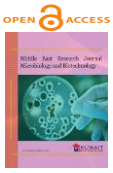

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Urinary Metabolic Profile and Stone Composition, Location and Recurrence in Kidney Stone Formers of the Salah-Aldeen Province, Iraq

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Abstract: ***Background:*** Urinary calculi are the third most common affliction of the urinary tract, exceeded only by urinary tract infection (UTI) and pathological conditions of prostate. Advances in the surgical treatment of urinary tract stones have outpaced our understanding of their etiology. ***Methodology:*** A total of 135 patients with urolithiasis were submitted to hospital-based series study and 91 of them were males. Recurrence of kidney stone, location of stone, urinalysis were carried out. Urine reagent strip test technique was also used for identification of different urine components. ***Results:*** The vast majority of the kidney stone were unilateral renal stones and the frequency was 65.92%(89/135). Urinalysis of the patients with kidney stones revealed positive findings and the most common finding were crystals which demonstrated among 66.7%, but the finding were casts with frequency of 3.7%. The reagent strip test utilized for urine testing showed that the prevalence of blood,protein, nitrate reductase, and leucocyte reductase were found in urine of patients with kidny stone and their frequency of presence was 61.5, 6.7, 39.3 and 40.7% respectively. The following urine constituents like nitrate reductase, leucocyte esterase, blood and protein were tested and their frequencies were 46.3, 55.6, 81.5 and 3.7% respectively. ***Conclusions:*** Urinary stone disease was more frequent in males than in females and the ratio was 2:1. The most common elements available in urinary stones were calcium of cations with frequency of 90.3%. Anions like phosphate, oxalate and urate were also identified and the most common was phosphate. More than half of the urolithiasis patients had one or more metabolic abnormalities like hypercalcemia and hyperuricemia.

Keywords: Urolithiasis, urinalysis, infection, stone recurrence and location.

Research Paper

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INTRODUCTION

Most urinary calculi generally are composed primarily of a poorly soluble salt with a small amount of protein, containing calcium (Ca^{+2}) as a main constituent [1,2]. The direct cause of calculi is unknown and likely to be multifactorial, but urinary physiological abnormalities can be identified in more than 60% of patients [3-5]. Hypercalciuria is the most common of these abnormalities, increases the risk of stone formation by raising saturation of stone forming salt and reducing the endogenous stone inhibitors [5-7]. The prevalence of urolithiasis is approximately 2-3% of general population [8,9]. The peak age of males is 30 years old, while in the women has bimodal age distribution with peaks at 35 and 55 years old. One kidney stone form the probability that a second stone will form within 5-7 years in approximately 50% [4,10]. Stone disease is 2-3 times more common in men than in women and it occurs more often in adults than in elderly and more often in elderly than in children. Urolithiasis occurs more frequently in hot dry areas than in temperate regions [11]. A seasonal variation is also seen with urinary calcium oxalate (CaOx) saturation in men during summer and in women during early winter [12]. Diet, climate and occupation are giving rise to excessive sweating, obstruction of urinary tract, urinary tract infection (UTI), crystalluria, inherited disorders (cystinuria, xanthinuria), diseases of general metabolism (gout, hyperparathyroidism, abnormal intestinal absorption…etc.) and idiopathic [6]. Obesity, medullary spongy kidney, associated tumors might cause urolithiasis [13,14]. A family history of kidney stone increases the risk by 3 times, insulin resistant state, history of hypertension, chronic metabolic acidosis and surgical menopause are all risk factors [15]. In postmenopausal women the occurrence of stone is

associated with history of hypertension and low dietary intake of Mg++ and Ca++[16]. Incidence of stone is higher in patients with anatomical abnormalities of urinary tract and neurological disease that may result in urinary stasis [17]. Despite these recognized risks, it has been found that patients still have low awareness of kidney disease and its potential safety risks with communication lacking with doctors, which greatly increases the risk of disease [18,19]. It was found that identifying the risk factors associated with renal stones can serve as a valuable reference for individuals, enabling them to implement preventive measures in their daily lives to reduce the incidence of this condition. It was found that adults and children with recurrent kidney stone disease should be under following up for metabolic evaluation for identification of metabolic abnormalities, and to exclude secondary and monogenic kidney stone disease, and finally recognition of systemic disease manifestations [4]. Dietary and pharmacotherapy should be considered to understand the underlying pathophysiology and disease activity. Education of patients for better health care and treatment was considered by other workers [20]. It has been found that crucial KSD knowledge gaps persist and require further investigation. Future research priorities involving development of treatment choices and formulation of randomized clinical trial evidence for better management of kidney stone disease [21].

MATERIALS AND METHODS

Patients

This study was conducted in the Urology Department wards and outpatients clinics in Tikrit teaching hospital and in Salah-Aldeen hospital of Tikrit city. A total of 135 patients with urolithiasis were submitted to hospital-based series study and 91 of them were males.

