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RESEARCH

Prevalence and clinical correlates of mesenteric panniculitis in urinary stone disease

Üriner taş hastalığında mezenterik panniküliti̇n prevalansı ve klinik belirleyicileri

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Abstract

Purpose: The aim of this study is to determine the prevalence of mesenteric panniculitis in patients with urinary system calculi and identify factors, such as hydronephrosis and calculus location, that might be associated with the presence of mesenteric panniculitis.

Materials and Methods: In this retrospective observational study, the prevalence of mesenteric panniculitis was determined in 692 patients with urolithiasis using non-contrast-enhanced computed tomography imaging between 2017 and 2020. The grade of hydronephrosis and the level of urinary calculi were recorded for each patient, and statistical analysis was performed to assess the link between these features and mesenteric panniculitis.

Results: The prevalence of mesenteric panniculitis in patients with urolithiasis was 6.35% and it was associated with the presence of hydronephrosis. It was more common in patients who had both ureterolithiasis and nephrolithiasis with no statistically significant difference regarding in age, gender, or the presence of either only nephrolithiasis or only ureterolithiasis.

Conclusion: Mesenteric panniculitis is more common in patients with both ureterolithiasis and nephrolithiasis and can be easily diagnosed with non-contrast computed tomography imaging. Because the mesentery and urinary system share a common lymphatic drainage system, increased lymphatic drainage due to hydronephrosis has been shown to contribute to the development of mesenteric panniculitis.

Keywords:. Mesenteric panniculitis, ureterolithiasis, nephrolithiasis, computed tomography

Öz

Amaç: Bu çalışmanın amacı, üriner sistem taşları olan hastalarda mezenterik panniküli̇tin prevalansını belirlemek ve hidronefroz ve taşın yeri gibi mezenterik panniküli̇tin varlığıyla ilişkili olabilecek faktörleri tanımlamaktır.

Gereç ve Yöntem: Bu retrospektif gözlemsel çalışmada, 2017 ile 2020 yılları arasında kontrastsız bilgisayarlı tomografi görüntüleme kullanılarak ürolitiyazisli 692 hastada mezenterik panniküli̇t prevalansı belirlenmiştir. Her hasta için hidronefroz derecesi ve üriner taşların seviyesi kaydedilmiş ve bu özellikler ile mezenterik panniküli̇t arasındaki bağlantıyı değerlendirmek için istatistiksel analiz yapılmıştır.

Bulgular: Ürolitiyazisli hastalarda mezenterik panniküli̇t prevalansı %6,35 idi ve hidronefroz varlığı ile ilişkiliydi. Üreterolitiazis ve nefrolitiazis olan hastalarda daha yaygındı, ancak yaş, cinsiyet (veya sadece nefrolitiazis veya sadece üreterolitiazis varlığı açısından istatistiksel olarak anlamlı bir fark yoktu.

Sonuç: Mezenterik panniküli̇t, hem üreterolitiyazis hem de nefrolitiyazis bulunan hastalarda daha yaygındır ve kontrastsız bilgisayarlı tomografi görüntüleme ile kolayca teşhis edilebilir. Mezenter ve üriner sistem ortak bir lenfatik drenajı paylaştığından, hidronefroza bağlı lenfatik drenajın artması mezenterik panniküli̇t gelişimine katkıda bulundugu gösterilmiştir.

Anahtar kelimeler: Mezenterik panniküli̇t, üreterolitiazis, nefrolitiazis, bilgisayarlı tomografi

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INTRODUCTION

Mesenteric panniculitis (MP) is a rare entity with unknown etiology characterized by circumscribed mass-like density in the mesentery, omentum and mesocolon. Diagnosis of MP is primarily based on radiology, and the most useful methods for detecting the disease are computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography[1,2]. Among these, CT is known to be the most commonly used radiological method in the diagnosis of mesenteric panniculitis, and limited information is available on other imaging techniques[2]. MP has been found to be associated with various diseases such as malignancy, trauma, obesity, and previous surgery, but the etiology of the disease is unclear[1,2].

