Brawijaya Journal of Urology
July 2024, Volume 5, Issue 1
p-ISSN: 2721-4982 **e-ISSN**: 2722-4546
DOI: https://doi.org/10.11594/bjurology.2024.005.01.1

The Association Between Urinary Tract Stones and The Incidence of Urinary Tract Infections

Taufiq Nur Budaya[1]*, Mohammad Saifur Rohman[2], Ardhino Ardhino[3], Fauzan Kurniawan Dhani[1]

[1]*Department of Urology, Faculty of Medicine, Universitas Brawijaya, Saiful Anwar General Hospital, Malang, Jawa Timur, Indonesia, 65111*
[2]*Department of Cardiology, Faculty of Medicine, Universitas Brawijaya, Saiful Anwar General Hospital, Malang, Jawa Timur, Indonesia, 65111*
[3]*Faculty of Medicine, Universitas Brawijaya, Malang, Jawa Timur, Indonesia, 65145*

***Corresponding Author**
Taufiq Nur Budaya
Department of Urology, Faculty of Medicine, Universitas Brawijaya, Saiful Anwar General Hospital, Malang, Jawa Timur, Indonesia, 65111
Email: taufiq_uro.fk@ub.ac.id

Introduction. This research was conducted to investigate the association between urinary tract stones and the occurrence of urinary tract infections in patients receiving treatment at Saiful Anwar General Hospital in Malang.
Methods. This research constitutes an analytical observational study employing a case-control research design conducted at Saiful Anwar General Hospital in Malang from 2015 to 2020.
Results. This study comprised a sample size of 104 patients. In the group of patients with urinary tract stones, the highest occurrence was among men (77.3%), particularly those aged between 30-60 years (59.1%). In the group of patients with UTIs, males had the highest prevalence (67.3%), with a significant portion at the age of 50 (55.8%). The Chi-Square analysis investigating the association between urinary tract stones and the presence of urinary tract infections resulted in a p-value of 0.008, accompanied by an Odd Ratio of 4.566.
Conclusions. A notable association has been identified between urinary tract stones and the presence of urinary tract infections.

Keywords: risk factor, urinary tract infection, urinary tract stone

Introduction

Approximately 150 million individuals worldwide suffer from urinary tract infections (UTIs), making them one of the most common bacterial infections [1] Currently, reported cases of UTI amount to 8.3 million per year, with a higher prevalence observed in women compared to men [2] Bacterial infections can be exacerbated by urinary stasis resulting from the presence of urinary tract stones [3]

Urinary tract stones are crystalline deposits that become lodged within the urinary tract and can appear in the kidney, ureter, bladder, and urethra [4] Importantly, urinary tract stone conditions are most frequently seen in urology clinics in Indonesia compared to other urological conditions [5] Data from the Indonesian Basic Health Research in 2013 revealed a 0.6% prevalence of urinary tract stone patients in Indonesia, with a specific prevalence rate of 0.7% in East Java alone [6] It's worth noting that urinary tract stones are more common in men than in women, with the majority of cases occurring in the 30-60 age group [7] The aim of this study was to investigate the association between urinary tract stones and the occurrence of urinary tract infections in patients at Saiful Anwar General Hospital in Malang.

Materials and Methods

This study represents an observational analytical investigation utilizing a case-control research methodology. Its primary objective is to ascertain a potential link between urinary tract stones and the occurrence of UTIs among patients treated at Saiful Anwar General Hospital in Malang from 2015 to 2020. Patients included in this study meet the inclusion criteria of having both urinary tract stones and a documented UTIs as per the records at Saiful Anwar General Hospital during the specified period from 2015 to 2020. Exclusion criteria apply to cases with insufficient patient data.

Data analysis involved the use of the Chi-Square test with SPSS version 25. Statistical significance was considered if the p-value was less than 0.05. In cases where the data did not meet the prerequisites for a Chi-Square test, data analysis was carried out

using the Fisher Exact test within the same software, and significance was determined if the p-value < 0.05. This study already received ethical clearance from Health Research Ethics Committee Faculty of Medicine Universitas Brawijaya (161/EC/KEPK-S1-PD/06/2021).

Results

The total sample size for this study includes 104 sets of patient medical records, with an equal 1:1 ratio for both case and control groups. The case group comprises 52 patients with urinary tract infections, while the control group consists of 52 patients without urinary tract infections. Data collection involved the extraction of patients' medical records from the period between 2015 until 2020.