Examination of urine

Centrifugation of 10 ml of urine was done utilizing centrifuge type Centra 4 (USA) and the 9 ml supernatant was discarded and the remaining one ml with sediments was thoroughly shaked and one drop amount was applied on clean slide with cover slip. The prepared slide was examined by the microscope Lomo Micrmed 2 (Russia). Urine was examined for pus cells, erythrocytes, casts, crystals and epithelial cells. Detection of pyuria was more readily determined by finding ≥ 10 white blood cells/ml or positive leucocyte esterase. Detection of hematuria was demonstrated by presence of blood in urine. Casts were also detected by direct microscopic examination [22,23].

Urine reagent strip test

This test was used for detection of leucocyte reductase, nitrate reductase, and protein and blood in urine. These tests were carried out using reagent strip from HUMAN test (Germany) by dipping the strip in urine and compared results with standard [6,13].

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics such as means, standard deviations, and frequency distributions were computed to summarize the data [24-26].

RESULTS

Recurrence rate of the urinary calculi

The present study revealed that 22/135(16.29%) of the patients studied were with family history of kidney stone and 14 of them were males. Nine cases were demonstrated with recurrent stone formation and these were 5 males and 4 females (Table 1, Figure 1). Chi-square test revealed that there was no statistically significant association between gender and recurrence of kidney stones ($p > 0.05$). A comparable stone recurrence between males and females was concluded.

Table 1: Distribution of patients according to recurrence of kidney stone

Type	Male No. (%)	Females No. (%)	Total
Non-recurrence	9(40.9)	4(18.2)	13(59.1)
recurrence	5(22.7)	4(18.2)	9(40.1)
Total	**14(63.6)**	**8(36,4)**	**22(100)**

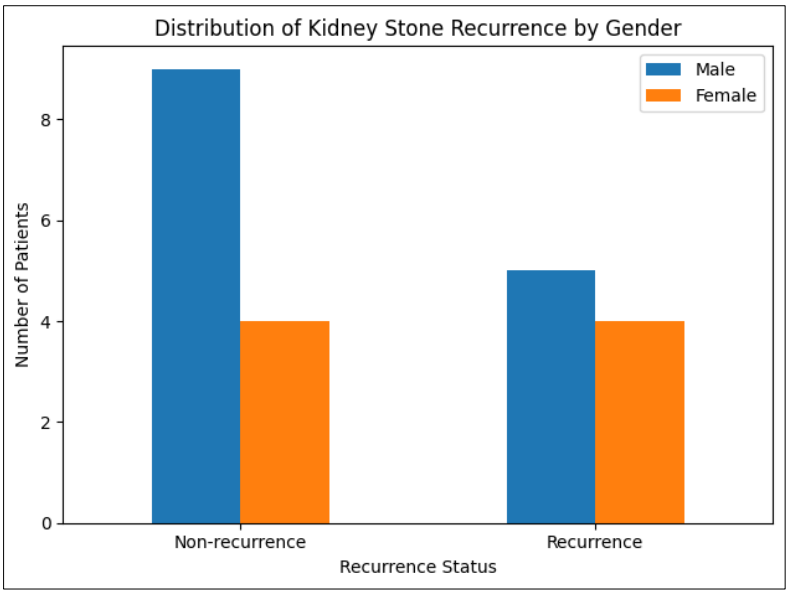

Figure 1: Distribution of Kidney stone recurrence by gender

Anatomical locations of the stone

The vast majority of the kidney stone were unilateral renal stones and the frequency was 65.92%(89/135). The bladder, ureteric, bilateral renal, renal and ureteric and urethral stones were seen with frequency of 13.3, 12.6, 4.44, 2.96 and 0.74 % respectively.

Table 2: Distribution of patients according to anatomic al location of urinary calculi

Location	Males No. (%)	Females No. (%)	Total No. (%)
Unilateral	50 (37)	39 (28.88)	89 (65.92)
Bladder	15 (11.1)	3 (2.22)	18 (13.33)
Ureteric	10 (7.4)	7 (5.18)	17 (12.59)
Bilateral	4 (3)	2 (1.48)	6 (4.44)
Renal and ureteric	2 (1.5)	2 (1.48)	4 (2.69)
Urethral	1 (0.74)	0	1(0.74)
Total	**82 (60.74)**	**53 (39.26)**	**135 (100)**