The prevalence rate of urinary calculi has been found to be 1.7-14.8%, and these rates are seen to be increasing. The frequency of hydronephrosis reaches 80% in urinary calculi patients presenting to the emergency department with acute renal colic, and hydronephrosis is a frequently observed complication in urinary calculi disease patients[3]. The gold standard for diagnosing urolithiasis is non-contrast enhanced CT[4]. The association between MP with urinary system tumors has been previously studied[1,5]. There has also been evidence of a connection between urinary calculi and MP[6,7]. However, there are no data in the literature regarding whether the presence of hydronephrosis, nephrolithiasis and ureterolithiasis is associated with MP or not. Although the mesentery and kidneys have different blood supply and venous return, they are adjacent anatomic structures and share a common lymphatic drainage[8]. These common features might explain the development of MP in patients with urinary system calculi. Our hypothesis suggests that urinary calculi disease is associated with MP due to this common lymphatic drainage pathway.

This study will investigate the prevalence of MP in patients with urolithiasis to determine whether urolithiasis represents a new factor in the etiology of MP. Furthermore, the relationship between the maximum MP diameter and hydronephrosis, the relationship between the maximum MP diameter and calculus location, and the prevalence of MP in patients with hydronephrosis, which have not been previously investigated in the literature, will be investigated. This will identify urinary system stones and stone-related factors that may play a role in the etiology of rare MP cases.

As a result, two separate hypotheses were established in our study; urolithiasis is not the etiology of MP and there is no relationship between MP diameter, grade of obstruction or the level of ureterolithiasis.

MATERIALS AND METHODS

This study was approved by Erzincan Binali Yıldırım University ethics committee. Informed consent was waived due to the retrospective nature of the study. (Date:29/04/2020, Decision no: 05/17)

Sample

The study flowchart, including inclusion/exclusion criteria is illustrated in Figure 1. Between July 2017 and April 2020, 1,292 patients who underwent abdominal non-contrast enhanced CT scans due to suspected urolithiasis at the Erzincan Binali Yıldırım University Faculty of Medicine Department of Radiology were included in this retrospective observational study. Ninety-three patients with inadequate image quality, motion artifacts, and missing data were excluded from the study. Among 1199 patients with evaluable abdominal NECT, urinary system stones were detected in 724 patients. A total of 32 patients with exclusion criteria of accompanying malignancy (n:3), peritonitis (n:1), previous surgery (n:15), and chronic disease (n:13) were excluded from the study. The study population for the final evaluation consisted of 692 patients. MP was detected in 44 patients among 692 patients.

CT imaging and assessment

All patients were examined using a 16-slice multi-detector computed tomography scanner (Somatom Emotion 16, Siemens Healthcare, Erlangen, Germany). The abdominal CT imaging parameters were as follows: collimation= 1 mm, tube current = 150 mAs, FOV= 300 mm, slice thickness= 2,5 mm and kVp= 100, and matrix= 512x512. Images were evaluated using an offline workstation (Syngo via, ver. 30B, Siemens Healthcare, Erlangen, Germany) by single radiologist with 10 years of experience in abdominal radiology. The window (W) and level (L) settings used for the diagnosing panniculitis were W: 400 HU and L:50 HU.

