

Evaluation of Demographic and Hematologic Parameters in Nephrolithiasis Patients with and without Prostate Stones: Cross-sectional Study

Prostat Taşlı Olan ve Olmayan Böbrek Taşlı Olgularda Demografik ve Hematolojik Parametrelerin Değerlendirilmesi: Kesitsel Çalışma

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ABSTRACT Objective: Prostate stones are regarded as asymptomatic and clinically insignificant and ignored by clinicians. To investigate the clinical and demographic differences between patients with and without prostate stones. **Material and Methods:** Since similar etiological factors play a role in the formation of prostate stones and kidney stones, male patients with clinically important kidney stones were retrospectively analyzed and grouped as patients with and without prostate stones. The presence of prostate calculi was detected with abdominopelvic non-contrast computerized tomography. A total of 244 patients were included in the study (144 [59.02%] had no prostate stone, 100 [40.98%] had prostate stones). The demographic and clinical data (age, urine pH, urine density, leukocyte count, neutrophil count, lymphocyte count, thrombocyte count, mean thrombocyte volume (MPV), neutrophil-lymphocyte ratio (NLR), thrombocyte lymphocyte ratio (PLR), kidney stone volume, kidney stone Hounsfield unit (HU), abdominal anterior wall fat thickness) were analyzed between those with and without prostate stones. **Results:** Demographic and clinical data analysis between patients with and without prostate stones obtained statistical results for age ($p=0.000$), urine pH ($p=0.479$), urine density ($p=0.215$), leukocyte count ($p=0.168$), neutrophil count ($p=0.055$), lymphocyte count ($p=0.712$), platelet count ($p=0.589$), mean platelet volume ($p=0.682$), NLR ($p=0.045$), PLR ($p=0.902$), stone volume ($p=0.307$), HU ($p=0.117$), and anterior abdominal fat thickness ($p=0.751$). **Conclusion:** Advanced age and high NLR can be considered risk factors for prostate stone formation.

ÖZET Amaç: Prostat taşları asemptomatik ve klinik önemsiz olarak kabul edilerek klinisyenler tarafından göz ardı edilmektedirler. Prostat taşı olan hastalarla olmayanlar arasındaki demografik ve hematolojik parametreleri incelemeyi amaçladık. **Gereç ve Yöntemler:** Prostat ve böbrek taşı oluşumunda benzer etiyolojik faktörler rol oynadığından dolayı klinik önemli böbrek taşı olan erkek hastalar retrospektif olarak incelendi ve prostat taşı olan hastalar ile olmayanlar diye gruplandırıldı. Hastaların prostat taşı mevcudiyeti ince kesit abdominopelvik bilgisayarlı tomografi ile değerlendirildi. Toplam 244 (144 [%59.02] hastada prostat taşı yok, 100 [%40.98] hastada prostat taşı var) hasta çalışmaya alındı. Olguların demografik ve klinik verileri (yaş, idrar pH'si ve dansitesi, lökosit, nötrofil, lenfosit ve trombosit sayısı, ortalama trombosit hacmi (MPV), nötrofil lenfosit (NLR) ve trombosit lenfosit oranları (PLR), böbrek taş hacmi, böbrek taş Hounsfield ünitesi (HU), karın ön duvar yağ kalınlığı) analiz edildi. **Bulgular:** Prostat taşı olan ve olmayan hastalar arasındaki demografik ve klinik veri analizinde sadece yaşın ve NLR'nin gruplar arasında fark ettiği görüldü ($p=0.000$ ve $p=0,045$). İdrar pH'si ($p=0,479$), idrar yoğunluğu ($p=0,215$), lökosit ($p=0,168$), nötrofil ($p=0,055$), lenfosit ($p=0,712$) ve trombosit sayısı ($p=0,589$), MPV ($p=0,682$), PLR ($p=0,902$), böbrek taş hacmi ($p=0,307$), HU ($p=0,117$) ve karın ön duvar yağ kalınlığı ($p=0,751$) gruplar arasında farklı bulunmadı. **Sonuç:** İleri yaş ve yüksek NLR prostat oluşumu için risk faktörü olarak değerlendirilebilir.

