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Urinary Stone and its Associated Factors in Northern Ethiopia

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Abstract

Background: Urinary stone is the presence of one or more stony concretes located at any level of a segment of the urinary tract. It is a worldwide problem that can affect all groups of ages and the prevalence has been increasing over time. Urolithiasis affects about 12% of the world population at some stage in their lifetime. Therefore, this study aimed to assess the prevalence and associated factors of urinary stone among adult patients attending in Tigray hospitals, Ethiopia.

Methods: A cross-sectional study was conducted among selected 562 adult patients who were attending at surgical outpatient departments of five selected public hospitals in Tigray region. Data were collected using face to face interviewing questionnaires and from medical chart review. Binary logistic regression model analyses were performed and analyzed using SPSS version 23.

Result: The prevalence of urinary stone was found 14.8%. After adjustment of the independent variables, the significant factors associated with urolithiasis were being male [AOR=2.47, 95% CI: 1.41 - 4.31], passing urine frequency less than five times in a day [AOR=2.55, 95 CI: 1.36 - 4.79], having diabetes mellitus [AOR=2.52 95% CI: 1.08 - 5.92], having hypertension [AOR=2.41 95% CI: 1.10 - 5.32] and history of urinary tract infection [AOR, 1.76 95% CI: 1.02 - 3.02].

Conclusion: one out of six people have urinary stone which was considerably high. The major factors associated with urinary stone were being male, less urine passing frequency, diabetes mellitus, hypertension and history of urinary tract infection.

Keywords: Kidney Stone; Urinary Stone; Urolithiasis; Tigray

Abbreviations: ACSH: Ayder Comprehensive Specialized Hospital; AOR: Adjusted Odds RatioBMI: Body Mass Index; CI: Confidence Interval; CKD: Chronic Kidney Disease; COR: Crude Odds Ratio; OPD: Out Patient Department; SCI: Spinal Cord Injury; TASH: TikurAnbesa Specialized Hospital; UTI: Urinary Tract Infection

Introduction

Urinary stone (Urolithiasis) is the presence of one or more stony concretes located at any level of a segment of the urinary tract [1]. It is a worldwide problem that can affect all groups of ages and the prevalence has been increasing over time [2]. Urolithiasis affects about 12% of the world population at some stage in their lifetime. The overall probability that an individual will form stones varies in different parts of the world [3].

The prevalence of urolithiasis is varying by age, sex and climatic conditions and appears to have increased in the last quarter of the 20th century [4]. The frequency of urolithiasis will rise even more by 7–10% in the next decades related to global warming, since stone disease is encountered more frequently in hot regions. In Asia and Africa, there is recognized stone belt which covers the area of Egypt, the Middle East, and Asia. In these regions, the prevalence of stone disease is high ranging from 10% to 15%. There is a widening of this stone belt toward countries of Sub-Saharan Africa. These may be due to raped economic growth, urbanization and changing the habit of diet in to western diet [5].

Twenty five percent of patients with urolithiasis have different health complications. The potential health complications of urinary stones include renal colic, urinary tract infection, obstruction of urine system, recurrent stone, renal failure and even death [6].Urine stone has a recurrence rate of up to 50% at 5 years and 80-100% in 20 years [7].

Today, urolithiasis is an economic challenge for all healthcare systems because the prevalence is rise significantly over the last few decades[8]. Urine stone does not affects the patient only, but also the national economy as the disease is prevalent in the productive age group [7]. The estimated patients with urolithiasis is greater than 1.3 million people in the labor force between ages 18 and 64 with total direct costs of urine stones is about ~$4.5 billion [9].

Some global studies were recommended that there is a need for more studies regarding stone magnitude in Africa because there are a limited number of literatures on urolithiasis [10]. Even though the problem exists in our country Ethiopia still there is no study done. Urinary stone is become a prevalent n sub-Saharan region but no studies have been done in Ethiopia. Thus, this study was aimed to assess prevalence and its associated factors of urolithiasis in Tigray region hospitals, Ethiopia 2019.

Methodology

Study Setting and Study Design: Hospital based cross-sectional study design was conducted in public hospitals of Tigray region from April 1st to May 1st 2019.