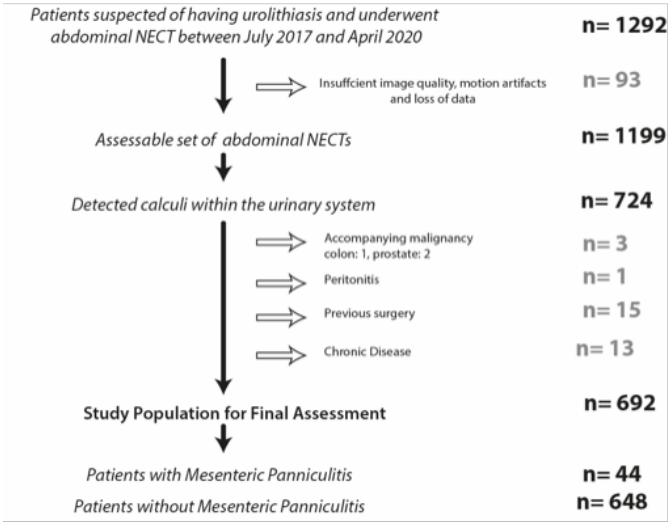

Figure 1. The flowchart with excluded patients.

The number and location of calculi were recorded for each patient. The term "urolithiasis" referred to the presence of a calculus in any location of the urinary system whereas, "nephrolithiasis (NL)" referred to a calculus confined to the renal pelvicalyceal system, and "ureterolithiasis (UL)" referred to a calculus within the ureters. In our study, the urinary tract dilatation classification system was used for hydronephrosis grading[9]. Hydronephrosis was graded according to a 4-point scale (0= none; 1= dilatation of renal pelvis; 2= dilatation of renal pelvis and calyces; 3= dilatation of pelvis and calyces with deformation of papillae). The location of a ureteral calculus was classified using a three–level scale: high (renal pelvis to inferior edge of the kidney, mid (inferior edge of the kidney to iliac crossing), and low (iliac crossing to bladder) (Figure 2 ABC).

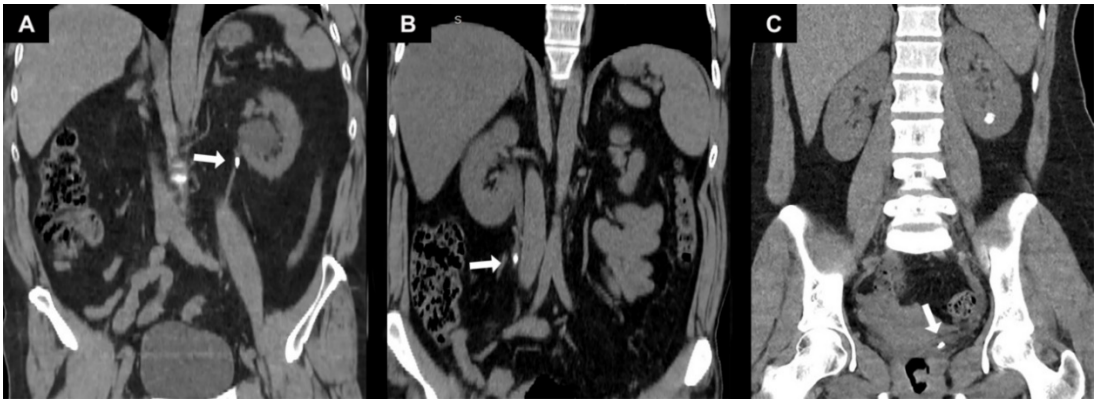

Figure 2ABC. Localization of ureteral calculi on coronal CT images. High (A), mid (B) and low (C) localizations (white arrows in A, B and C).

MP was defined according following the criteria: a mesenteric mass that clearly defines and displaces nearby structures without invading them, inhomogeneous fat density within the mass greater than that of adjacent retroperitoneal/mesocolonic fat, the presence of small soft tissue nodules, typically less than 10 mm within the mesenteric fat, a low-attenuation fatty halo surrounding the lymph nodes/mesenteric vessels, and a hyperattenuating pseudo-capsule encircling the affected area in the absence of ascites or known malignancy involving the mesentery. Patients who met at least three out of five criteria were diagnosed with MP[10]. The maximum diameter of MP was measured on axial CT images and recorded for each patient (Figure 3).

