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RESEARCH ARTICLE

Seasonal Pattern of Diverticular Disease Admissions in Central Anatolia

Orta Anadolu'da Divertiküler Hastalık Başvurularının Mevsimsel Paterni

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ABSTRACT

Aim: In the present study, we aimed to investigate the seasonal characteristics of presentations to the hospital due to diverticular disease.
Method: The patients who were admitted to the hospital between January 1st, 2015 and January 1st, 2020 due to diverticular disease were included in the study. The study was designed retrospectively. The patients were divided into groups according to the treatment method, namely Group 1: patients who received surgical treatment, and Group 2: patients who received medical treatment. Age, sex and seasonal periods were compared. Also, the patients were separated into three groups according to age: those between 18 and 40 years of age, those between 40 and 60 of age and those over 60 years of age. The sex and the treatment methods of the patients were also examined in the season groups
Results: One hundred fifty seven patients participated in our study. Group 1 consisted of 39 patients and Group2 consisted of 118 patients. Presentations to the hospital with acute diverticulitis occurred most frequently in the winter (39.5%). The average age was higher in Group 1 (60.61 vs 54.42, p=0.030). The sex distribution was similar in the groups (p=0.152). Winter was dominant in treatment groups (30.8% vs 42.4% p=0.060). In winter, the average age of the patients who received surgical treatment was higher than those who received medical treatment (68 vs 50 p=0.001). In winter, all patients who received surgical treatment were over 60 years of age. In summer, the ratio of patients who received medical treatment was highest for the group over 60 years of age (p=0.040).
Conclusion: In our study, we displayed the seasonal change in hospital admissions due to diverticular disease. We detected an increased rate of presentations to the hospital in winter. Selection of the treatment method did not display a seasonal variation. However, when we made an additional evaluation according to the age groups, it was seen that greater number of patients who were older than 60 years received surgical treatment in winter whereas the greater number of them received medical treatment in summer. Pathophysiological mechanism of this change could not be fully revealed.
Keywords: Diverticular disease, seasonal change, surgical treatment

ÖZ

Amaç: Bu çalışmada divertiküler hastalık sebebiyle hastaneye başvurunun mevsimsel eğilimlerini araştırmayı amaçladık.
Yöntem: 1 Ocak 2015 ile 1 Ocak 2020 yılları arasında divertiküler hastalık nedeniyle hastaneye yatırılan hastalar çalışmaya dahil edildi. Çalışma retrospektif olarak dizayn edildi. Hastalar tedavi yöntemine göre Grup 1: cerrahi ve Grup 2: medikal olmak üzere iki gruba ayrıldı. Yaş, cinsiyet ve mevsimsel dönem karşılaştırıldı. Ayrıca hastalar yaşa göre 18-40, 40-60, 60 üstü olmak üzere üç gruba ayrıldı. Hastaların cinsiyeti ve tedavi yöntemi de mevsim gruplarında incelendi.
Bulgular: Çalışmamıza 157 hasta katıldı. Grup 1 cerrahi: 39, Grup 2 medikal: 119 hastadan oluşuyordu. Akut divertikülit nedeniyle başvuru en sık kış mevsiminde olmuştu (%39,5). Grup 1'de yaş ortalaması daha yüksekti (60,61 vs 54,42 p=0,030). Gruplarda cinsiyet dağılımı benzerdi (p=0,152). Her iki grupta da kış mevsimi ağırlıktaydı (%30,8 vs %42,4 p=0,060). Kış mevsiminde cerrahi tedavi uygulanan hastaların yaş ortalaması medikal tedavi alanlardan fazlaydı (68 vs 50 p=0,001). Kış mevsiminde cerrahi tedavi uygulanan hastaların hepsi 60 yaşın üstündeydi. Yaz mevsiminde ise medikal tedavi uygulanan hasta oranı 60 yaş üstü grupta en fazlaydı (p=0,040).
Sonuç: Çalışmamızda divertiküler hastalık sebebiyle hastaneye yatışın mevsimsel değişimini gösterdik. Kış mevsiminde artmış bir başvuru oranı saptadık. Tedavi yöntemi seçimi mevsimsel varyasyon göstermiyordu. Fakat yaş gruplarına göre ayrıca değerlendirdiğimizde kış aylarında 60 yaş üstü daha çok cerrahi tedavi alırken yaz aylarında 60 yaş üstü daha çok medikal tedavi almıştı. Bu değişimin patofizyolojik mekanizması tam olarak ortaya koyulamamıştır.
Anahtar Kelimeler: Divertiküler hastalık, mevsimsel değişim, cerrahi tedavi