Eligibility Criteria

Inclusive Criteria: All adult (age greater than or equal to 18 years old) patients who were attending surgical OPD of the selected public hospitals in Tigray region were included in the study.

Exclusive Criteria: Pregnant women were excluded from the study.

Sample Size Determination: The required sample size was determined by using single population proportion formula. By considering 95% confidence Interval, prevalence 22.3% according to the study conducted in TASH, Addis Ababa [11] and 5% margin of error. Finally, the estimated sample size was 267 plus 5 % non-response rate that is 281 by considering design effect of 2 the total sample size was 562.

Sampling Technique and Procedure: First five hospitals were selected using simple random sampling technique from the eligible 16 public hospitals. The study participants were selected using systematic random sampling method from the patients who were at-

tending surgical OPD during data collection period.

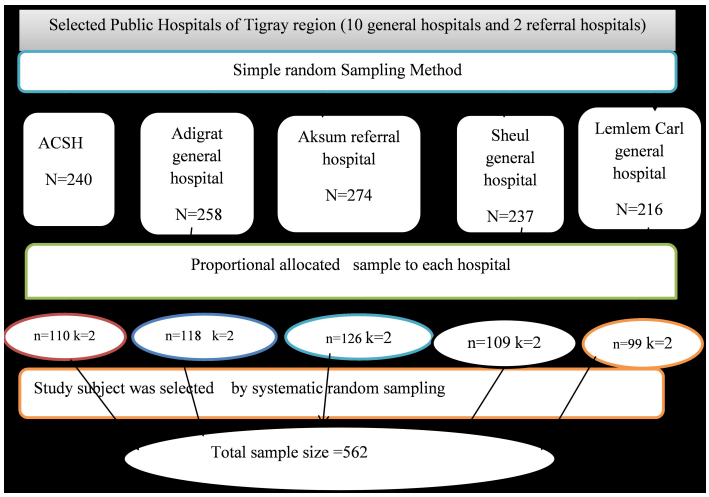

Figure 1: Schematic presentation of the sampling procedure for a study on urinary stone and associated factors in northern Ethiopia 2019

Data Collection Instrument and Techniques: Ten BSc nurses as data collectors and five senior BSc nurses as supervisors were recruited. Primary data were collected by face to face interview and secondary data by reviewing of patient medical card. Weight and height was measured with participants standing without shoes and wearing light clothing and then BMI was calculated as body weight (kg)/height (m^2) and BMI was determined and classified based on WHO BMI classification. The BMI Classification for this study was as follow: BMI < 18.5 kg/ m^2, BMI ≥18.5 to 24.9 kg/ m^2, BMI ≥ to 25 to 29.9 kg/ $m^2$and BMI ≥ to 30 kg/m^2 was considered as underweight, normal weight, overweight and obesity respectively.

Study Variables

Dependent Variable

Urinary stone (Yes/No)

Independent Variables

Socio-Demographic Characteristics: sex, age, occupation, residence, level of education, and source of water and weather condition

Behavioral and Dietary Factors: milk and milk product, red meat, tea and coffee intake, amount of daily water intake, dietary salt intake, cigarette smoking, urine passing frequency and alcohol intake

Health Related Factors: BMI status, diabetes mellitus, hypertension, gout, UTI, history of urolithiasis, urinary obstruction, spinal cord injury, and family history of urolithiasis

Operational Definition: Urolithiasis: For this study we consider patient having urolithiasis if the physician was diagnosed as the patient having urolithiasis and documented in the patient's medical chart.

Data Quality Assurance: Data quality was ensured by providing training to data collectors and supervisors. The data collection tools were first developed in English then translated in to Tigrigna language, finally translated back in to English. Training was given to data collectors and supervisors on the objective of the study, method of data collection, the way of data quality control methods, definition of terms and how to check the completeness and consistency of each questionnaire

Pre-test was done on five percent of the total sample size at Mekelle general hospital one week prior to the actual data collection period. Based on the result of the pretest necessary corrections were done on the questionnaire and chart review checklist. During data collection period adequate supervision were undertaken by supervisors. Spot checking for the filled data collection tools were done on daily basis by the data collectors and supervisors. Digital scale for weight measurement was checked and made it at zero level before each measurement

Data Processing and Analysis: Data were coded, and entered by Epi data manager version 4.4.3.1 and then exported to SPSS version 21 for analysis. A descriptive statistics was computed and the results was summarized and presented by texts, tables, frequency, percentages and charts. Binary logistic regression model was used to test the association between dependent and independent variables. All variables with P value <0.25 in the bivariate regression analyses were included in the multivariable analysis. Degree of association was interpreted by using adjusted odds ratio with 95% confidence intervals and significance level was declared at P-value <0.05.

