of hemodialysis was 28.68 ± 8.93 mo. Fifty-three patients were treated with simple hemodialysis, and seventeen patients underwent hemodialysis combined with peritoneal dialysis. Thirty-three patients had a renal injury, and thirty-seven patients had primary renal injury. The number of tablets taken per day was 6.36 ± 2.02. Among the 20 patients without gastrointestinal symptoms, 12 were male, and 8 were female, with an average age of 45.76 ± 6.52 years and a BMI of 22.16 ± 3.68 kg/m². Four patients were treated with glucocorticoids, and nine patients had diabetes. The duration of hemodialysis was 19.67 ± 6.64 months. Twelve patients were treated with simple hemodialysis, and eight patients underwent hemodialysis combined with peritoneal dialysis. Nine patients had a renal injury, and eleven had primary renal injury. The number of tablets taken per day was 4.03 ± 1.85.

The results showed significant differences in age, BMI, glucocorticoid use, diabetes mellitus, hemodialysis time, and the number of tablets taken per day between the two groups (Table 1).

Laboratory inspection index

The laboratory examination indexes of the two groups were PTH, Hb, urea clearance index, CRP, ALB, TC, TG, BUN, and SCr. As shown in Table 2, PTH, Hb, urea clearance index, and CRP were significantly different between the two groups (P < 0.05).

Gastrointestinal symptoms

Among the 78 patients with gastrointestinal symptoms, 41, 37, 33, 28, 23, and 17 patients had dyspepsia, constipation, reflux, diarrhea, abdominal pain, and eating disorders, respectively. The incidence rates from high to low were indigestion (52.56%), constipation (47.44%), reflux (42.31%), diarrhea (35.90%), abdominal pain (29.49%), and eating disorders (21.79%; Table 3 and Figure 2).

GSRS scale score

The total average GSRS scale score was 1.35 ± 0.47 points, including 1.41 ± 0.65 , 1.37 ± 0.46 , 1.33 ± 0.42 , 1.35 ± 0.44 , 1.38 ± 0 0.69, and 1.36 ± 0.60 points for digestive disorders, constipation, reflux, diarrhea, abdominal pain, and eating disorders,



Table 1 Co	omparison of	general dat	a between t	two arou	ps of i	batient
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Variables	Having gastrointestinal symptoms group, <i>n</i> = 78	No gastrointestinal symptoms group, <i>n</i> = 20	t/χ²	P value
Sex			2.602	0.199
Male	36	12		
Female	42	8		
Age in year	59.84 ± 9.56	45.76 ± 6.52	5.654	< 0.001
BMI in kg/m ²	18.84 ± 2.23	22.16 ± 3.68	6.943	< 0.001
Using glucocorticoids				
Yes	27	4	4.695	0.013
No	43	16		
Combined diabetes			4.579	0.017
Yes	46	9		
No	24	11		
Dialysis time in month	28.68 ± 8.93	21.67 ± 6.64	2.453	0.036
Dialysis treatment method			1.624	0.203
Alone	53	12		
Union	17	8		
Type of renal injury			1.203	0.138
Secondary renal injury	33	9		
Primary disease	37	11		
Number of tablets taken as tablets/day	6.36 ± 2.02	4.03 ± 1.85	7.984	< 0.001

BMI: Body mass index.

Table 2 com	parison of laborat	ory examination resu	ilts between tl	ne two groups
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Variable	Having gastrointestinal symptoms group, <i>n</i> = 78	No gastrointestinal symptoms group, $n = 20$	t value	P value
PTH in pg/mL	168.76 ± 19.15	103.57 ± 9.83	15.978	< 0.001
Hb in g/L	87.03 ± 10.95	118.26 ± 16.79	9.606	< 0.001
Urea clearance index in kt/v	0.69 ± 0.23	0.93 ± 0.34	3.29	0.012
CRP in mg/L	24.23 ± 3.02	13.46 ± 2.89	15.674	< 0.001
ALB in g/L	35.96 ± 4.17	37.93 ± 3.62	0.521	0.893
TC in mmol/L	5.57 ± 1.06	6.08 ± 1.59	1.478	0.117
TG in mmol/L	1.21 ± 0.53	1.52 ± 0.67	1.323	0.193
BUN in mmol/L	7.49 ± 0.62	7.38 ± 0.55	0.723	0.472
SCr in µg/L	95.45 ± 6.78	96.87 ± 6.03	0.664	0.509

ALB: Albumin; BUN: Blood urea nitrogen; CRP: C-reactive protein; Hb: Hemoglobin; PTH: Parathyroid hormone; SCr: Serum creatinine; TC: Total cholesterol; TG: Triglyceride.