Table 1. Characteristic study

Characteristic	n	%
Age		
≥50	55	52,9
<50	49	47,1
Sex		
Male	75	72,1
Female	49	47,1
Education		
No School	21	20,2
Elementary School	34	32,7
Junior High School	17	16,3
Senior High School	27	26,0
Undergraduate	5	4,8
Urinary Tract Stone Disease		
Yes	22	21,2
No	82	78,8
Urinary Tract Stone Disease by Sex		
Male	17	77,3
Female	5	22,7
Urinary Tract Infection		
Yes	52	50,0
No	52	50,0
Urinary Tract Infection by Sex		
Male	35	67,3
Female	17	32,7

Table 1 presents the general characteristics of the patients, with the following observations: 72.1% of the patients are male, 52.9% are in the age group of 50 years or older, and 32.7% have an educational background of up to primary school. The data indicates that out of the total sample, 22 patients (21.2%) had urinary tract stones, while 82 patients (78.8%) did not have urinary tract stones. Moreover, among the patients, 52 (50%) experienced urinary tract infections, and 52 (50%) did not have urinary tract infections. Further analysis reveals that out of the 22 patients with urinary tract stones, 77.3% were male, and 22.7% were female, indicating a higher prevalence of urinary tract stones among males. Similarly, among the 52 patients with urinary tract infections, 67.3% were male, and 32.7% were female, suggesting a higher prevalence of urinary tract infections among male patients.

Based on the analysis using the Chi-Square test (Table 2), the p-value obtained is 0.008, which is less than 0.05. This indicates a statistically significant association between urinary tract stones and the occurrence of urinary tract infections in patients. The odds ratio (OR) calculated is 4.566 with a 95% confidence interval (CI) ranging from 1.537 to 13.565. In practical terms, this means that patients with urinary tract stones are 4.6 times more likely to experience urinary tract infections compared to patients without urinary tract stones.

Table 2. Chi square test

Urinary Tract Stone	Urinary Tract Infection				OR 95% CI	p
	Yes		No			
	n	%	n	%		
Yes	17	32,7	5	9,6		
No	35	67,3	47	90,4	4,6 (1,5-13,5)	0,008
Total	52	100	52	100		

Discussion

Urinary tract stones occurred in 22 patients with the following gender distribution: 17 males (77.3%) and 5 females (22.7%). This suggests that the most common gender among patients with urinary tract stones is male. This finding aligns with research conducted by Anhar & Widianto [8] at Muslimat Ponorogo Hospital, where out of 120 patients with urinary tract stones, the prevalence of males was higher than females, with percentages of 77% and 23%, respectively. Similar results were reported by Silalahi [9] at Urology Policlinic dr. Esnawan

Antariksa Air Force Hospital, where males had a higher prevalence of 90.6% for urinary tract stones.

The formation of urinary tract stones is influenced by the dominant presence of testosterone in males, whereas estrogen, which is more dominant in females, inhibits crystallization by regulating the formation of 1,25-dihydroxy-vitamin D. Additionally, the longer and narrower anatomy of the male urinary tract increases the risk factors for conditions such as urinary tract stones, benign prostatic hyperplasia, and urethral obstruction [7].

Regarding age distribution among patients with urinary tract stones, the data shows that out of the 22 patients, they can be divided into three age groups as follows: 3 individuals (13.6%) were under 30 years old, 13 individuals (59.1%) were between 30-60 years old, and 6 individuals (27.3%) were 60 years or older. This indicates that the most common age group among patients with urinary tract stones is 30-60 years old. Research by Ruckle et al. [10] revealed a similar pattern, with the highest prevalence in the 40-60 age group at 50%, while those under 40 years old accounted for 10% and those over 60 years old were 40%. Simanullang's study also showed the highest prevalence in the 30-50 age group, with 171 patients (54.1%), while the age groups under 30 and over 50 had 30 patients (9.5%) and 115 patients (36.4%), respectively [11].

Based on the data from the entire sample, urinary tract infections occurred in 52 patients with a gender distribution of 35 males (67.3%) and 17 females (32.7%). This indicates that the most common gender among patients with urinary tract infections is male. However, this finding contradicts the research conducted by Herlina at RSUD Bekasi City, which showed that urinary tract infections are more commonly experienced by women, with a prevalence of 65.6%, while men accounted for only 34.4% [12].

The Chi-Square test yielded a significant result, confirming the hypothesis and indicating a substantial association between urinary tract stones and UTIs in patients at Saiful Anwar General Hospital in Malang during the period from 2015 until 2020. The odds ratio (OR) calculated was 4.566, with a 95% confidence interval (CI) ranging from 1.537 to 13.565. This suggests that patients with urinary tract stones are 4.6 times more likely to experience urinary tract infections compared to those without urinary tract stones. These findings are consistent with the outcomes of other research, such as Yongzhi et al. [13] who also established a significant link between UTS and UTI. Similarly, Hsiao CY [14]. found that urolithiasis is associated with the occurrence of urinary tract infections.

