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Relationship Between Upper Gastrointestinal Tract Bleeding And Seasonal Meteorological Parameters

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ABSTRACT

Introduction: Determining the relationship between seasons, circadian rhythm and weather has been addressed in many studies since triggering factors may contribute to the incidence of diseases.
Objective: We sought to investigate the association between meteorological factors and the occurrence of peptic ulcer bleeding.
Methods: This study was conducted retrospectively, endoscopic reports, gender, day, month, year and season of admission were recorded in patients with peptic ulcer-related gastrointestinal bleeding. Throughout the study period, data on daily average temperature (°C), daily average atmospheric pressure (mb), daily average relative humidity (%), and maximum wind speed (m/s) were analyzed and compared.
Results: Endoscopy was performed in 176 patients with upper intestinal bleeding. 67% (n=118) of the patients were male. The average age of the patients was 59.87±19.19 years. The highest number of patients was found in winter (n=54, 30.7%) and highest number was found in March (n=20, 11.40%). However, there was no significant variation in proportion of patients admitted across different seasons (p=0.109). In addition, regression analysis revealed that daily meteorological parameters alone had no effect on upper gastrointestinal bleeding due to peptic ulcer.
Conclusion: The highest number of patients was found to be in winter and the lowest in spring. However, while a negative correlation was observed between the number of patient admissions and mean air temperature, this correlation was not statistically significant. There was a positive correlation between daily mean relative humidity and daily mean atmospheric air pressure, but meteorological parameters alone were not effective in the number of patients admitted with gastrointestinal bleeding (GIB).

Keyswords: Meteorology, Gastrointestinal Bleeding, Peptic Ulcer.

INTRODUCTION

Upper gastrointestinal bleeding (UGIB) refers to hemorrhage occurring from the esophagus, stomach, or duodenum, located above the ligament of Treitz (1). Key risk factors for UGIB include advanced age, the use of anticoagulants, and high doses of non-steroidal anti-inflammatory drugs (2). While peptic ulcer disease remains the leading cause of UGIB, other contributing factors include conditions such as esophagitis, gastritis, Mallory-Weiss tears, and malignancies (3,4).

Determining the relationship between seasons, circadian rhythm and weather has been addressed in many studies since triggering factors may contribute to the incidence of diseases (5,6). Meteorological factors, particularly air temperature, have been linked to an increased incidence and mortality of cardiovascular and cerebrovascular diseases (7-10). In addition, changes in meteorological factors cause the emergence or triggering of the disease through many different mechanisms such as blood pressure and neuroendocrine factors (11,12). One of proposed mechanisms related to the relationship between UGIB and meteorologic parameters is that exposure to cold increases arterial pressure, cardiac output and causes peripheral vasoconstriction, leading to an increase in portal tension and portal venous flow (12). Another mechanism is that Helicobacter pylori infection, one of the risk factors for UGIB, causes changes in the gastric mucosa depending on seasonal parameters, weather and diet (13). Another proposed mechanism is that exposure to low temperatures elevates blood pressure, cardiac output, and peripheral resistance, while also influencing neuroendocrine factors. These changes can result in an

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increased hepatic vein pressure gradient, ultimately contributing to esophagogastric variceal bleeding (EGVB) (14-17).

This study aimed to investigate the correlation between meteorological factors and the incidence of peptic ulcer bleeding.

METHODS

This retrospective study was conducted after obtaining approval from the ethics committee of our local university on 25.04.2024 (Number: 2024/06-04).

Study Population And Data Collection

Demographic and endoscopic data of patients aged 18 years and older with a diagnosis of peptic ulcer-related gastrointestinal bleeding who underwent endoscopy at XXX hospital between January 01, 2019 and December 31, 2023 were obtained from the electronic hospital record system. Patients under 18 years of age were excluded from the study. Endoscopic reports, gender, day, month, year and season of admission were recorded. Data on daily average temperature (°C), daily average atmospheric pressure (mb), daily average relative humidity (%), and maximum wind speed (m/s) were retrieved from the official website of Ministry of Environment, Urbanization, and Climate Change, General Directorate of Meteorology.

Statistical Analysis

In this study, data analysis was conducted using the SPSS 21.0 (IBM Corporation, Armonk, NY, USA) software and Microsoft Excel. The Kolmogorov-Smirnov normality test was used to assess the data distribution. For normally distributed data, results were expressed as mean ± standard deviation (SD), while categorical data were presented as percentages (%). The independent samples t-test was utilized for comparisons between groups, and Pearson correlation analysis was performed to assess relationships between variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Endoscopy was performed in 176 patients with upper intestinal bleeding. 67% (n=118) were male, 33% (n=58) were female and number of male patients was significantly higher ($p < 0.001$). The mean age of all patients was 59.87±19.19 years.