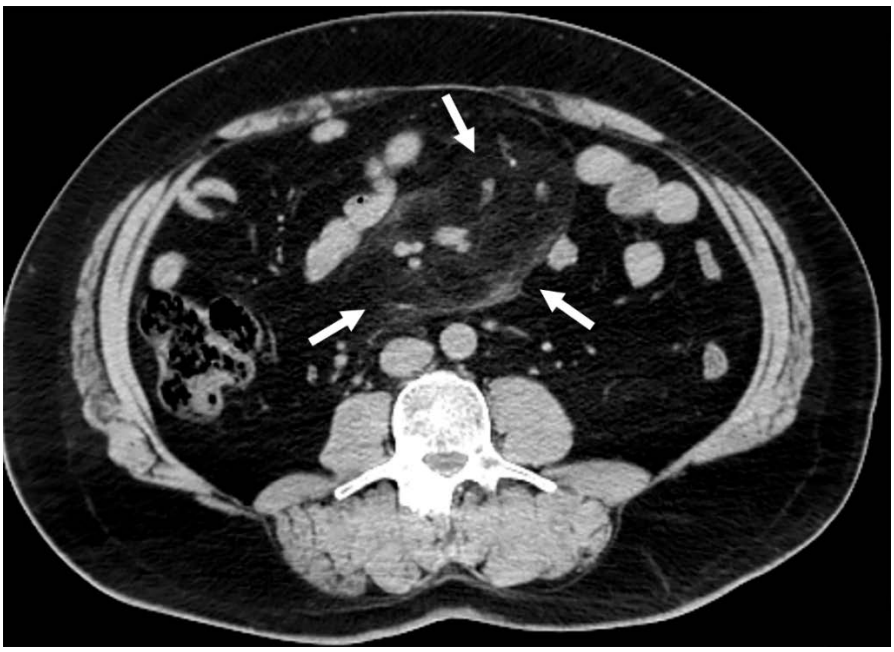

Figure 3. Mesenteric panniculitis on axial CT image characterized by a mesenteric mass slightly hyperdense to the adjacent retroperitoneal/mesocolonic fat containing small soft tissue nodules and hyperattenuating pseudo-capsule (white arrows).

Statistical analysis

Summary statistics were reported as mean± SD in the text. The normality of data distribution was assessed with the Shapiro-Wilk test. Continuous variables with a normal distribution (age) were compared using an independent t-test, whereas nominal categorical variables (gender, presence of ureterolithiasis and nephrolithiasis, hydronephrosis) were analyzed using a Chi–square test. Spearman rank correlation was used to assess the correlation between diameter of mesenteric panniculitis with grade hydronephrosis and level of the ureterolithiasis. A power analysis conducted to determine the minimum subject number with 0.05 alpha and 0.8 beta. Our sample size met the minimum required subject size. A two-tailed p-value < 0.05 was considered statistically significant. All statistical analyses were performed using the R statistical software package (R studio, Vienna, Austria).

RESULTS

The prevalence of MP in patients with urolithiasis was 6.35% in our study. The mean age of the study population was 48.5±14.4 years and, 492 out of 692 patients were male (71.1%). The median maximum diameter of the mesenteric panniculitis was 6 cm, ranging between 2 and 10 cm.

A comparison of demographic data, along with the presence of ureterolithiasis and nephrolithiasis, is

summarized in Table 1. MP was more common in patients who had both UL and NL (p=0.018) with no statistically significant difference regarding age (p=0.082), gender (p=0.268) or the presence of either only NL or only UL (p= 0.066 and 0.602 respectively).

Table 1. Comparative data and corresponding p values belong to the urolithiasis patients with and without mesenteric panniculitis.