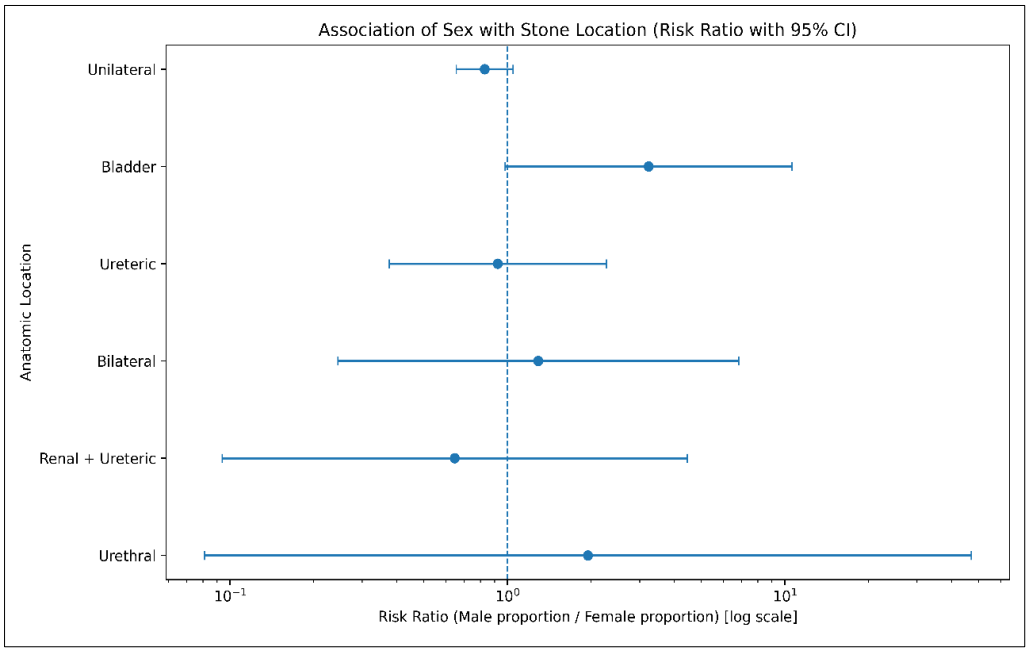

Figure 2: Association of gender with kidney stone location (Risk ratio with 95% Confidence interval (CL)

Urinalysis

Urinalysis of the patients with kidney stones revealed positive findings and the most common finding were crystals which demonstrated among 66.7%, but the finding were casts with frequency of 3.7%. Other components associated with urine collected were also seen and these were bacteriuria, erythrocytes, pus cells, epithelial cells and pyuria with frequency of 34.1, 56.3, 39.3 57.8% and 14.1% respectively (Table 3). Figure 3 explains the regression equation ($y = \beta x + \alpha$) and coefficient of determination (R^2). The coefficient value reflected a proportional variance of the frequencies of findings which explained by the linear trend.

Table 3: Distribution of kidney stones among patients according to urinalysis

Finding	Males No. (%)	Females No. (%)	Total No. (%)
Epithelial cells	45 (11.97)	33 (8.78)	78 (20.74)
Pus cells	21 (5.59)	32 (8.51)	53 (14.1)
Erythrocytes	50 (13.3)	26 (6.91)	76 (20.21)
Crystals	61 (16.22)	29 (7.71)	90 (23.93)
Casts	2 (0,53)	3 (0.80)	5 (1.33)
Pyuria	19 (5.05)	9 (2.39)	28 (7.50)
Bacteriuria	19 (5.05)	27 (7.18)	46 (12.23)
Total	**217 (57,73)**	**159 (42.28)**	**376 (100)**

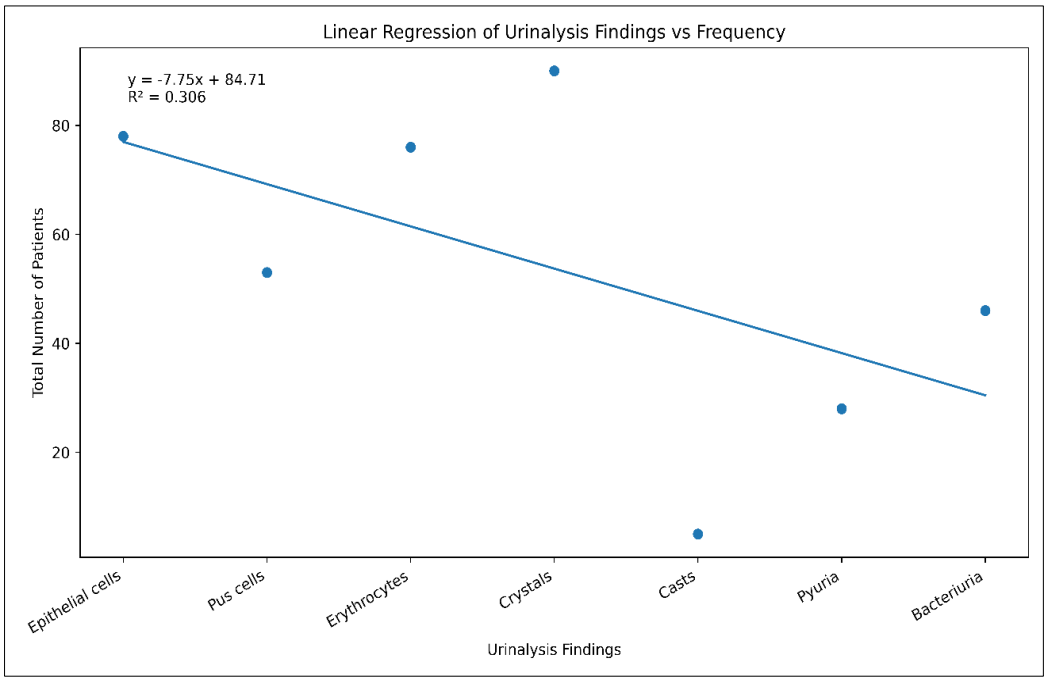

Figure 3: Linear regression of urinalysis findings with their frequencies

Enzymes, blood and protein in urine

The reagent strip test utilized for urine testing showed that the prevalence of blood,protein, nitrate reductase, and leucocyte reductase were found in urine of patients with kidny stone and their frequency of presence was 61.5, 6.7, 39.3 and 40.7% respectively(Table 4). Statistically, there was a significant difference betwwen these parameters ($P<0.01$) using Chi-square test. A simple model of linear regression (y=β0+β1xy = \beta_0 + \beta_1 xy=β0+β1x) was utilized to demonstrate the distribution trend of urine findings by strip test for kidney stone patients. Urine blood revealed the highest frequency and lied above the regression line showing a strong association with renal calculi pathology. But urine protein showed less effect as can be seen below the regression line in the Figure 4.