Results

Socio-Demographic Characteristics: A total of 562 participants were included in this study with response rate of 100%. The mean and standard devotion age of respondents was 40 ± 26 years. Fifty eight (19.1%) of males respondents, 54 (17.4%) of urban dwellers respondents, and 22 (22%) of living in low land area respondents had urinary stone (Table1).

Table 1: Socio demographic characteristics of patients attending surgical OPD in Tigray region hospitals, Ethiopia, 2019 (N=562)

Characteristics		Urinary stone			
		No (n=479)		**Yes (n=83)**	
		Number (n)	Percentage (%)	Number (n)	Percentage(%)
Sex	Female Male	234245	90.380.9	2558	9.719.1
Age	18-24 years 25-34 years 35-44 years 45-54 years 55-64 years 65-90 years	6111599727062	87.182.181.184.790.991.2	925231376	12.917.918.915.39.18.8
Education	No formal educationPrimary school (1-8)Secondary school (9-12)College or university	2087487110	90.079.683.782.1	23191724	10.020.416.317.9
Occupation	FarmerGovernment employeePrivate employeeMerchantNon employedStudentOther*	197752678314923	86.885.276.584.881.690.779.3	3013814756	13.214.823.515.218.49.320.7
Residence	Urban Rural	257222	82.688.4	54 29	17.411.6
Source of water	River waterGround waterPipe (tape)waterHigh land(bottled)	604335224	83.384.386.377.4	128567	16.715.713.722.6
Environmental Weather	High land Low land	40178	86.878.0	6122	13.222.0

Other*=pensioner, house wife and daily labors

Health Related Factors: Based on the assessment of health related factors 12 (37.5%) of respondents who had DM, 13 (29.5%) of respondents who had hypertension and 10 (30.3%) of respondents with history of urolithiasis had urinary **stone (Table 2).**

Table 2: Health related factors among adult patients attending surgical OPD in Tigray region hospitals, Ethiopia, 2019 (N=562)

Variables		urinary stone			
		No		**Yes**	
		Number(n)	Percentage (%)	Number(n)	Percentage (%)
BMI category	UnderweightNormal weightOverweight	3840932	82.685.782.1	8687	17.414.317.9
Diabetes mellitus	No Yes	45920	86.662.5	7112	13.437.5
Hypertension	NoYes	44831	86.570.5	7013	13.529.5
Gout	NoYes	45425	85.286.2	794	14.813.8
Spinal cord injury	NoYes	41564	84.987.7	749	15.112.3
UTI	NoYes	370109	87.578.4	5330	12.521.6
Urinary obstructive disease	NoYes	42554	84.790.0	776	15.310.0
Family history of urolithiasis	NoYes	45029	86.272.5	7211	13.827.5
Pervious history of urolithiasis	NoYes	45623	86.269.7	7310	13.830.3
Others*	No	453	85.0	80	15.0
	Yes	26	89.7	3	10.3

Others*= Appendicitis, Bowel obstruction, Choleltihiasis, CKD, Goiter, Hernia and Hydronephrosis and Hyperparathyroidism

Behavioral and Dietary Factors: Twenty seven (15%) of participants who drank water less than five glass of water per a day had urolithiasis. Besides, 68 (12.8%) of participants who passed urine < five times a day had urolithiasis and 16 (21%) of respondents who took high dietary salt had urinary stone (Table 3).