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Introduction

Diverticular disease consists of various pathologies associated with diverticula in the colon. Diverticular disease of the colon is prevalent in industrialised countries. It has an important influence on patient health and healthcare costs.[1] The prevalence of colonic diverticulosis has a tendency to increase worldwide probably due to lifestyle changes in various populations.[2] The pathophysiology of diverticulosis and/or diverticulitis is challenging to describe. Diverticulitis may be caused by a combination of triggering factors or a single factor.[1]

The concept of seasonal change is well known in medical literature. The seasonal patterns of some gastrointestinal diseases such as inflammatory bowel disease, acute infective gastroenteritis, upper gastrointestinal tract bleeding, peptic ulcer, acute pancreatitis, acute cholecystitis and acute appendicitis have been demonstrated.[3,4,5]

The seasonal pattern of diverticular disease has not been fully revealed. Studies have shown that the number of patients who present to the hospital with acute diverticulitis increases in summer months.[6,7] The aetiology of this seasonal variation is uncertain. Diet changes according to seasons, dehydration, alterations in colon motility, changes in infectious diseases and seasonal fluctuations in vitamin D levels may play a role in the aetiology.[8] In the literature, these seasonal differences have mostly been associated with exposure to ultraviolet (UV) light, which makes an important contribution to serum vitamin D levels. Given the geographical and seasonal differences, the number of cases presenting with diverticulitis were considerably higher in geographical regions with low UV light level.[6]

In this study, considering evidence in literature as baseline, we aimed to investigate whether there was a difference between hospital admission ratios and treatment methods and to explore the relation of these differences in different age groups.

Materials and Methods

Patients admitted to the General Surgery Department of Erciyes University Faculty of Medicine with a pre-diagnosis of acute diverticulitis between 1 January 2015 and 1 January 2020 was included in the study. Patients who had missing clinical data or who were <18 years old were excluded from the study. Patients were diagnosed as having acute diverticulitis based on their clinical history and imaging methods. By examining patient files and hospital information system records, a common database was created. Patient information retrieved from this database was evaluated retrospectively.

The study was performed in accordance with the ethical rules based on the principles of the Declaration of Helsinki.

Patients were grouped according to the seasons of their admission to the hospital and were compared in terms of age, sex and treatment. Patients were divided into two groups in terms of the treatment method, i.e. surgical group and medical group. Percutaneous drainage was considered a medical treatment. Moreover, the patients were divided into three groups according to age: 18-40, 40-60 and >60 years. Sex and treatment methods were also examined according to seasonal groups.

This study was carried out in a university hospital, which is a tertiary hospital that provides services to five million people in Kayseri, located in the Middle Kızılırmak region of Turkey, near Central Anatolia and Taurus Mountains. It is located between latitudes 37°45′ north and 38°18′ north and longitudes 34°56′ east and 36°58′ east. The city centre of Kayseri has an altitude of 1054 m. Kayseri has predominantly steppe climate. The summers are hot and dry, and the winters are cold and snowy. We obtained weather data of cities from the Turkish state meteorological service (http://www.mgm.gov.tr/veridegerlendirme/ilveilceler-ista- tistik.aspx). In the Northern Hemisphere, the seasons are described as winter (December-February), spring (March-May), summer (June-August) and autumn (September-November).