Keywords: Prostate stone; nephrolithiasis; inflammation; neutrophil

Anahtar Kelimeler: Prostat taşı; nefrolitiazis; inflamasyon; nötrofil

Patients with kidney stones have higher rates of coronary artery atheroma plaque and prostate stones, showing they may be affected by similar etiologic factors.¹ In spite of prostate stones being known for

hundreds of years, their clinical significance is uncertain.² Most prostate stones are small, asymptomatic, and in spite of not being identified on physical examination, prostate stone rates are commonly re-

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ported after identification due to common use of imaging systems in recent years.^{2,3} With increased incidence observed in the elderly, there are a variety of opinions related to formation of prostate stones. Commonly accepted factors are precipitation of prostate gland secretion content and infection stone formation among those with refluxed urine within prostate tissue. Incidence rates were shown to increase with kidney stones among those with kidney stones and children with hypercalciuria.^{4,5} We aimed to research the efficacy of factors affecting urinary system stone formation and growth (urine pH, urine density, obesity, age), some inflammatory markers [neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), leukocyte count, neutrophil count, platelet count and volume] and diseases with similar etiologic pathologies in stone formation [kidney stone size and Hounsfield unit (HU), atheroma plaque presence] on formation of prostate stones.^{1,6-8}

MATERIAL AND METHODS

The study was conducted in accordance with the Declaration of Helsinki Principles. Ethics committee permission was granted by the Clinical Research Ethics Committee of Health Sciences University İstanbul Gaziosmanpaşa Training and Research Hospital. Decision no: 108, date 17.6.2020. Data from preoperative examinations were analyzed retrospectively for patients who were scheduled for surgical treatment for kidney stones between 01/2013-01/2020. Patients with diagnosis of clinically significant kidney stones were retrospectively screened and grouped into patients with and without prostate stones. Those with previous prostate and urinary tract stone surgery, chronic renal failure, with urinary infection, and hematologic diseases were not included in the study. Prostate stones, anterior abdominal fat thickness and kidney stone assessment were obtained from non-contrast computed tomography (Siemens Somatom Emotion Duo, Germany) images. To calculate HU values for kidney stones, PACS Dicom Viewer-V2.7 software was used for digital imaging and assessment. Mean HU value determination was calculated with 1 cm-diameter circular area. Leukocyte count, neutrophil count, lymphocyte count, platelet count, mean platelet volume (MPV), NLR, and PLR were

obtained from full blood count, while urine pH and urine density were recorded from full urine tests.

RESULTS

A total of 244 male patients were included in the study [144 (59.02%) had no prostate stones, 100 (40.98%) had prostate stones]. Median age was 49.0 years for those with prostate stones [interquartile range (IQR) 16.0] and 38.0 years for those without prostate stones (IQR 16.0). For kidney stone volume values, median was 874.9 mm² (IQR 1299.6) for those with prostate stones and 806.6 mm² (IQR 1453.9) for those without prostate stones median; kidney stone HUs were 1257.7 (IQR 407.5) for those with prostate stones and 1222.0 (IQR 354.7) for those without prostate stones and anterior abdominal fat thickness was median 2.4 cm for those with and without prostate stones (IQR 1.1) and 1.4, respectively (Table 1). In terms of blood parameters, leukocyte count, neutrophil count, lymphocyte count, platelet count, MPV were not different between groups. NLR was median 2.3 (IQR 1.1) for those with prostate stoned and median 2.0 (IQR 1.1) for those without prostate stone. This difference was statistically different. Demographic and clinical data analysis between patients with and without prostate stones revealed statistical results for age (p=0.000), urine pH (p=0.479), urine density (p=0.215), leukocyte count (p=0.168), neutrophil count (p=0.055), lymphocyte count (p=0.712), platelet count (p=0.589), MPV (p=0.682), NLR (p=0.045), PLR (p=0.902), stone volume (p=0.307), HU (p=0.117), and anterior abdominal fat thickness (p=0.751) (Table 1).

STATISTICAL ANALYSIS

Descriptive statistics were given as mean, standard deviation, median, minimum and maximum values for continuous variables. For statistical comparison of data, normal distribution of continuous data was analyzed with the Kolmogorov-Smirnov analysis. Comparison of continuous data in independent groups used the t-test for parametric values and the Mann-Whitney U test for non-parametric values. Categorical data were compared with the chi-square test. Statistical significance was accepted as p value below 0.05 in the 95%

TABLE 1: Clinical variables between men with and without prostatic calculi.