When the number of patients admitted by months was compared, it was found that highest number of patients admitted in March (n=20, 11.40%) and lowest number in April (n=6, 3.4%). However, no significant difference was found between the percentages of patients admitted according to months (p=0.131). When the number of patients admitted according to seasons was compared, it was found that highest number of patients admitted in winter (n=54, 30.7%) and lowest number of patients admitted in spring (n=35, 19.9%). However, no significant difference was observed in the percentages of patients admitted across different seasons (p=0.109) (Table 1) (Figure 1).

Table 1. Number and Percentages of Admissions According to Seasons and Months

Seasons	Months	n (%)	Total n (%)
Winter	December	17 (9,70)	54 (30.7)
	January	19 (10,80)	
	February	18 (10,20)	
Spring	Mart	20 (11,40)	35 (19,9)
	April	6 (3,40)	
	May	8 (4,50)	
Summer	June	16 (9,10)	37 (21,0)
	July	12 (6,80)	
	August	10 (5,70)	
Autumn	September	14 (8,00)	50 (28,4)
	October	19 (10,80)	
	November	17 (9,70)	

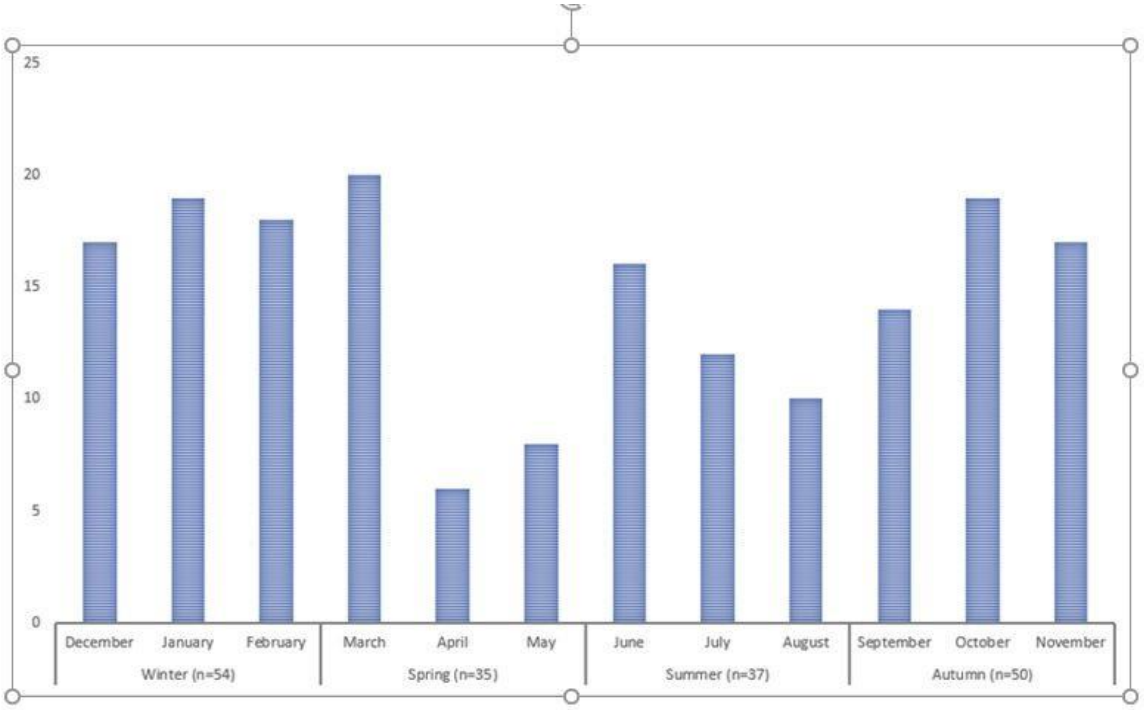

Figure 1. Distribution of Patients by Months and Seasons

Although, a negative correlation was observed between number of patients admitted and mean air temperature, no statistically significant correlation was found (r=-0.031, p=0.181), but there was a positive correlation between mean daily relative humidity (r=0.048, p=0.039) and mean daily atmospheric air pressure (r=0.077, p=0.001).

Although a positive correlation was observed between daily mean relative humidity and daily mean atmospheric pressure, regression analysis indicated that meteorological parameters alone did not have an effect on the number of patients admitted with upper gastrointestinal bleeding (Table 2).

