Open Journal of Gastroenterology, 2013, 3, 134-137 **OJGas**
http://dx.doi.org/10.4236/ojgas.2013.32022 Published Online May 2013 (http://www.scirp.org/journal/ojgas/)

Influence of meteorological factors on the seasonal onset of esophagogastric variceal bleeding

Jun Chen[1], Donghua Li[2], Shaoyong Xu[1], Zequn Sun[1], Bin Wang[1], Changsheng Deng[3]

[1]Department of Gastroenterology, People's Hospital Affiliated to Hubei University of Medicine, Shiyan, China
[2]Shiyan Meteorological Bureau, Shiyan, China
[3]Department of Gastroenterology, Zhongnan Hospital of Wuhan University, Wuhan, China
Email: Chenjun@medmail.com.cn

Received 21 February 2013; revised 28 March 2013; accepted 3 May 2013

ABSTRACT

Purpose: To investigate the influence of meteorological factors on the esophagogastric variceal bleeding. The rhythmicity and variation mechanism of the onset of esophagogastric variceal bleeding were determined by large sample study. Methods: 572 patients with esophagogastric variceal bleeding confirmed by endoscopy were enrolled in the study, and the gender, age, onset date and Child-Pugh grading of liver function were recorded, the meteorological data were provided by the Shiyan Meteorological Bureau, which included temperature, air pressure, air speed, precipitation, sunshine duration and so on. Results: The onset numbers in the four seasons were 130, 122, 144 and 176, respectively, and differences of the onset number in different seasons were significant (X^2 = 11.888, p = 0.008), and the onset number in winter reached to maximum, while it decreased to minimum in summer. The results of Child-Pugh grading were as follows: Grade A 113 (19.8%), Grade B 234 (40.9%), and Grade C 225 (39.3%). There was no significance among the different grades by crosstabs analysis (X^2 = 4.463, p = 0.107). The Spearman correlation analysis concluded the result of (r > 0 and p < 0.01) in the air pressure (mean, maximal and minimal), daily mean temperature, ten days' air pressure (mean, daily difference, maximal, minimal and range), ten days' temperature range on the onset day, while the result of (r < 0 and p < 0.01) in the daily maximal temperature, daily minimal temperature, ten days' temperature (mean, maximal and minimal) and ten days' ≥0˚C accumulated temperature. The p value was more than 0.01 in the other factors. Conclusion: The onset of esophagogastric variceal bleeding was rhythmical, which rose to the maximum in winter and decreased to minimum in summer. The onset of the disease correlated positively with daily air pressure (mean, maximal, minimal), daily mean temperature, ten days' air pressure (mean, daily difference, maximal, minimal and range) and ten days' temperature range, and correlated negatively with daily maximal temperature, daily minimal temperature, ten days' temperature (mean, maximal and minimal) and ten days' ≥0˚C accumulated temperature, and had no relationship with other factors. The mechanism of the onset may associate with the increase of portal venous flow through vasoconstriction induced by chill factors. It also may be the variation of air pressure which influenced the intraesophageal pressure and led to intraesophageal hemangiectasia that may increase the risk of bleeding.

Keywords: Meteorological Factor; Esophagogastric Variceal Bleeding

1. INTRODUCTION

Esophagogastric variceal is one of the most important reasons that may lead to upper gastrointestinal hemorrhage. The previous research of the factors related to upper gastrointestinal hemorrhage showed that the meteorological factor may influence the onset of the upper gastrointestinal hemorrhage in some extent; however, the studies about the influence of this kind of factor on the esophagogastric variceal bleeding are less and the conclusions are not consistant. The study is to investigate the influence of meteorological factor on the esophagogastric variceal bleeding primarily and confirm the onset rhythmicity of the esophagogastric variceal bleeding. The mechanism of the variation of the onset rhythmicity is also analyzed according to the analysis of associated meteorological factors.

2. MATERIALS AND METHODS

2.1. Collection of the Cases

The patients who were confirmed for upper gastrointestinal hemorrhage and diagnosed as esophagogastric variceal bleeding by endoscope from 1st, January 2007 to 31st, December 2009 were involved in the study. The gender, age, etiology, onset date, liver function and Child-Pugh grading were collected. The onset day, period of ten days, month and season of the patient were recorded. The season was divided into spring (March-May), summer (June-August), autumn (September-November) and winter (December-next February).