Variables	Urolithiasis w/ mesenteric panniculitis (n=44)	Urolithiasis w/o mesenteric panniculitis (n= 648)	p value
Age, years ±SD	52.2±12.9	48.2±14.5	0.082
Gender (%)			0.268
Male	35 (79.5)	457 (70.5)	
Female	9 (20.5)	191 (29.5)	
Only NL (%)	17 (38.6)	337 (52.0)	0.066
Only UL (%)	7 (15.9)	132 (20.4)	0.602
UL+NL (%)	20 (45.5)	179 (27.6)	**0.018**
Hydronephrosis (%)	29 (65.9%)	114 (17.6%)	**<0.001**

SD, standard deviation; NL, nephrolithiasis; UL, ureterolithiasis
Bold text denotes the statistical significance

MP was found to be associated with hydronephrosis (p< 0.001) however, the maximum diameter of the mesenteric panniculitis was not associated with either the grade of hydronephrosis or level of ureterolithiasis (p= 0.839, r=-0.031 and p=0.725, r=0.054 respectively) (Figure 4).

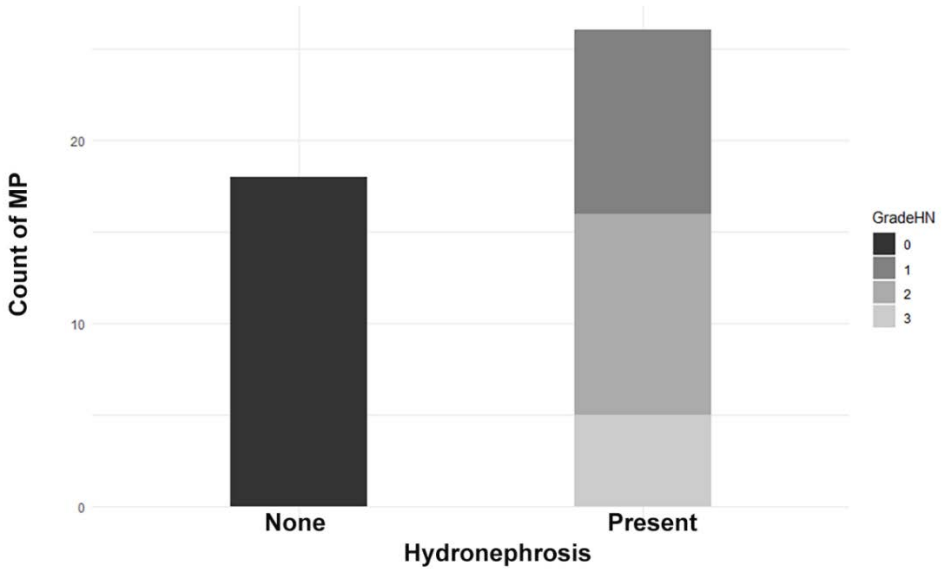

Figure 4. The bar chart shows the number of mesenteric panniculitis patients with and without hydronephrosis. See the text for p values.

DISCUSSION

MP is described as a non-specific inflammatory process of the mesentery with fibrotic proliferation of the mesenteric fat[11]. The disease has a male dominance (2-3:1) and is more common in elderly although some pediatric cases were described[12-14]. Its prevalence has been reported between 0.16-3.3% in the literature[15]. There is only one autopsy series that reported the prevalence of MP as 1.3%[16]. The most common clinical findings in patients with mesenteric panniculitis include pain, nausea, weight loss, vomiting, and fever[17,18]. Previous studies have linked MP with various diseases such as malignancy, trauma, obesity, and previous surgery[1]. Ehrenpreis et al., in which 83% of the patient population had a history of malignancy found association between MP and various malignancies such as lymphoma, prostate cancer and renal cell cancers[5]. On the other hand, similar studies in the literature have reported diverse results[15,19]. Although genitourinary system tumors were found to be associated with MP, as mentioned above, the cancer–MP link is still controversial in the literature[15]. To negate the effect of malignancy, we excluded the patients with malignancy and any history of other malignant diseases. Furthermore, our study population was relatively young, thus we expected malignancy rates to be as low as possible.