Table 3: Behavioral and dietary factors among adult patients attending surgical OPD in Tigray region hospitals, Ethiopia, 2019 (N=562)

Variable		**Urinary stone**			
		No		**Yes**	
		Number (n)	Percentage (%)	Number (n)	Percentage (%)
Milk and milk products	No Yes	151328	87.384.3	2261	12.715.7

Frequency of milk and milk product (n=389)	≥once a day2-6 times per weekonce a week< once a week	537495106	79.182.288.085.5	14161318	20.917.812.014.5
Red meat	No Yes	95384	91.383.8	974	8.716.2
Frequency of red meat intake (n=458)	≥ Once a day2-6 times per weekOnce a week2-4 times per month7 glass of water	113	86.2	18	13.8
High dietary salt intake	No	419	86.2	67	13.8
	Yes	60	80.3	16	19.7

Prevalence of Urinary Stone: The overall prevalence of urinary stone among in public hospitals of was 83 (14.8%) [95% CI: 11.9%, 17.8%].

Factors Associated With Urinary Stone

Male respondents were found 2.5 [AOR=2.47, 95% CI: 1.41 - 4.31] times more likely to have urolithiasis compared to their female counterparts. The odds of having urolithiasis was 2.6 [AOR=2.55, 95% CI: 1.36 - 4.79] times more among respondents who had passed urine < five times in a day compared to their counterpart. The odds of having urolithiasis was 2.5 [AOR=2.52 95% CI: 1.08 - 5.92] times higher among respondents who have diabetes mellitus than participants without diabetes mellitus. Respondents who had hypertension were 2.4 [AOR=2.41 95% CI: 1.10 - 5.32] times more likely to develop urolithiasis than normotensive once. Also, the odds of having urolithiasis was 1.8 [AOR, 1.76 95% CI: 1.02 - 3.02] times more among UTI patients compare to those who did not have UTI (Table 4).

Table 4: Logistic regression analysis of associated factors with urinary stone among adult patients attending surgical OPD in Tigray region hospitals, Ethiopia, 2019

Table4

Urine passing frequency					
≥5 times per day	161	15	1.00	1.00	
<5 times per day	318	68	2.30 [1.27 - 4.14]	**2.55 [1.36 - 4.79]**	**0.004****
High dietary salt intake					
No	419	67	1.00	1.00	
Yes	60	16	1.67 [0.91 - 3.07]	1.29 [0.62 - 2.63]	0.529
Diabetes mellitus					

No	459	71	1.00	1.00	
Yes	20	12	3.88 [1.82 - 8.28]	**2.53 [1.08 - 5.92]**	**0.033***
Hypertension					
No	448	70	1.00	1.00	
Yes	31	13	2.42 [1.34 - 5.38]	**2.41 [1.10 - 5.32]**	**0.029***
Urinary tract infection					
No	370	53	1.00	1.00	
Yes	109	30	1.92 [1.17 - 3.16]	**1.76 [1.02, 3.02]**	**0.042***
Family history of urolithiasis					
No	450	72	1.00	1.00	
Yes	29	11	2.37 [1.13 - 4.95]	1.75 [0.76 - 4.03]	0.191
History of urolithiasis					
No	456	73	1.00	1.00	
Yes	23	10	2.72 [1.24 - 5.94]	1.66 [0.67 - 4.12]	0.278

NB *= P<0.05, ** = P < 0.01, 1.00 = reference

Discussion

In this study, the prevalence of urinary stone was 14.8% [95% CI: 11.9-17.8%]. This result is in line with studies done in Bahrain (14.4%), Greece (15%) and Mekelle general hospital (13.7%) [12–14]. However, this study finding is higher than the studies conducted in Chad (5.7%) and USA (8.8%) [15,16]. This difference might be due to difference in study period (season of the study and time gap between the studies. This is supported by previous study estimated that the prevalence of urolithiasis will rise by 7–10% for the next decades [5]. The magnitude of urolithiasis with in the Afro-Asian stone belt is from 10 to 15% [17] and the study area of this study is within the stone belt region.

This finding is lower than the studies done in TASH (Addis Ababa) (22.3%), Kenya (19.67%), Saudi Arabia (22.4%) and India (22.4%) [11,18–21]. This discrepancy might be due to the variation in the magnitude of the risk factors, urbanization and use of sophisticated diagnostic materials. The study done in Saudi Arabia and India was community based (which allows identifying asymptomatic urolithiasis patients). Geographical variation in stone disease typically reflects environmental risk factors, with higher stone prevalence in hot or arid climates (2).

In this study, being male was significantly associated with urolithiasis. This is similar with the study done in USA, and China [15, 22-23]. Early epidemiological studies also supported that stone disease in men is 2.2 to 3.4 times more than women [24]. This could be due to men are more likely to engage in heavy physical labor, to sweat more, and more often be dehydrated than women.