2.2. Collections of Meteorological Data

The meteorological data in Shiyan area from 1st, January 2007 to 31st, December 2009 were provided by the Shiyan Meteorological Bureau, which included temperature, air pressure, humidity, air speed, precipitation, sunshine duration and so on. And the ten days' values of the above meteorological data were analyzed.

2.3. Statistical Analysis

The data were analyzed by statistical software of SPSS12.0 and the differences between seasons and months were analyzed by two-sided X^2 test, the relationship between the time interval onset number and meteorological factors were analyzed by Spearman correlation analysis. The statistical significance of differences was set as $p < 0.05$.

3. RESULTS

3.1. General Condition

There were 572 cases involved in the study, 365 males and 216 males. The mean age was 51 years old (18 - 75 yrs). They were divided into several groups according to etiology, of those 338 were liver cirrhosis after hepatitis B, 36 liver cirrhosis after hepatitis C, 75 idiopathic portal hypertension, 59 liver cirrhosis after hepatitis B and liver cancer, 6 liver cirrhosis after hepatitis C and liver cancer, 1 liver cirrhosis and hepatitis B after liver transplantation.

3.2. Seasonal Differences of Esophagogastric Variceal Bleeding

The onset numbers in the four seasons were 130, 122, 144 and 176, respectively, and the difference was significant ($X^2 = 11.888$, $p = 0.008$). The onset number in winter reached to the maximum and decreased to minimum in summer. The result of Child-Pugh grading were as follows: Grade A 113 (19.8%), Grade B 234 (40.9%), and Grade C 225 (39.3%). There was no significance between the different grades by crosstabs analysis ($X^2 = 4.463$, $p = 0.107$), which indicated that the seasonal difference of the disease was not influenced by Child-Pugh grading.

3.3. Onset Difference of Esophagogastric Variceal Bleeding between Months

The onset numbers in the twelve months were as follows: 62, 56, 49, 45, 36, 38, 43, 41, 43, 48, 53 and 58, and the difference among months was significant ($X^2 = 37.615$, $p = 0.000$). The onset number reached to the maximal on January and December, while it decreased to minimal on May and June.

3.4. Relations between the Meteorological Factors and Esophagogastric Variceal Bleeding

The Spearman correlation analysis indicated that the air pressure (mean, maximal and minimal) and mean temperature on the onset day correlated positively to the esophagogastric variceal bleeding, and the maximal temperature and minimal temperature correlated negatively to the esophagogastric variceal bleeding. While the humidity, air speed, precipitation and sunshine duration had no relationship with the esophagogastric variceal bleeding (**Table 1**).

The Spearman correlation analysis indicated that there were positive correlations between the esophagogastric variceal bleeding and ten days' air pressure (mean, daily difference, maximal, minimal, range) as well as ten days' temperature rang, and there were negative correlations between the esophagogastric variceal bleeding and ten days' temperature (mean, maximal, minimal) as well as ten days' ≥0˚C accumulated temperature, while the daily

Table 1. Relations between the day meteorological factors and esophagogastric variceal bleeding on onset day.

Item	Coefficient correlation	p
Mean air pressure	0.366	0.000
Maximal air pressure	0.365	0.000
Minimal air pressure	0.371	0.000
Mean temperature	0.395	0.000
Maximal temperature	−0.393	0.000
Minimal temperature	−0.351	0.000
Mean relative humidity	−0.009	0.918
Minimal relative humidity	−0.089	0.329
Mean air speed	−0.071	0.423
Daily total precipitation	−0.078	0.398
Sunshine hours	−0.162	0.075

difference of ten days' temperature, ten days' mean relative humidity, ten days' precipitation and ten days' sunshine duration had no relationship with the esophagogastric variceal bleeding (**Table 2**).