Table 2. Binary Logistic Regression Results

	B	SE	% 95 CI	Exp (B)	p
Constant	-28.079	42.560		0.509	
Age	0.018	0.012	0.995 – 1.041	1.018	0.130
Sex (Female)	0.116	0.438	0.476 - 2.650	1.123	0.792
Temperature	0.030	0.033	0.996 – 1.098	1.030	0.366
Relative humidity	0.017	0.015	0.987 – 1.048	1.017	0.274
Atmospheric pressure	0.026	0.047	0.936 – 1.126	1.027	0.574
R^2 (Cox-Snell) =0.025 R^2 (Nagelkerke) = 0.042 Model: $X^2(2)$=4.502. p <0.480					

DISCUSSION

In our study, when the number of patients admitted by months was compared, it was found that the highest number of patients were admitted in March and the lowest in April. When the number of patients admitted according to the seasons was compared, it was found that highest number of patients was in winter and lowest number was in spring. Although a negative correlation was observed between the number of patients admitted and average air temperature, no statistically significant correlation was found, but a positive correlation was found between daily average relative humidity and daily average atmospheric air pressure. However, it was determined that meteorological parameters alone were not effective in the number of patients.

There is uncertainty as to whether previously observed seasonal variations still exist in patients with gastrointestinal bleeding. Furthermore, there are a limited number of studies examining the impact of seasonal variations. Hypotheses about the mechanisms underlying the seasonal course of UGIB cases

in these studies are intriguing, and an attempt is made to show how they reveal seasonality and its relationship with various meteorological parameters.

In the cold season, gastric mucus becomes less viscous, the expression of heat shock protein (HSP) 70 diminishes, and gastric acidity rises (13). This change in gastric mucosal function affects emergence of peptic ulcer disease. Since peptic ulcer disease is related with season and climate, UGIB developing due to this disease may also show the same tendency. Non-steroidal anti-inflammatory drugs (NSAIDs) can induce gastrointestinal injury through both local and systemic effects, leading to damage in the gastrointestinal tract. The long-term effects of these drugs can potentially mask the influence of meteorological factors on gastrointestinal health. Therefore, clinicians should pay attention to peptic ulcer disease, and timely treatment of the disease can prevent UGIB, especially from ulcer not associated with NSAIDs (18). In the study by Yuan et al. UGIB with different etiologies showed different onset periods and episodes of peptic ulcer bleeding not related to NSAIDs were lowest in summer and highest in December (19). However, peptic ulcer bleeding associated with NSAIDs did not show a significant change between seasons and months. We think that the significant increase in the number of patients admitted with UGIB in the winter months without discrimination according to bleeding characteristics in our study is related to and supported by this mechanism.

Since exposure to cold increases blood pressure and cardiac output and causes peripheral vasoconstriction, it may cause an increase in portal tension and portal venous flow, leading to esophagogastric variceal bleeding (12). Fabrice Boulay et al. reported that deaths and hospitalizations due to EGVB in France occurred over a significant annual period and peaked in winter months (December/January) (20). However, some studies have shown the opposite results. Yuan et al. found no seasonal pattern in patients with esophagogastric bleeding (19). It is thought that the different results given by these studies may be due to the different geographical locations of the study regions. In our study, it was found that there was no significant change according to months and the number of patients admitted with upper GI bleeding was higher in winter season, but meteorological parameters alone had no effect on the number of patients admitted with upper GI bleeding in our regression analysis.

Guo CG et al. found that among different meteorological parameters, UGIB cases were inversely correlated with various temperature parameters including atmospheric temperature, maximum temperature and minimum temperature, and positively correlated with atmospheric pressure, indicating that UGIB may be linked to the negative correlation between atmospheric pressure and air temperature (21). In our study, although there was a negative correlation between the number of patients admitted and mean air temperature, no statistically significant correlation was found, and a positive correlation was found between daily mean relative humidity and daily mean atmospheric air pressure.

The reason for the difference in the results of the studies investigating the effects of meteorological factors on the incidence of GIB may be related to the sample size and the different climatic variations of the study sites, and may be due to multifactorial factors such as medications that may change the incidence of GIB, especially aspirin, PPIs, drugs used in the eradication of H. pylori and drugs used in the treatment of other systemic diseases, drug use habits of individuals, and different stress reactions of individuals. The fact that there are studies with the same or different results in the studies, as in our study, and the fact that the case samples were taken from retrospective patient admission days and endoscopic images and that detailed patient history and medical drug interrogation were not performed sufficiently, causes the determination of the relationship between the number of patient admissions and the metrological events with the disease to be insufficient. The fact that all these factors were not included in the studies can be considered as a major limitation for our study as in other studies.

CONCLUSION

As a result, in our study, highest number of patients was found to be in winter season and the lowest in the spring season. However, although there was a negative correlation between the number of patients admitted and the average air temperature, no statistically significant correlation was found, there was a positive correlation between daily average relative humidity and daily average atmospheric air pressure, but it was determined that meteological parameters alone were not effective in the number of patients admitted with GIB.

DESCRIPTIONS

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