Statistical Analysis

In the statistical analysis, SPSS 23.0 software program (IBM Corp., Armonk, NY, USA) was used. Categorical measurements were summarised as numbers and percentages, and continuous measurements were summarised as average, standard deviation and minimum-maximum. The compliance of variables to normal distribution was examined using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). In the comparison of categorical variables, chi-square test and Fisher's exact test were employed. In variables that did not comply with a normal distribution, Mann-Whitney U test was used. Statistical significance level was taken as 0.05 in all tests.

Results

In this study, 157 patients participated in our study. The surgical and medical groups consisted of 39 and 118 patients, respectively. Of the patients who received surgical treatment, 21 underwent colon resection with or without faecal diversion and anastomosis and 18 patients underwent Hartmann's procedure. The average patient age was 55.96. The sex distribution was comparable. The most frequent age group was 40-60 years (40.8%). The predominant season of

hospital admission due to acute diverticulitis was the winter (39.5%). Data are shown in Table 1 and Graphic 1.

On average, the surgical group was older than the medical group (60.61 vs 54.42 p=0.030). The sex distribution were comparable in both groups (p=0.152). The winter season was dominant in the treatment groups (30.8% vs 42.4%, p=0.060). Seasonal variation of diverticular disease between the treatment groups is shown in Table 2.

In autumn, a higher number of female patients received medical treatment (50% vs 80%, p=0.049). In winter, on average, the patients in the surgical group were older than those in the medical group (68 vs 50, p=0.001), and all patients who underwent surgical treatment were >60 years old. In summer, the ratio of those who received medical treatment was the highest in the group aged >60 years (p=0.040). Case distribution of age groups and sex by seasons is shown in Table 3.

Table 1. Seasonal variations of diverticular disease

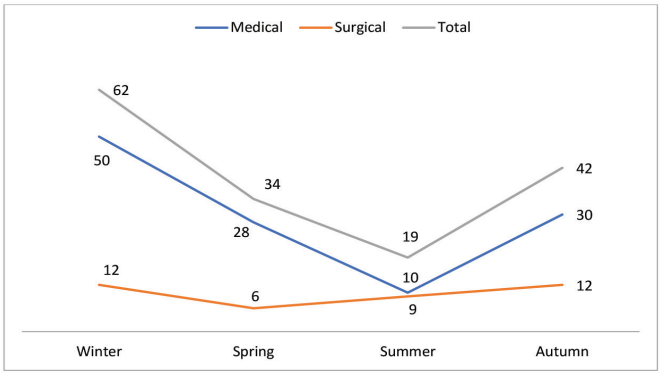
Measurements		Diverticular disease admissions n (%)
Age [(mean ± SD) (min-max)]		55.96±15.51 (21-90)
Sex	Male	77 (49.0)
	Female	80 (51.0)
Season	Winter	62 (39.5)
	Spring	34 (21.7)
	Summer	19 (12.1)
	Autumn	42 (26.8)
Age groups, years	18-39	30 (19.1)
	40-60	64 (40.8)
	≥61	63 (40.1)

max: Maximum, min: Minimum, SD: Standard deviation

Discussion

In this study, where hospital admissions due to diverticular disease and treatment methods were examined, the number of hospital admissions due to diverticular disease increased in the winter and the treatment methods were not associated with seasons.

The prevalence of diverticular disease is comparable for male and female patients. However, diverticular disease occurs in <10% of patients aged <40 years and in 50%-70% of patients aged 80 years, and prevalence increases considerably with age. Studies conducted within the last 10 years have also



Graphic 1. Distribution of diverticular disease admissions according to seasons and the numbers indicate the number of patients

Table 2. Seasonal variation of diverticular disease according to treatment groups