Another entity that has been found to be associated with MP is a previous history of surgery[20,21]. However, this association seems weak because one of these studies[20] had fewer subjects, and the other study only included recent surgeries[21]. Nevertheless, we excluded patients with a previous history of surgery in our study to find a clear link between urinary system calculus and MP. Furthermore, we also excluded other known chronic diseases to eliminate the possible link between any chronic disease and MP.

Little data are available in the literature regarding the association between non-malignant urinary system disease and the MP. In one study, authors presented a case in which the patient had previous diagnosis of membranous glomerulonephritis and developed MP after steroid therapy[22]. To date, there is no definitive study that evaluates the association between urolithiasis, hydronephrosis and MP. A few studies have mentioned the association of MP and urolithiasis only[6,7]. In our experience, the best possible explanation for association between the urinary calculi and MP is based on the anatomy of the mesentery and urinary organs. Venous drainage of these distinct structures is separate but converges at the suprahepatic level of the inferior vena. The common anatomic connection between these two is the lymphatic drainage. Lymphatic vessels of the kidneys enter pre-aortic, para-aortic and retro aortic lymph nodes on the left, and paracaval, precaval, retrocaval and interaortocaval lymph nodes on the right side[23]. On the other hand, lymphatic drainage of upper ureters joins that of the kidneys or lumbar nodes whereas middle segments drain to the common iliac lymph nodes, and the distal segments drain to the common, internal or external iliac lymph nodes[24]. Mesenteric lymphatic drainage has some similar features, especially renal lymphatic drainage. Lymphatic drainage of the inferior and superior portions of the mesentery converges at the level of superior mesenteric lymphatics, which subsequently drains into the pre-aortic lymphatics [8] . Another mechanism that possibly explains the association between MP and urinary calculus is the increased lymphatic drainage during the hydronephrosis[25,26]. This explains why MP is associated with not only NL or UL, but both. Hydronephrosis caused by UL might increase the flow of lymphatics at the level of kidneys exacerbating the development of MP.

Our study has some clinical implications. First, the presence of both NL and UL is associated with increased prevalence of MP, and all these entities can be diagnosed with non-contrast enhanced CT imaging. Second, mesentery and the urinary system have common lymphatic drainage, and increased lymphatic drainage due to hydronephrosis might contribute the development of MP. Supporting our hypothesis, we think that the presence of hydronephrosis associated with intra and infra renal calculi alters the drainage of the lymphatics of the urinary system, which converges with the lymphatics of the mesentery, thus causing the development of MP. Third, diameter of MP is not associated with either the grade of obstruction or level of ureterolithiasis. No data comparing MP diameter with these parameters were found in the literature review. This insignificance is thought to stem from inter-individual differences such as intra-abdominal mesenteric fat and body mass index (BMI). The retrospective nature of our study prevented us from accessing patients' BMI data, thus preventing us from confirming this information. Furthermore, the MP diameter measurement we performed in our study is a measurement method we developed and can be

used in other studies. We believe our study will contribute to the literature in this respect.

When our hypotheses were evaluated as a result of our study, our first hypothesis was rejected because MP is frequently observed in patients with urolithiasis and therefore could be considered an etiological factor. Our second hypothesis was accepted because no relationship was found between MP and the grade of obstruction or the level of ureterolithiasis.

Some limitations should also be considered in our study. Our poposed common lymphatic pathway mechanism should be supported by experimental studies. Another limitation of our study is that the diagnosis of MP was evaluated by a single radiologist, but the fact that the evaluating radiologist had 10 years of experience and the diagnostic criteria for MP were quite clear minimizes the possibility of bias. It is recommended that prospective studies conducted with larger patient groups in the future include measurements of patients' BMI and intra-abdominal mesenteric fat thickness. MP is more common in patients with urinary system calculi, and, owing to conjoined lymphatic drainage system, the concurrence of both NL and UL with hydronephrosis is associated with an increased prevalence of MP, which can be readily diagnosed using non-contrast enhanced CT imaging.

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