Table 4: Distribution of kidney stones of patients according to urine findings using strip testing

Test	Males No. (%)	Females No. (%)	Total No. (%)
Nitrate reductase	21 (15.6)	32 (23.7)	53 (39.3)
Leucocyte esterase	21 (15.6)	34 (25.1)	55 (40.7)
Urine blood	54 (40)	29 (21.4)	83 (61.5)
Urine protein	6 (4.4)	3 (2.2)	9 (6.7)
Total	**102 (51)**	**98(49)**	**200 (100)**

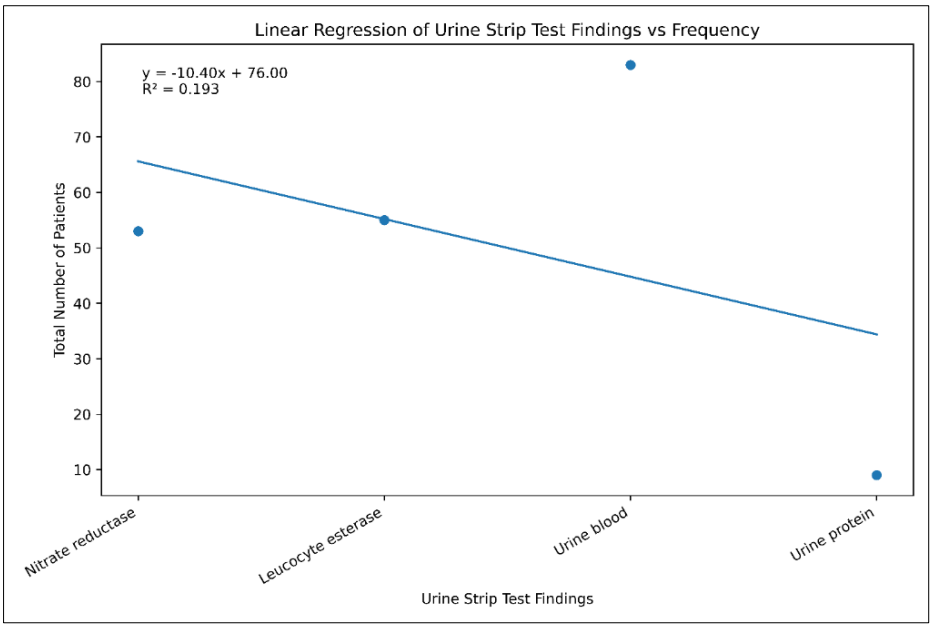

Figure 4: Linear regression of urine trip test findings and frequency

The reagent strip test findings of the urine who passed their kidney stones spontaneously or their stones have been removed were shown in Table 5. The following urine constituents like nitrate reductase, leucocyte esterase, blood and protein were tested and their frequencies were 46.3, 55.6, 81.5 and 3.7% respectively. The statistical analysis did not show any significant difference in the reagent strip test findings (P >0.05) using Chi-square test. Figure 5 reveals the linear model equation (y=β1x+β0y = \beta_1 x + \beta_0y=β1x+β0) with coefficient of determination equal to 0.75. Leucocyte esterase and nitrate reductase revealed the highest scores and lied above the regression line showing a strong association with infection stone. But urine protein showed less effect as can be seen below the regression line.

Table 5: Distribution of patients with underwent urinary lithotomy or spontaneous stone shedding showed by reagent strip test

Test	Infection stone No. (%)	Non-infection stone No. (%)	Total No. (%)
Nitrate reductase	11 (10.9)	14 (13.9)	25 (24.8)
Leucocyte esterase	13 (12.9)	17 (16.8)	30 (29.7)
Urine blood	13 (12.8)	31 (30.7)	44 (43.5)
Urine protein	2 (2.0)	0	2 (2.0)
Total	39 (38.6)	62 (61.4)	101 (100)