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Table 3 Comparison of the incidence of different types of gastrointestinal symptoms				
Variable	n	Incidence, %		
Dyspepsia	41	52.56		
Mild	21	26.92		
Moderate or moderate weight	20	25.64		
Constipation	37	47.44		
Mild	28	35.90		
Moderate or moderate weight	9	11.54		
Countercurrent	33	42.31		
Mild	32	41.03		
Moderate or moderate weight	1	1.28		
Diarrhea	28	35.90		
Mild	25	32.05		
Moderate or moderate weight	2	2.56		
Serious or very serious	1	1.28		
Abdominal pain	23	29.49		
Mild	19	24.36		
Moderate or moderate weight	3	3.85		
Serious or very serious	1	1.28		
Eating disorder	17	21.79		
Mild	15	19.23		
Moderate or moderate weight	2	2.56		

A total of 199 patients with uremia who underwent regular hemodialysis treatment at the blood purification Center of our hospital



Figure 1 Flowchart illustrating the patient selection process.

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Figure 2 Incidence of different types of gastrointestinal symptoms.

respectively (Table 4 and Figure 3).

Univariate analysis

According to the results in Tables 1 and 2, 10 indexes, including age, BMI, glucocorticoid use, diabetes mellitus, hemodialysis time, number of tablets per day, PTH, Hb, urea clearance index, and CRP, were significantly different between patients with gastrointestinal symptoms and those without gastrointestinal symptoms (P < 0.05). These 10 factors may be the factors influencing gastrointestinal symptoms in patients with uremia undergoing hemodialysis.

Multi-factor analysis

To further determine the independent factors influencing gastrointestinal symptoms in patients with uremia undergoing hemodialysis, 10 factors obtained by univariate analysis were taken as independent variables, and multivariate logistic regression analysis was performed. Our results showed that age, number of tablets, glucocorticoid use, dialysis time, PTH, CRP, and diabetes mellitus were independent risk factors for gastrointestinal symptoms in patients with uremia undergoing hemodialysis. At the same time, BMI, Hb, and urea clearance index were independent protective factors (Table 5 and Figure 4).

DISCUSSION

Uremia is also known as end-stage renal failure[18]. The clinical pathogenesis of uremia involves the retention of toxic metabolites in the body, resulting in blood poisoning and renal function deterioration syndrome, with digestive system symptoms such as nausea, vomiting, abdominal distension, and diarrhea[19]. Digestive system symptoms are often the earliest manifestation in patients with uremia. In this study, the incidence of gastrointestinal symptoms in patients with uremia undergoing hemodialysis was 79.59%, with dyspepsia (52.56%) accounting for the highest incidence, followed by constipation and reflux and relatively few symptoms of abdominal pain and diarrhea. Despite the high incidence of gastrointestinal symptoms in this study, the GSRS score was generally low, and most patients had mild symptoms, consistent with the results of Drüeke and Ikizler[6]. The reason for the high incidence of gastrointestinal symptoms may be that in patients with uremia undergoing hemodialysis, due to the decrease of prostaglandin synthesis that protects the gastric mucosa, gastric mucosal resistance decreases with the increase of urea nitrogen. Anemia or metabolic disorders puts the gastric mucosa in a state of chronic ischemia and hypoxia for a long time, which leads to the occurrence of gastrointestinal symptoms.

Several studies have reported age as a risk factor for gastrointestinal symptoms, and the occurrence of gastroesophageal reflux disease can be predicted when the age is over 60 years in the general population[20,21]. This study showed that in patients with uremia undergoing hemodialysis, age is an independent risk factor for gastrointestinal symptoms; the older the patient, the higher the risk of gastrointestinal symptoms (odds ratio [OR]: 2.671; 95% confidence interval [CI]: 1.875-3.937). In contrast, the lower the BMI, the higher the possibility of gastrointestinal symptoms (OR: 0.168; 95%CI: 0.037-0.716); high BMI is an independent protective factor for gastrointestinal symptoms. This may be because the older the patient, the less he eats, which leads to insufficient protein intake and increased occurrence of gastrointestinal symptoms.

In patients with uremia undergoing hemodialysis, the more drugs they take, the more serious gastrointestinal symptoms caused by the drugs[22]. Multivariate analysis showed that the number of drugs taken was an independent risk factor for gastrointestinal symptoms (OR: 2.727; 95%CI: 2.251-3.602). Therefore, rational use of drugs to prevent patients from taking unnecessary drugs and address adverse reactions is a clarion call for all medical staff.



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Table 4 Score of Gastrointestinal Symptom Grading Scale for gastrointestinal symptoms			
Variable	Average score of entries, points		
Dyspepsia	1.41 ± 0.65		
Constipation	1.37 ± 0.46		
Countercurrent	1.33 ± 0.42		
Diarrhea	1.35 ± 0.44		
Abdominal pain	1.38 ± 0.69		
Eating disorder	1.36 ± 0.60		
Total score	1.35 ± 0.47		

Data are mean ± standard deviation.