In this study, urine passing frequency < five times per a day was significantly associated with urolithiasis. This result is similar with the study done in India [25]. This association could be because of less urine passing frequency can result in urine stasis (super saturation of urine), retention of urine electrolytes (like sodium and calcium) which induces crystallization and formation of urine stones.

In this study, having diabetes mellitus was significantly associated with urolithiasis. This finding is supported by the studies done in USA, China, India and Taiwan [15,23,26-27]. This could be due to the high blood sugar in patients having diabetes mellitus can causes acidic urine, dehydration and super saturation of urine which increases risk for development of urine stones especially uric

acid stone.

Hypertension was significantly associated with urolithiasis in this study. This result is similar with the studies done in Korea, USA and Taiwan [26–28]. This association could be due to the reduction of sodium and calcium reabsorption in the proximal tubule and thick ascending loop which results in hypercalciuria and renal stone (calcium stones).

In this study history of UTI was significantly associated with urolithiasis. This finding is supported by the studies done in India and Pakistan [18,29]. Bacteria have long been recognized to contribute for the development of struvite urinary stones. Underlying mechanisms for this association indicate that bacteria aggregate selectively to crystals, increased clumping of crystals, and then they stimulate incorporation of proteins into the stone matrix.

Limitation of the Study

There might be a recall bias in the food and fluid frequency questions because self-reported measures depend largely on individuals' memory. Recommendation For researchers it is better to study in the community at all to identify asymptomatic urolithiasis case using screening material.

Declarations

Ethics Approval and Consent from The Participant

Ethical clearance was obtained from Mekelle University Colleges of Health science health research ethics review committee (ERC1278/2019). Official supportive letter was obtained from Tigray Regional Health bureau (570/1418/11) to the selected hospitals. Then permission was secured from administrative bodies of selected hospitals to communicate with relevant bodies at the hospital. Written informed consent was secured before data collection from all study participants. All of the study participants were informed about the purpose of the study, their right to participate or to terminate at any time if they want and respondents were ensured about the confidentiality of information they provide. Beneficence of the participants was maintained throughout the study.

Competing Interests

The authors declare that they have no competing interests.

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Consent for Publication

Not applicable

Availability of Data and Materials

The datasets used and/or analyzed during the current study are presented within the manuscript and available from the corresponding author on reasonable request.

Author's Contributions

AH was made substantial contributions to the conception, design of the work, methodology, analysis, data interpretation and wrote the final manuscript. KK, GM, KZ, and GM, had equally contributed to analysis and interpretation of the data. WA has made substantial contribution in reviewing overall the study in analysis, interpretation of data, has drafted the manuscript and substantively revised the work. All authors read and approved the final manuscript.

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References

1. Türk T KnollA Petrik, K Sarica, A Skolarikos, M Straub CS (2016) EAU Guidelines on Urolithiasis. European Association of Urology, 487.

2. Saeed R Khan, Margaret S Pearle WG et al. (2017) Kidney stones. PMC. 2: 1891–782.

3. Romero V, Akpinar H, Assimos DG (2010) Kidney Stones : A Global Picture of Prevalence, Incidence, and Associated Risk Factors Kidney Stones : A Global Perspective, 12: 86–96.

4. Knoll T, Schubert AB, Fahlenkamp D, Leusmann DB (2011) Urolithiasis Through the Ages : Data on More Than 200 , 000 Urinary Stone Analyses. J Urol [Internet], 185: 1304–11.

5. Brikowski TH, Lotan Y, Pearle MS (2008) Climate-related increase in the prevalence of urolithiasis in the United States. PNAS. 105: 9841–6.

6. Keddis MT, Rule AD (2014) Nephrolithiasis and loss of kidney function Mira. Curr Opin Nephrol Hypertens PMC, 22: 390–6.

7. Gupta NP (2003) Impact of Socioeconomic Status in Etiology and Management of Urinary Stone Disease. Urol Int, 70: 255–61.