	No prostatic stones						Prostatic stones						p value
	Mean	SD	Median	Minimum	Maximum	Interquartile range	Mean	SD	Median	Minimum	Maximum	Interquartile range	
Age	40.1	13.1	38.0	8.0	75.0	16.0	50.5	11.2	49.0	27.0	82.0	16.0	0.000
Urine pH	6.0	0.5	6.0	4.8	7.5	0.5	6.0	0.5	6.0	4.8	8.0	0.3	0.479
Urine density	1016.9	6.9	1016.0	1002.0	1055.0	9.0	1015.7	5.5	1015.0	1004.0	1033.0	7.0	0.215
Leukocyte count	7.9	2.2	7.7	3.4	15.4	2.7	8.3	2.1	7.8	3.8	15.6	2.9	0.168
Neutrophil count	4.8	1.7	4.7	1.8	11.6	2.3	5.2	1.7	4.9	2.6	11.4	2.3	0.055
Lymphocyte count	2.4	0.8	2.3	0.8	5.5	0.9	2.3	0.7	2.3	0.9	3.9	1.0	0.712
Platelet count	256.8	59.1	257.0	135.0	467.9	78.0	253.7	62.0	245.8	127.0	433.0	72.5	0.589
Mean platelet volume	9.2	1.5	9.2	5.6	12.8	2.1	9.2	1.2	9.2	6.2	13.6	1.8	0.682
NLR	2.2	1.1	2.0	0.5	6.5	1.1	2.5	1.2	2.3	1.0	10.0	1.1	0.045
PLR	117.6	39.7	110.1	54.7	264.6	46.2	119.9	47.1	111.6	52.8	262.8	62.5	0.902
Stone volume	1478.1	2319.7	806.6	60.8	18502.3	1453.9	1609.4	2149.7	874.9	72.7	15470.4	1299.6	0.307
HU	1144.9	279.9	1222.0	439.1	1642.0	354.7	1189.2	299.5	1257.7	14.3	1739.6	407.5	0.117
Anterior abdominal fat thickness	2.4	1.0	2.4	0.5	5.3	1.4	2.5	0.8	2.4	1.0	5.5	1.1	0.751

SD: Standard deviation; NLR: Neutrophil-lymphocyte ratio; PLR: Platelet-lymphocyte ratio; HU: Hounsfield unit.

confidence interval. Statistical analyses used the SPSS v.21.0 program.

DISCUSSION

Studies have found high incidence of both prostate stones and coronary artery atheroma plaque among those with kidney stones.^{1,5} A study about the incidence of prostate stones identified that the incidence was 44.4% for those with kidney stones, 21.0% for those without, 71% in autopsy studies and 40.7% in a study researching the effect of prostate specific antigen level in patients without cancer. Another study assessing a variety of urologic complaints with transrectal ultrasonography identified incidence of 47.2% for those younger than 50 years and 86% for those older than 50 years.^{5,9-11} In our study, the prostate stone incidence rate in the kidney stone group was 25% and it was observed to significantly increase with age, consistently with other studies.

Studies to determine the content of prostate stones by Sutor et al. investigated 28 prostate stones with the x-ray diffraction method and showed that 14 were formed of material that precipitated in urine and not from possible precipitation of prostatic secretions.¹² Another study investigated prostate stones of 5 patients and showed they were formed from a mixture of calcium phosphate and calcium carbonate.¹³ Magura et al. showed that prostatic stones formed by similar aggregation mechanism of kidney stones.⁴ Al taheini et al. showed that prostate stones are rarely observed in children with hypercalciuria in a study including a limited number of patients.¹⁴ Kirby et al. showed reflux of urine into prostatic tissue in a study using carbon particles.¹⁵ These studies showed the urine content may cause prostate stone formation in patients.

Han et al. showed in a study of urine pH and stone composition that calcium phosphate and struvite stones were formed in alkaline urine, while uric acid and cysteine stones were formed in acidic urine.¹⁶ It is known that HU changes with stone content and that as the HU

of infection stones reduces, the calcium in stones increases.

Another significant risk factor for stone formation is obesity. A study found uric acid amounts increased and urine pH lowered in obese people.^{17,18} A review showed that increasing fluid intake reduced urine density and was significant in reducing the recurrence and formation of stone disease.¹⁹ Studies assessing kidney stone disease with age and fluid intake showed that incidence changed with age and peaked in white males from 30-40 years and increased fluid intake prevented kidney stones.¹⁶ In our study, urine pH, urine density, stone volume and HU values were not identified to be statistically different between those with prostate stones and those without.

Metabolic syndrome itself and its components were shown to affect lower urinary tract symptoms (LUTS).^{20,21} However, the correlation between body mass index and prostatic stones has still not gained clarity. In our study, we did not identify a correlation between anterior abdominal fat thickness variation and prostate stones. In a study which showed prostate blood flow increased in elderly men with LUTS, they claimed a prediction could be made about understanding pathological processes in prostate diseases.²² A study by Soric et al. showed the inflammation process contributed to prostate stone formation in patients by measuring high seminal plasma cytokines [interleukin-

1 beta (IL-1 β), IL-8].²³ NLR, lymphocyte monocyte ratio, PLR and MPV have been used as biomarkers in research determining the prognosis for patients in a variety of clinical situations.^{8,24} In our study, NLR was significantly higher among those with prostate stones.

CONCLUSION

Increased age may be a risk factor for prostate stone formation. The elevation of NLR among the males with prostate stones shows that the inflammatory process is a factor in the pathophysiology of prostate stone formation.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

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