Measurements		Surgical n (%)	Medical n (%)	p*
Age [(mean + SD) (min-max)]		60.61±11.91 (36-80)	54.42±16.29 (21-90)	**0.030**
Sex	Male	23 (59.0)	54 (45.8)	0.152
	Female	16 (41.0)	64 (54.2)	
Season	Winter	12 (30.8)	50 (42.4)	0.060
	Spring	6 (15.4)	28 (23.7)	
	Summer	9 (23.1)	10 (8.5)	
	Autumn	12 (30.8)	30 (25.4)	
Age groups, years	18-39	4 (10.3)	26 (22.0)	**0.018**
	40-60	12 (30.8)	52 (44.1)	
	≥61	23 (59.0)	40 (33.9)	

max: Maximum, min: Minimum, SD: Standard deviation

Table 3. Case distribution of age groups and sex according to seasons

Measurements		Surgical n (%)	Medical n (%)	p*
Winter	Male	10 (83.3)	28 (56.0)	0.081
	Female	2 (16.7)	22 (44.0)	
Spring	Male	4 (66.7)	14 (50.0)	0.458
	Female	2 (33.3)	14 (50.0)	
Summer	Male	3 (33.3)	6 (60.0)	0.245
	Female	6 (66.7)	4 (40.0)	
Autumn	Male	6 (50.0)	6 (20.0)	**0.049**
	Female	6 (50.0)	24 (80.0)	
Seasons and age	Winter	68.33±5.58	50.28±17.28	0.001
	Spring	62.33±14.03	52.21±11.40	0.067
	Summer	58.88±8.82	67.20±13.75	0.140
	Autumn	53.33±13.64	59.13±16.51	0.288
Winter	18-39	0 (0.0)	16 (32.0)	**0.000**
	40-60	0 (0.0)	20 (40.0)	
	>61	12 (100.0)	14 (28.0)	
Spring	18-39	0 (0.0)	6 (21.4)	0.436
	40-60	4 (66.7)	16 (57.1)	
	≥61	2 (33.3)	6 (21.4)	
Summer	18-39	0 (0.0)	0 (0.0)	**0.040**
	40-60	6 (66.7)	2 (20.0)	
	≥61	3 (33.3)	8 (80.0)	
Autumn	18-39	4 (33.3)	4 (13.3)	0.134
	40-60	2 (16.7)	14 (46.7)	
	≥61	6 (50.0)	12 (40.0)	

investigated the incidence and disease progression in young patients with diverticulitis.[1,9] In a population study that analysed 267,000 patients presenting with acute diverticulitis between 1998 and 2005, an increase of 26% in the total was seen in the number of admissions due to diverticulitis from 1998 until 2005. The increase rate was higher in patients aged 18-44 years than in older patients (82% vs 36%, respectively). In that study, diverticulitis dominantly occurred in young male patients, and the disease had a more aggressive course with high rates of complication and recurrence.[10] In the present study, sex distribution was consistent with the literature, and the incidence was higher in patients aged >40 years.

Acute diverticulitis is accompanied by diverse clinical scenarios ranging from pericolonic inflammation to faecal peritonitis. Planning for patients with purulent peritonitis and faecal peritonitis is more inclined to operative treatment.[11,12] Traditional treatment of mild acute diverticulitis has focused on antibiotics, pain control and bowel rest. These treatment principles have been examined recently. In the latest guidelines issued by the American Gastroenterology Society Institute, the recommendation for acute diverticulitis without abscess is the administration of selective antibiotics according to the characteristics of the patient, instead of the routine use of antibiotics.[13] In 1923, Hartmann's resection was described as an alternative to abdominoperineal resection for patients with rectal cancer. This procedure has rapidly become the most frequently applied procedure for patients with perforated diverticulitis over time. In selected emergent cases, loop ileostomy with sigmoid resection and primary anastomosis may be performed.[14] In our series, the treatment method was planned according to the patient's

clinical status and disease severity. Our medical treatment consisted of bowel rest and antibiotherapy as recommended in the literature. While planning the surgical treatment method, we considered the degree of peritonitis and the general status of the patient. Patients for whom we planned surgical treatment had advanced age. Especially, for patients aged >60 years, our surgical treatment ratio was higher, and this could be associated with the deteriorated clinical status due to increasing age.