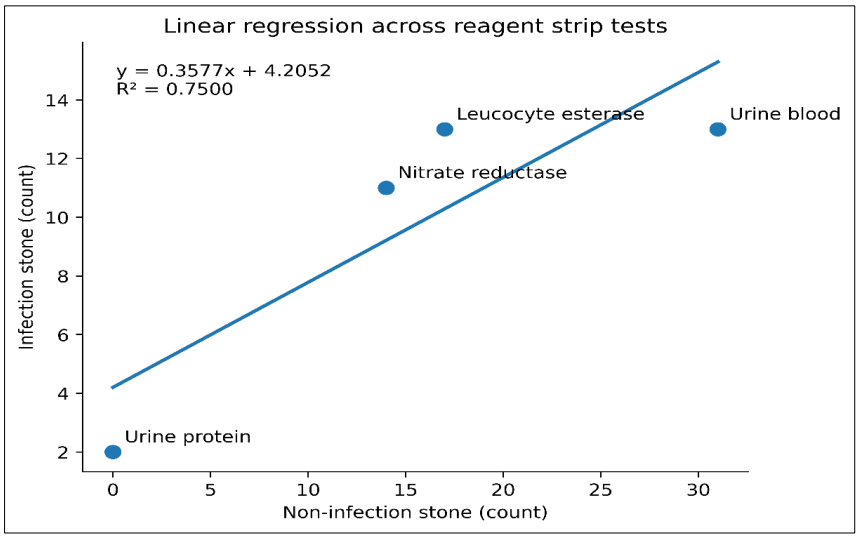

Figure 5: Linear regression across reagent strip test

DISCUSSION

The present study revealed a history of previous kidney stone was observed in 22 (16.3%) of the total number of patients and they were 14 males and 8 females with the frequency of 15.4 and 18.2% of the total males and females respectively. Chi-square test revealed that there was no statistically significant association between gender and recurrence of kidney stones ($p > 0.05$). A comparable stone recurrence between males and females was concluded. A previous review demonstrated that first-time stone formers had almost 26% recurrence rate over the following in a study of 5 years period[27]. It was recently found by a comprehensive meta-analysis that identified risk factors that increased the likelihood of a kidney stone recurrence was reported elsewhere [28]. These risk factors included diabetes, family history of kidney stone, hypertension and other related demographic factors [29]. It has been found a relationship between recurrences of kidney stone, renal tubular acidosis, hyperoxaluria, uric acid, cystine stone and struvite and chronic renal failure and permanent kidney damage [30,31,32]. Furthermore, the previous studies demonstrated that a worldwide incidence of urolithiasis elevated over the last three decades, causing a greater financial cost on global healthcare delivery systems[33,34]. The vast majority of the kidney stone were unilateral renal stones and the frequency was 65.92% (89/135). The bladder, ureteric, bilateral renal, renal and ureteric and urethral stones were seen with frequency of 13.3, 12.6, 4.44, 2.96 and 0.74 % respectively. The results presented here were almost comparable to those reported by other authors [35,36]. It was presumed that the narrow bladder neck or tendency for sphincter spasm or the longer urethra in males may contribute to the retention of small stones in the bladder that will lead to their further growth to take place [37]. The occurrence of urethral stones in females was infrequent in comparison with those in males. This might contribute to two factors which are either the short urethra or the infrequency of the bladder stones in females [38]. The present study showed that the urinalysis of the patients with kidney stones revealed positive findings and the most common finding were crystals which demonstrated among 66.7%, but the finding were casts with frequency of 3.7%. Other components associated with urine collected were also seen and these were bacteriuria, erythrocytes, pus cells, epithelial cells and pyuria with frequency of 34.1, 56.3, 39.3 57.8% and 14.1% respectively. Figure 3 explains the regression equation ($y = \beta x + \alpha$) and coefficient of determination (R^2). The coefficient value reflected a proportional variance of the frequencies of findings which explained by the linear trend. Different urine tests like 24-hour urine examination were carried out to assess the underlying chemical risk factors leading to future stone production which needs optimal prophylactic therapy to be administered and should be carefully discussed with all patients with nephrolithiasis once the acute stone episode has been properly and adequately treated. This testing was strongly recommended by many authors including the American Urological Association.[39,40]. Moreover, it was demonstrated that abnormal urinary chemistry was contributing to stone recurrence in over 93% of patients with nephrolithiasis tested by 24-hour urine and blood testing[5,38]. Urinalysis was carried out on every patient with a suspected kidney stone. It was found that hematuria was usually associated with up to 15% of kidney stone patients who did not demonstrate microscopic hematuria. On the other hand, the presence of urinary crystals is usually suggested urolithiasis. The presence of nitrites, leukocytes, and more than 104 bacteria/ ml of urine were indicating of a possible urinary infection followed by culture, antibiotic sensitivity and treatment [22]. In addition, total count of white blood cells (WBC) with differential particularly when the patient is febrile was carried out with urinalysis suggesting of a possible infection [41,42].