Table 5 Results of the logistic regression analysis				
Variable	P value	OR	95%CI	
Age	< 0.001	2.671	1.875-3.937	
BMI	0.018	0.168	0.037-0.716	
Number of tablets	0.016	2.727	2.251-3.602	
Glucocorticoid	0.032	1.143	1.034-1.267	
Dialysis time	< 0.001	2.163	1.236-3.152	
РТН	0.036	2.237	1.538-2.786	
CRP	0.041	1.307	1.113-1.894	
Diabetes mellitus	0.002	1.723	1.235-2.274	
Hb	0.023	0.742	0.638-0.965	
Urea clearance index	0.039	0.821	0.702-0.971	

BMI: Body mass index; CI: Confidence interval; CRP: C-reactive protein; Hb: Hemoglobin; OR: Odds ratio; PTH: Parathyroid hormone.



Figure 3 Gastrointestinal Symptom Grading Scale score of gastrointestinal symptoms. GSRS: Gastrointestinal Symptom Grading Scale.

In addition, this study showed that corticosteroids, diabetes mellitus, hemodialysis time, PTH, and CRP were independent risk factors for patients with uremia undergoing hemodialysis, which was consistent with the results of previous retrospective studies[23-25]. These observations may be due to the many adverse reactions of glucocorticoids, in which the digestive system stimulates the gastric mucosa and promotes the secretion of gastric acid and pepsin, thus reducing the resistance of the gastric mucosa. Glucocorticoids aggravate or even induce the occurrence of bleeding and perforation caused by peptic ulcer. Moreover, in patients with diabetes, hyperglycemia leads to the weakening of gastric motility and gastric secretion disorders, resulting in corresponding gastrointestinal symptoms. The longer the hemo-



Figure 4 Forest map of independent influencing factors of gastrointestinal symptoms in uremic patients undergoing hemodialysis. BMI: Body mass index; CRP: C-reactive protein; Hb: Hemoglobin; PTH: Parathyroid hormone.

dialysis time, the higher the PTH and CRP levels, the worse the patient's resistance, and the higher the inflammation, which further increases the risk of gastrointestinal symptoms.

The independent influencing factors identified in this paper are of great significance for healthcare professionals in the symptom management and screening program of uremic hemodialysis patients. For example, patients with higher BMI may need more active diet management and exercise programs to optimize weight control. Elderly patients may need to monitor age-related complications more frequently and slowly adjust dialysis parameters to avoid intolerance. The number of patients taking drugs may increase side effects, and healthcare professionals should provide guidance on the importance of insisting on taking drugs and the risk of missing doses. Dialysis time and urea clearance index are the key to maintain electrolyte balance and urination. Healthcare professionals should closely monitor these parameters to ensure effective dialysis and avoid any episodes of hyperkalemia or hypotension. It may be necessary to adjust the dialysis time or dialyzer type according to the patient's individual response. Hb level is a key index of anemia management in hemodialysis patients. Hb levels should also be regularly monitored and iron and erythropoietin doses adjusted to maintain Hb within the target range. This is very important for preventing fatigue, improving the quality of life and reducing the risk of blood transfusion. In clinical practice, healthcare professionals can further improve the overall clinical outcome of uremic patients by optimizing the care of uremic hemodialysis patients based on the above risk factors.

This study has some limitations. First, this is a retrospective cohort study that may be susceptible to selection bias. Second, this is a relatively small sample size, single-center clinical study. In addition, this study only collected the incidence of gastrointestinal symptoms in patients with uremia undergoing hemodialysis over the past 2 wk, and the long-term impact remains unclear. Long-term, multicenter clinical studies are needed to confirm these findings in the future.

CONCLUSION

This study showed that age, number of tablets, dialysis time, glucocorticoid, PTH, combined diabetes mellitus and CRP were independent risk factors for gastrointestinal symptoms in patients with uremia undergoing hemodialysis, while BMI, Hb, and urea clearance index were independent protective factors. Therefore, the implementation of personalized preventive measures in the early stage is critical to reducing the occurrence of gastrointestinal symptoms in patients with uremia undergoing hemodialysis.

FOOTNOTES

Author contributions: Yuan D, Wang XQ, Shao F, Zhou JJ, and Li ZX contributed equally to this work; Yuan D and Wang XQ designed the research study; Shao F and Zhou JJ performed the primary literature and data extraction; Yuan D and Wang XQ analyzed the data and wrote the manuscript; Li ZX was responsible for revising the manuscript for important intellectual content; All authors read and approved the final version.

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