In the latest studies published in the literature, geographical and seasonal changes were observed in hospital admissions for diverticulitis.[6,7,8,11] Based on this observation, diverticulitis risk was associated with UV radiation exposure and vitamin D serum levels. Some observational retrospective studies have argued that the diverticulitis rate was lower in the winter, the admission rate was higher in low UV regions than in high UV regions, and there was an inverse ratio between 25-hydroxyvitamin D serum levels and hospital admission for diverticulitis.[6,12]

Based on the literature, the seasonal distribution of hospital admissions due to diverticular disease has not been established. In their study conducted in Denmark, Hupfeld et al.[13] found that hospital admissions due to diverticular disease were most frequent in autumn, with a rate of 26.1%. In Canada, Warner et al.[14] could not find a seasonal relation in the rates of hospital admissions due to diverticular disease. In the United States, Ricciardi et al.[7] demonstrated a seasonal cyclic fluctuation where the highest incidence was noted in the summer months for hospital admissions due to acute diverticulitis. They explained that infectious conditions increase in summer and related with diet changes, which was associated with greater consumption of fruits and vegetables in the summer and indigestible food materials that affect the lumen of the diverticulum caused by diet variations. Another probable factor that could be associated with the seasonal variation in the incidence of diverticulitis was changes in the intake of food-containing fibre.[7]

In their study, Adler et al.[8] included countries from different hemispheres and showed that hospital admissions due to diverticulitis increased in summer, and this finding was valid internationally and in both hemispheres. They attributed this situation to the argument that seasonal changes in diet, physical activity and medicine intake could trigger diverticulitis and to the probable increase in sensitivity to diverticulitis by stool stasis associated with slowing of the colonic passage caused by relative dehydration in the summer.[8]

In Italy, Manfredini et al.[4] demonstrated a cyclic pattern with two phases in hospital admissions due to acute diverticulitis peaking in autumn and spring. Moreover, they showed that winter could represent as a low-frequency but high-risk season and that mortality cases peaked only in winter.[4]

In the United States, Maguire et al.[6] observed a higher rate of geographical and lower rate of seasonal variation among young patients. Moreover, seasonal change was more prominent among Caucasian patients than among African-American patients. In the same study, the seasonality rates were higher among rural hospitals and the source of these differences could be related to vitamin D levels.[6]

Unlike previous studies, we detected an increased rate of hospital admissions in winter. The selection of treatment method did not demonstrate seasonal variation. However, on evaluation according to age groups, a high number of patients aged >60 years received surgical treatment in winter and a high number received medical treatment in summer. The finding that a high number of older patients received surgical treatment in winter may be related to the delay in presenting to the hospital due to winter conditions. Similarly, this situation can be explained by the low-fibre diet in winter. In another study in our region, we found an increase in hospital admissions due to appendicitis in winter.[3]

The reason for this tendency is uncertain. The pathogenesis of diverticular disease is probably multifactorial. Seasonal changes in different geographical zones and diet and lifestyle changes in similar geographical regions may cause this seasonal pattern.

The most important limitations of this study were its retrospective design, small sample size and single-centre setting. However, given the limited number of studies on this subject, we believe that our study makes a contribution to the literature.

Conclusion

In this study, we showed the seasonal change in hospital admissions due to diverticular disease, but the pathophysiological mechanism of this change could not be fully revealed. Thus, there is a need for multicentre studies on this subject. Our results suggest that there exists a seasonal risk factor shared in international populations and that this situation warrant further research to explain the pathophysiology of this common disease.

Ethics

Ethics Committee Approval: We did not receive an ethics committee approval because the study is retrospective.

Informed Consent: Because the study was retrospective, we could not get informed consent.

Peer-review: Externally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: F.D., E.M.S., M.A., T.T., İ.B., Concept: F.D., U.T., E.M.S., M.A., T.T., İ.B., Design: F.D., U.T., E.M.S., M.A., T.T., İ.B., Data Collection or Processing: F.D., U.T., E.M.S., M.A., İ.B., Analysis or Interpretation: F.D., Literature Search: U.T., Writing: F.D., U.T., M.A.

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