The automatic urine analyzer was utilized for urine assessment of protein, glucose, urobilinogen, bilirubin, ketone bodies, specific gravity, occult blood, pH, white blood cells, nitrite, creatinine, and albumin. The results showed a sensitivity of 100% and a specificity of 58.6% in determining albumin in urine, which is important for determining the stage of diabetic nephropathy [43]. The reagent strip test utilized for urine testing utilized in the present study showed that the prevalence of blood, protein, nitrate reductase, and leucocyte reductase were found in urine of patients with kidny stone and their frequency of presence was 61.5, 6.7, 39.3 and 40.7% respectively. Statistically, there was a significant difference between these parameters ($P<0.01$) using Chi-square test. A simple model of linear regression ($y=\beta0+\beta1xy = \beta_0 + \beta_1 xy=\beta0+\beta1x$) was utilized to demonstrate the distribution trend of urine findings by strip test for kidney stone patients. Urine blood revealed the highest frequency and lied above the regression line showing a strong association with renal calculi pathology. But urine protein showed less effect as can be seen below the regression line in the Figure 4. It was found that urolithiasis was demonstrated when solutes crystallize out of urine to form stones. Kidney stone may occur due to various factors like anatomic abnormality leading to urinary stasis, low urine volume, dietary factors with high oxalate or high sodium, urinary tract infections, systemic acidosis, medications and due to inheritable genetic reasons such as cystinuria[12,44]. Almost 80% of patients with kidney stone were form calcium stones which primarily composed of calcium oxalate or calcium phosphate. The other main types of renal stones were with low frequency like uric acid, struvite (calcium magnesium ammonium phosphate, and cystine stones [5]. Furthermore, It was found out that the most common causes of urolithiasis were inadequate hydration and low urine volume. Moreover, it was concluded that the most common chemical factors causing urinary stone formation were hypercalciuria, hyperoxaluria, hyperuricosuria, and

hypocitraturia[13,14]. It was demonstrated previously that Struvite stones was caused by Proteus spp. which are Gram-negative bacteria and urease-producing organisms which able to break down urea into ammonia [45-48]. However, there are many preventive measures like higher total dietary fiber, reduced animal meat protein, fruit and vegetable intake, and a low sodium diet along with moderate calcium intake revealing a reduction of nephrolithiasis.

CONCLUSIONS

Urinary stone disease was more frequent in males than in females and the ratio was 2:1. The most common elements available in urinary stones were calcium of cations with frequency of 90.3%. Anions like phosphate, oxalate and urate were also identified and the most common was phosphate. More than half of the urolithiasis patients had one or more metabolic abnormalities like hypercalcemia and hyperuricemia. The vast majority of the kidney stone were unilateral renal stones and the frequency was 65.92% (89/135). The bladder, ureteric, bilateral renal, renal and ureteric and urethral stones were seen with frequency of 13.3, 12.6, 4.44, 2.96 and 0.74 % respectively. The coefficient value reflected a proportional variance of the frequencies of urine findings which explained by the linear trend. Urine blood revealed the highest frequency and lied above the regression line showing a strong association with renal calculi pathology.

Statement of Ethics: All the procedures involving human participation were conducted in strict accordance with ethical standards of Institutional Research Committee, Department of Scientific Research, Tikrit University as well as the 1964 Helsinki Declaration and its subsequent amendments or equivalent ethical norms.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest Statement: The author declares that he has no conflicts of interest, financial or otherwise.

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REFERENCES

1. Al-Jebouri MM. Medical Bacteriology. 1st edn. Mosul University Press, Mosul, Iraq.1990 (Arabic).
2. Scales CD, Smith AC, Hanley JM, Saigal CS., Urologic Diseases in America Project. Prevalence of kidney stones in the United States. European Urolology. 2012 Jul;62(1):160-5. [PMC free article] [PubMed]
3. Al-Jebouri MM, Madish SA. The role of sex hormones in the formation of renal stones with reference to urinary tract infections of Iraqi patients. World Journal of Pharmacy and Pharmaceutical Sciences. 2014;3(4):352-365.
4. Bargagli M, Scoglio M, Howles SA, Daniel G. Fuster DG. Kidney stone disease: risk factors, pathophysiology and management. National Review of Nephrology. 2025; 21: 794–808. https://doi.org/10.1038/s41581-025-00990-x
5. Ferraro PM, Ticinesi A, Meschi T, Rodgers A, Di Maio F, Fulignati P, Borghi L, Gambaro G. Short-Term Changes in Urinary Relative Supersaturation Predict Recurrence of Kidney Stones: A Tool to Guide Preventive Measures in Urolithiasis. Journal of Urology. 2018 Nov;200(5):1082-1087. doi: 10.1016/j.juro.2018.06.029. Epub 2018 Jun 22. PMID:
6. Al-Jebouri MM, Al-Alwani HR. Angiotensin 1-converting enzyme gene polymorphism in patients with chronic renal failure. World Journal of Pharmaceutical Research. 2014; 4:1-11.
7. Al-Jebouri MM, Al-Obaidy HS. "Providine-iodine as a new lethal photosensitizer for killing of disinfectant-resistant Staphylococcus aureus of wounds by light from a helium/neon laser". Proceedings of First Scientific Conference / college of science 1997; 1,239-250.
8. Al-Jebouri MM. "Impact of sublethal disinfectant exposure on antibiotic resistance patterns of *Pseudomonas aeruginosa*". Medical Principles and Practice. 2024; 13:1-9. https://doi: 10.1159/000542322
9. Yuan-Hsin Chen, Chih-Fu Wei, Ya-Yun Cheng, Carol Mita, Chinh Lu Duc Hoang, Cheng-Kuan Lin, *et al.,* Urine cadmium and urolithiasis: A systematic review and meta-analysis. Environmental Research.2024;252(1):118745, ISSN 0013-9351. https://doi.org/10.1016/j.envres.2024.118745.
10. Al-Jebouri MM, Mahmood BYR. "Estimation of cytokines involved in acute-phase wound infection with reference to residence time of patients in hospitals". Modern Research of Inflammation. 2019;8(1):1-10. DOI: 10.4236/mri.2019.81001
11. Ferraro PM, Curhan G C, D'Addessi A, Gambaro G. Risk of recurrence of idiopathic calcium kidney stones: analysis of data from the literature. *Journal of Nephrology*. 30, 227–233 (2017). Article PubMed Google Scholar
12. Chen KW, Meskawi M, Miller LE, Bhattacharyya S, Tailly T, Chew BH, Bhojani N. Trends in kidney stone prevalence among U.S. adults A concerning contemporary gender analysis from the NHANES database. Canadian Urological Association Journal. 2025 Feb;19(2):58-60. doi: 10.5489/cuaj.8935. PMID: 39418488; PMCID: PMC11819852.
13. Scales C D Jr, Smith A C, Hanley J M, Saigal CS. Prevalence of kidney stones in the United