Urinary tract stone and UTI are interrelated. UTI commonly occurs in patients with urinary tract stone because it can create conditions of urinary stasis and urinary incontinence, making it more conducive for bacteria to proliferate. Urease-producing bacteria can also be involved in the formation of infectious stones composed of monoammonium urate, struvite, and/or carbonate apatite (staghorn stones) [14].

Conclusion

A notable association has been identified between urinary tract stones and the presence of urinary tract infections.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgement

The authors acknowledge the Department of Urology, Faculty of Medicine Universitas Brawijaya, Saiful Anwar General Hospital who made this publication possible.

References

[1] Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nat Rev Microbiol. 2015;13(5):269-284. doi:10.1038/nrmicro3432

[2] Zeng Z, Zhan J, Zhang K, Chen H, Cheng S. Global, regional, and national burden of urinary tract infections from 1990 to 2019: an analysis of the global burden of disease study 2019. World J Urol. 2022;40(3):755-763. doi:10.1007/s00345-021-03913-0

[3] Heyns CF. Urinary tract infection associated with conditions causing urinary tract obstruction and stasis, excluding urolithiasis and neuropathic bladder. World J Urol. 2012;30(1):77-83. doi:10.1007/s00345-011-0725-9

[4] Ma Q, Fang L, Su R, Ma L, Xie G, Cheng Y. Uric acid stones, clinical manifestations and therapeutic considerations. Postgrad Med J. 2018;94(1114):458-462. doi:10.1136/postgradmedj-2017-135332

[5] Sarwono S, Setiani O, Nurjazuli N. Risk Factor of Urolithiasis in Redisari Village, Rowokele

Sub Ditrict, Kebumen District. HIGIENE: Jurnal Kesehatan Lingkungan. 2017;3(1), 57-61.

[6] Noviandrini E, Birowo P, Rasyid N. Urinary stone characteristics of patients treated with extracorporeal shock wave lithotripsy in Cipto Mangunkusumo Hospital Jakarta, 2008-2014: A gender analysis. Medical Journal of Indonesia. 2015;24(4):234-238. doi: 10.13181/mji.v24i4.1258

[7] Liu Y, Chen Y, Liao B, et al. Epidemiology of urolithiasis in Asia. Asian J Urol. 2018;5(4):205-214. doi:10.1016/j.ajur.2018.08.007

[8] Huda NH, Agung W. Index Massa Tubuh Sebagai Faktor Resiko Terjadinya Batu Saluran Kemih Di RS Muslimat Ponorogo Dalam Kurun Waktu Januari 2007—Desember 2010. Jurnal Kedokteran Dan Kesehatan Indonesia. 2014;6(2), 75–84. doi:10.20885/JKKI.Vol6.Iss2.Art4

[9] Silalahi MK. Faktor-Faktor yang Berhubungan Dengan Kejadian Penyakit Batu Saluran Kemih Pada di Poli Urologi RSAU dr. Esnawan Antariksa. Jurnal Ilmiah Kesehatan. 2020;12(2). https:// doi:10.37012/jik.v12i2.385

[10] Ruckle AF, Maulana A, Ghinowara, T. Faktor Resiko Infeksi Saluran Kemih Pada Pasien Dengan Batu Saluran Kemih. Biomedika. 2020;12(2), 124-130.

[11] Simanullang P. Karakteristik Pasien Batu Saluran Kemih di Rumah Sakit Martha Friska Pulo Brayan Medan Tahun 2015 s/d 2017. Jurnal Darma Agung. 2019;27(1), 807-813. doi:10.46930/ojsuda.v27i1.136

[12] Herlina S, Mehita AK. Faktor Yang Mempengaruhi Terjadinya Infeksi Saluran Kemih Pada Pasien Dewasa Di RSUD Kota Bekasi. Jurnal Keperawatan Widya Gantari Indonesia. 2015;2(2). doi:10.52020/jkwgi.v2i2.861

[13] Yongzhi L, Shi Y, Jia L, Yili L, Xingwang Z, Xue G. Risk factors for urinary tract infection in patients with urolithiasis-primary report of a single center cohort. BMC Urol. 2018;18(1):45. Published 2018 May 21. doi:10.1186/s12894-018-0359-y

[14] Hsiao CY, Chen TH, Lee YC, et al. Urolithiasis Is a Risk Factor for Uroseptic Shock and Acute Kidney Injury in Patients With Urinary Tract Infection. Front Med (Lausanne). 2019;6:288. Published 2019 Dec 5. doi:10.3389/fmed.2019.00288