4. DICUSSION

The risk of esophagogastric variceal bleeding associates with the pressure gradient of hepatic vein, varicose veins grading, red sign and esophagogastric varicose veins [1, 2], and the constipation, vomiting, severe cough and alcoholism are the triggers of bleeding [3], while the studies focusing on the influence of season and meteorological factors on the esophagogastric variceal bleeding are less and the results are not unanimous. Tahri and his colleague [4] found that the morbidity of esophagogastric variceal bleeding reached to maximum in winter, OR = 3.2 (95% CI: 1.6 - 6.5). Boulay and his colleague [5] researched the seasonal variation of patients' death and hospitalization for esophagogastric variceal bleeding in the French population, 13,514 cases and 17,026 cases were involved in the study, respectively. They demonstrased that the monthly mortality was more than the average rate about 14% in winter (January and December), while the monthly mortality was less than the average rate about 10% in July, and the difference between the above two values was 24%, and the variation of the mortality associated with age and gender. Because there was a seasonal fluctuation in the hospitalization number of the patients who suffered from esophagogastric variceal bleeding, which was obvious in winter and spring, and reached to peak in the beginning of winter. The hospitalization rate and mortality increased with age. Sato and his colleague [6] noticed that the seasonal difference of the esophagogastric variceal bleeding in the patients with liver cirrhosis whose liver function was Child-Pugh Grade C was more obvious. And our study also showed that the morbidity of esophagogastric variceal bleeding reached to maximum in winter, especially in January and December, and decreased to minimum in May and July. However, there were different results. Sezgin and his colleague [7] studied the 336 cases with upper gastrointestinal hemorrhage in Mersin province of Turkey and 22% of them were esophagogastric variceal bleeding. They found that esophagogastric variceal bleeding reached to maximum in March and Spring, decreased to minimum in September and Autumn, and there was a seasonal fluctuation of the disease onset. The result was different from ours, which may be the difference of the constituent ratio in upper gastrointestinal hemorrhage, which more peptic ulcer bleeding was highest (48.2%) and the morbidity of peptic ulcer was more in Winter and Spring than in Summer and Fall.

Table 2. Relations between the day meteorological factors and esophagogastric variceal bleeding on ten days'.

Item	Coefficient correlation	p
Ten days' mean air pressure	0.426	0.000
Ten days' air pressure daily difference	0.450	0.000
Maximal air pressure	0.411	0.000
Minimal air pressure	0.240	0.008
Ten days' air pressure range	0.500	0.000
Ten days' mean temperature	−0.502	0.000
Ten days' temperature daily difference	0.156	0.088
Ten days' maximal temperature	−0.419	0.000
Ten days' minimal temperature	−0.524	0.000
Ten days' temperature range	0.384	0.000
Ten days' mean relative humidity	0.044	0.629
Ten days' precipitation	−0.018	0.849
Ten days' sunshine duration	−0.105	0.254
Ten days' ≥0˚C accumulated temperature	−0.502	0.000

Shiyan City of Hubei Province is located in east longitude of 110.78, north latitude of 32.63. We studied many meteorological factors in that area, such as temperature, air pressure, humidity, precipitation, sunshine duration, ≥0˚C accumulated temperature. We demonstrated both of that the air pressure and temperature associated with the esophagogastric variceal bleeding, while the humidity, air speed, precipitation and sunshine duration had no relationship with the esophagogastric variceal bleeding. Tahri and his colleagues [4] analyzed the meteorological factors associated with the 67 cases with esophagogastric variceal bleeding in Tunisia: they showed that the esophagogastric variceal bleeding had no relationship with mean air pressure, sunshine duration, nebulosity, air speed, wind direction and mean humidity, but strictly associated with the mean temperature, raining and stormy weather. In the multivariate analysis, the stormy weather was an independent factor, and the OR is 13.4 (95% CI: 1.5 - 118.5), which correlated negatively with the full moon and showed circadian rhythm, and the onset on 6 pm to 12 pm was very frequent. But it's controversial reports. Lopez-Cepero and his colleague [8] used retrospective analysis to study the 499 cases with upper gastrointestinal hemorrhage in Jerez de la Frontera of Spain, including 108 cases with esophagogastric variceal bleeding. They found that there was no relationship between the onset of bleeding and seasonal variation and meteorological factors (temperature, air pressure, humidity, wind direction and air speed). Nomura and his colleague [9] reported 411 cases with upper gastrointestinal hemorrhage in Metropolitan Bokutou hospital in Tokyo, including 115 cases with esophagogastric variceal bleeding; That the onset of esophagogastric variceal bleeding had no seasonal and monthly fluctuation. And it's possi-

ble due to the different areas, which may lead to different conclusions.