States. *European Urology.* 2012;62: 160–165. Article PubMed PubMed Central Google Scholar
14. Scales CD Jr, Tasian GE, Schwaderer AL, Goldfarb DS, Star RA, Kirkali Z. Urinary Stone Disease: Advancing Knowledge, Patient Care, and Population Health. Clinical Journal of American Society of Nephrology. 2016 Jul 7;11(7):1305-1312. doi: 10.2215/CJN.13251215. Epub 2016 Mar 10. PMID: 26964844; PMCID: PMC4934851.
15. Malieckal D, Goldfarb DS. Occupational kidney stones. *Current Opinion of Nephroogyl and Hypertensions.2020;* 29: 232–236. Article PubMed Google Scholar
16. New F, Somani BK. A complete world literature review of quality of life (QOL) in patients with kidney stone disease (KSD). *Current Urology Report. 2016;*17: 88. Article PubMed PubMed Central Google Scholar
17. Ferraro PM, Curhan GC, D'Addessi A, Gambaro G. Risk of recurrence of idiopathic calcium kidney stones: analysis of data from the literature. *Journal of Nephrology.* 2017;30: 227–233. Article PubMed Google Scholar
18. Saigal CS, JoyceG, Timilsina AR. Direct and indirect costs of nephrolithiasis in an employed population: opportunity for disease management? *Kidney International.* 2005;68, 1808–1814. Article PubMed Google Scholar
19. Lotan Y, Cadeddu J A, Roerhborn CG, Pak CY, Pearle MS. Cost-effectiveness of medical management strategies for nephrolithiasis. *Journal of Urology.* 2004;172, 2275–2281.
20. Article PubMed Google Scholar
21. Flannigan R, Choy WH, Chew B, Lange D. Renal struvite stones-pathogenesis, microbiology, and management strategies. Natatural Review of Urology. 2014 Jun;11(6):333-41. doi: 10.1038/nrurol.2014.99. Epub 2014 May 13
22. Pearle MS, Goldfarb DS, Assimos DG, Curhan G, Denu-Ciocca CJ, Matlaga BR, et al, White JR; American Urological Association. Medical management of kidney stones: AUA guideline. Journal of Urology. 2014 Aug;192(2):316-24. doi: 10.1016/j.juro.2014.05.006. Epub 2014 May 20. PMID: 24857648.
23. Al-Jebouri MM, Kaki MNM Application of matrices modelling for infectious diseases of humans. Open Journal of Applied Sciences.2025;15(9):2733-2758.
24. Al-Jebouri MM, Mdish SA. Tracing of antibiotic-resistant bacteria isolated from semen of Iraqi males with primary infertility. Open Journal of Urology.2019;9(1):19-29.
25. Al-Jebouri MM. Modellings of Infectious Diseases and Cancers under Wars and Pollution Impacts in Iraq with Reference to a Novel Mathematical Model and Literature Review. Open Journal of Pathology.2023; 13 (3): 126-139. DOI: 10.4236/ojpathology.2023.133013
26. Al-Jebouri MM, Kaki MN. Mathematical Considerations for the Infectious Infertility of Male in Iraq. World Journal of Public Health.2025;10(4):449-458. https://doi.org/10.11648/j.wjph.20251004.12
27. Al-Jebouri MM, Kaki MM. Dynamics and Phase Portraits of the SEIQR Model. Annals of Public Health and Epidemiology. 2025; 3(2):1-8.
28. Parks J H, Coe F L, Evan AP, Worcester EM. Urine pH in renal calcium stone formers who do and do not increase stone phosphate content with time. *Nephrol. Dialysis and Transplantation.* 2009;24: 130–136.
29. Stoller ML, Low R K, Shami GS, McCormick VD, Kerschmann RL. High resolution radiography of cadaveric kidneys: unraveling the mystery of Randall's plaque formation. *Journal of Urology.1996;*156, 1263–1266.
30. Allam AT, El-Dessouki AM, El-Shiekh RA, *et al.,* A holistic guide to effective prevention and treatment for kidney stones: a systematic review exploring anti-urolithiasis approaches. *Naunyn-Schmiedeberg's Archives of Pharmacology*. 2025. https://doi.org/10.1007/s00210-025-04658-y
31. Shoag J, Halpern J, Goldfarb DS, Eisner BH. Risk of chronic and end stage kidney disease in patients with nephrolithiasis. *Journal of Uroogyl.* 2014;192, 1440–1445. Article PubMed Google Scholar
32. Israr B, Frazier RA, Gordon MH. Effects of phytate and minerals on the bioavailability of oxalate from food. *Food Chemistry.* 2013;141, 1690–1693. Article CAS PubMed Google Scholar
33. Al-Jebouri MM."Clinical Immunology and Allergy". 1st 2dn. Peramerd Publishing Company, Sulaymania, Iraq, 2024,514 p.(in Arabic).
34. Hill AJ, Basourakos SP, Lewicki P, Wu X, Arenas-Gallo C, Chuang D, *et al.,* Incidence of Kidney Stones in the United States: The Continuous National Health and Nutrition Examination Survey. Journal of Urology. 2022 Apr;207(4):851-856. doi: 10.1097/JU.0000000000002331. Epub 2021 Dec 2. PMID: 34854755.
35. Shoag J, Halpern J, Goldfarb DS, Eisner BH. Risk of chronic and end stage kidney disease in patients with nephrolithiasis. *Journal of Urology.* 2014; 192:1440–1445. Article PubMed Google Scholar
36. Al-Jebouri MM,Mohamed AA. A study on infertility of males infected with *Mycoplasma hominis* with reference to sperm morphology. Open Journal of Pathology. 2020;11(1):7-21.
37. Jasim HH, Al-Jebouri MM, The relationship between periodontal disease and predisposing factors. Tikrit Medical Journal for Dental Sciences.2016;4(1):68-80.
38. Evan AP, Lingeman J, Coe F, Shao Y, Miller N, Matlaga B, Phillips C, Sommer A, Worcester E. Renal histopathology of stone-forming patients with distal renal tubular acidosis. Kidney International. 2007 Apr;71(8):795-801. doi:

10.1038/sj.ki.5002113. Epub 2007 Jan 31. PMID: 17264873

39. Daudon M, Dore J C, Jungers P, Lacour B. Changes in stone composition according to age and gender of patients: a multivariate epidemiological approach. *Urological Research.* 2004;32, 241–247.
40. Ferraro PM, Taylor EN, Gambaro G, Curhan GC. Soda and other beverages and the risk of kidney stones. *Clinical Journal of American Society of Nephrology.* 2013;8: 1389–1395.
41. Rodriguez A, Curhan G C, Gambaro G, Taylor EN, Ferraro PM. Mediterranean diet adherence and risk of incident kidney stones. *American Journal of Clinical Nutrition 2020;* 111: 1100–1106.
42. Howles SA, Wiberg A, Goldsworthy M, Bayliss AL, Gluck AK, Ng M, *et al.,* Genetic variants of calcium and vitamin D metabolism in kidney stone disease. Natational Community. 2019 Nov 15;10(1):5175. doi: 10.1038/s41467-019-13145-x. Erratum in: Nat Commun. 2022 May 30;13(1):3115. doi: 10.1038/s41467-022-30920-5. PMID: 31729369; PMCID: PMC6858460.
43. Al-Jebouri MM, Al=Shakarjy. The effect of low-power laser combined with providine-iodine photosensitizer on elastase production of Pseudomonas aeruginosa isolated from wounds. Journal of Applied Medical Sciences.2013;2(2):63-67.
44. Inagaki K, Tsuriya D, Hashimoto T, Nakamura K Verification of the Reliability of an Automated Urine Test Strip Colorimetric Program Using Colorimetric Analysis: Survey Study. JMIR Form Res 2025;9:e62772. doi: 10.2196/62772PMID: 39810396PMCID: 11750113
45. Ward JB, Feinstein L, Pierce C, Lim J, Abbott KC, Bavendam T, *et al.,* NIDDK Urologic Diseases in America Project. Pediatric Urinary Stone Disease in the United States: The Urologic Diseases in America Project. Urology. 2019 Jul; 129:180-187. doi: 10.1016/j.urology.2019.04.012. Epub 2019 Apr 18. PMID: 31005657; PMCID: PMC6988134.
46. Bargagli M, Moochhala S, Robertson WG, Gambaro G, Lombardi G, Unwin RJ, *et al.,* Urinary metabolic profile and stone composition in kidney stone formers with and without heart disease. Journal of Nephrology. 2022 Apr;35(3):851-857. doi: 10.1007/s40620-021-01096-w. Epub 2021 Jun 21. PMID: 34152561; PMCID: PMC8995244.
47. Al-Jebouri MM. "The effect of sublethal concentrations of disinfectants on antibiotic resistance pattern of Pseudomonas aeruginosa". Journal of Hospital Infection.1989; 14:14-19.
48. Al-Jebouri MM, Edham MH. An assessment of biological pollution in certain sector of lower Al-Zab and River Tigris waters using bacterial indicators and related factors in Iraq. Journal of Water Resource and Protection2012, 4:32-38. DOI:10.4236/jwarp.2012.41005
49. Sultan HI, Al-Jebouri MM. Pulmonary tuberculosis in Al-Zab district. Tikrit Medical Journal. 2010;16(1):37-41.