8. Ali Asghar Ketabchi GAA (2008) Prevalence of Symptomatic Urinary Calculi in Kerman, Iran. Urol J, 5: 156–60.

9. Hyams ES, Matlaga BR (2014) Economic impact of urinary stones. Transl Androl Urol, 3: 278–83.

10. Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A (2007) Epidemiology of stone disease across the world. World J Urol, 10: 345.

11. Andualem D GG (2014) Admission Patterns and Management of Urolithiasis: A Hospital Based Study in Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia. D. East centeral Africa J Surg, 19.

12. Stamatiou KN, Karanasious VI , Kavouras RE, Papadimitrio VT, Cholpaioa C, Lebren FA SF (2006) Prevalence of urolithiasis in rural Thebe, Greece. Int Electron J Rural Heal Res Educ Pract policy, 6: 1445–6354.

13. Elshehry A, Saad MM (2016) Urolithiasis Visits and Trends. Bahrain Med Bull. 38: 211–3.

14. Hagos Alemu M (2008) Pattern of urinary tract stone diseases in Mekelle, Ethiopia. Vol. 46, Ethiopian medical journal, 237-41.

15. Scales CD, Smith AC, Hanley JM, Saigal CS (2012) Prevalence of Kidney Stones in the United States. Eur Urol, 62: 160–5.

16. Rimtebaye K, Sillong FD, Zarif A, Tashkand A (2015) Urolithiasis : Diagnostic and Therapeutic Aspects in Urology Department of N ' Djamena in Chad. Open J Urol, 5: 199–206.

17. Fisang C, Anding R, Müller SC, Latz S, Laube N (2015) Urolithiasis — an Interdisciplinary Diagnostic , Therapeutic and Secondary Preventive Challenge. Dtsch Arztebl Int. 112: 83–91.

18. Marak A, Shantibala K, Singh TA, Singh RKN, Singh LS (2013) Urolithiasis : prevalence and related factors in rural area of Manipur. Int J Med Sci Public Heal. 2: 3–6.

19. Sahlu Wondimu, Solomon Bekele, Dawit G Giorgis, Feron Getachew NS (2018) Pattern of surgical admissions to Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A five-year retrospective study. J Surg, 23: 66–70.

20. Ngugi PM, Magoha GAO, Kiptoon D (2010) urolithiasis in Nirobi, Kenya. East Afr Med J. 87: 395–9.

21. Ahmad F, Nada MO, Farid A Bin, Haleem MA, Razack (2015) SMA of Kidney Diseases and Transplantation Renal Data from the Arab World Epidemiology of Urolithiasis with Emphasis on Ultrasound Detection : A Retrospective Analysis of 5371 Cases in Saudi Arabia. Saudi J Kidney Dis Transpl. 26: 386–91.

22. Jiang YG, He LH, Luo GT, Zhang XD (2017) Prevalence of kidney stones and associated risk factors in the Shunyi District of Beijing , China. Hong Kong Med J, 23: 12–5.

23. Zeng G, Mai Z, Xia S, Wang Z, Zhang K, Wang L (2017) Prevalence of kidney stones in China : an ultrasonography based cross-sectional study. BJU Int, 120: 109–16.

24. Strope et al. (2012) Changes in Gender Distribution of Urinary Stone Disease Seth. Urol PMC, 75:543–6.

25. Dongre AR, Rajalakshmi M, Deshmukh PR, Kumar R (2017) Risk Factors for Kidney Stones in Rural Puducherry : Case-Control Study. J Clin Diagnostic Res, 11: 9–13.

26. Nerli R, Jali M, Guntaka AK, Patne P, Patil S (2016) Type 2 diabetes mellitus and renal stones. Adv Biomed Res, 14:139.

27. Chu F, Chang C, Huang P, Lin Y, Ku P, Sun J, et al. (2017) The Association of Uric Acid Calculi with Obesity , Prediabetes , Type 2 Diabetes Mellitus , and Hypertension. Biomed Res Int, 2: 6.

28. Jeong IG, Kang T, Bang JK, Park J, Kim W, Hwang SS, et al. (2011) Association Between Metabolic Syndrome and the Presence of Kidney Stones in a Screened Population. YAJKD [Internet], 58: 383–8.

29. Hizbullah Jan, Ismail Akbar, Haider Kamran JK (2008) frequency of renal stone disease in patientes with urinary tract infection. J Ayub Med Coll Abbottabad 20, 20: 60–2.