The effect of meteorological factors on diseases shows time lag characteristics, that is, the meteorological factors may not only influence the morbidity and mortality of the disease on the very day, but influence the patient's condition in several days. In order to prevent the meteorological data on the very day and consider the time lag characteristics that the meteorological data influence on the disease onset, we combined the time point meteorological data with dynamic meteorological data to analyze the relationship between meteorological factors and the onset of esophagogastric variceal bleeding at the very day of onset and analyzed the relationship between ten days' meteorological factors and the onset of esophagogastric variceal bleeding. We found that the ten days' air pressure, ten days' temperature and ten days' ≥0˚C accumulated temperature had a relationship with the onset of esophagogastric variceal bleeding, while the ten days' temperature daily difference, ten days' mean relative humidity, ten days' precipitation and ten days' sunshine duration had no relationship with the onset of esophagogastric variceal bleeding. The temperature and air pressure are still the main factors that may influence the onset of the disease. The analyzing results of meteorological data on the very day and ten days' after the onset of the disease showed that there was optimal temperature and air pressure of the human body, if it deviated the optimal temperature and air pressure, no matter what the temperature and air pressure increase or decrease, the morbidity may be rising.

The variation of meteorological factors may influence morbidity, and the mechanism is not clear yet. The possible mechanism includes: 1) the vasoconstriction induced by chill may promote the blood going to the visceral circulation and increase the portal venous flow, which may raise the portal venous pressure and variceal bleeding [10]; 2) neuroendocrine factor. Wittert and his colleague [11] confirmed that the acute chill stimulation possibly inhibit the release of pituitrin in human and rat. The lower pituitrin level makes exciting of the sympathetic nerve to cause over release of epinephrine which may lead to vasoconstriction and cause the increase of the portal venous pressure and varicose veins; 3) the variation of air pressure may influence the intraesophageal pressure, with the outside air pressure decreasing the intraesophageal pressure may also decrease, which lead to intraesophageal hemangiectasis and increase the possibility of bleeding. It is speculated that the negative effect may be significant in the patients with severe varicose veins.

REFERENCES

[1] Silkauskaite, V., Pranculis, A., Mitraite, D., *et al*. (2009) Hepatic venous pressure gradient measurement in patients with liver cirrhosis: A correlation with disease severity and variceal bleeding. *Medicina* (*Kaunas*), **45**, 8-13.

[2] Varghese, J., Cherian, J.V., Solomon, R., *et al*. (2008) Predictors of variceal bleed among patients with liver cirrhosis in the era of sclerotherapy. *Singapore Medical Journal*, **49**, 239-242.

[3] Liao, W.C., Hou, M.C., Chang, C.J., *et al*. (2011) Potential precipitating factors of esophageal variceal bleeding: A case-control study. *American Journal of Gastroenterology*, **106**, 96-103. doi:10.1038/ajg.2010.342

[4] Tahri, N., Amouri, A., Fekih, H., *et al*. (2003) Meteorologic conditions and esophageal varices rupture. *Annales de Medecine Interne*, **154**, 509-514.

[5] Boulay, F., Berthier, F., Dahan, M.D.C., *et al*. (2001) Seasonal variations in variceal bleeding mortality and hospitalization in France. *American Journal of Gastroenterology* **96**, 1881-1887. doi:10.1111/j.1572-0241.2001.03889.x

[6] Sato, G., Matsutani, S., Maruyama, H., *et al*. (1998) Chronobiological analysis of seasonal variations of variceal hemorrhage. *Hepatology*, **28**, 893-895. doi:10.1002/hep.510280344

[7] Sezgin, O., Altintaş, E. and Tombak, A. (2007) Effects of seasonal variations on acute upper gastrointestinal bleeding and its etiology. *Turkish Journal of Gastroenterology*, **18**, 172-176.

[8] López-Cepero, J.M., López-Silva, M.E., Amaya-Vidal, A., *et al*. (2005) Influence of climatic factors on the incidence of upper gastrointestinal bleeding. *Journal of Gastroenterology and Hepatology*, **28**, 540-545. doi:10.1157/13080601

[9] Nomura, T., Ohkusa, T., Araki, A., *et al*. (2001) Influence of climatic factors in the incidence of upper gastrointestinal bleeding. *Journal of Gastroenterology and Hepatology*, **16**, 619-623. doi:10.1046/j.1440-1746.2001.02486.x

[10] Izzo Jr., J.L., Larrabee, P.S., Sander, E., *et al*. (1990) Hemodynamics of seasonal adaptation. *American Journal of Hypertension*, **3**, 405-407. doi:10.1093/ajh/3.5.405

[11] Wittert, G.A., Or, H.K., Livesey, J.H., *et al*. (1992) Vasopressin, corticotrophin-releasing factor, and pituitary adrenal responses to acute cold stress in normal humans. *Journal of Clinical Endocrinology & Metabolism*, **75**, 750-755. doi:10.1210/jc.75.3.750

