Int. J. Pharm. Investigation, 2023; 13(4):889-894.
https://www.jpionline.org

Original Article

A Prospective Study on Risk Factors, and Prescription Patterns in Urolithiasis Patients in Tertiary Care Hospitals of Khammam Region

Johurul Islam[1], Abdul Mannan[1], Ariful Islam[1], Thirunagiri Praveenkumar[2,*], Maram Chinnaeswaraiah[3]

[1]Department of Pharmacy Practice, Anurag Pharmacy College (Affiliated to JNTU Hyderabad), Ananthagiri, Kodad, Telangana, INDIA.
[2]Department of Pharmaceutics, Anurag Pharmacy College (Affiliated to JNTU Hyderabad), Kodad, Telangana, INDIA.
[3]Department of Pharmacognosy, Anurag Pharmacy College (Affiliated to JNTU Hyderabad), Kodad, Telangana, INDIA.

ABSTRACT

Introduction: Urolithiasis is a hard deposit of minerals and salts that form inside the kidney, ureter, and bladder in the urinary system. Kidney stones are a common disease of the urinary tract. Prevention of stones mainly depends on the mechanisms of the stone formation, daily water intake, and food habits. **Aim and Objectives:** A prospective observational study was conducted on risk factors, and prescription patterns in urolithiasis patients. **Materials and Methods:** The study was conducted from August 2022 to February 2023 in Khammam, Telangana. Men and women were included as a sample of subjects aged 18-60 years. The total number of samples was 200. **Results:** Urolithiasis was more commonly observed in males than females aged 18-60. Urolithiasis developed in individuals who consumed less water, frequently ate non-veg, and had a family history of calculi. Out of 200 patients, only 27 patients had complications like AKI, and abdominal pain and painful incomplete urination was the most reported symptoms. **Conclusion:** The prevalence, risk factors, and prescription pattern of urolithiasis were observed in this study. The Formation of Kidney stones may be due to diet, age progression, gender, obesity, genetics, and lifestyle factors. A better understanding of the epidemiology of urolithiasis is further essential to plan effective treatment and preventive strategies.

Keywords: Urolithiasis, Prevalence, Risk factors, Prescription pattern.

Correspondence:
Mr. T. Praveenkumar
Department of Pharmaceutics, Anurag Pharmacy College (Affiliated to JNTU Hyderabad), Kodad, Telangana, INDIA.
Email: praveensuri1@gmail.com

Received: 12-03-2023;
Revised: 24-04-2023;
Accepted: 06-06-2023.

INTRODUCTION

Urolithiasis is the most common urological disease in human beings in the world. It is the most painful and common urological disorder of the urinary system.[1] Now a day, kidney stone formation has significantly increased in all developed countries. Urolithiasis is a hard deposit of minerals and salts that form inside the kidney, ureter, and bladder in the urinary system.[2,3] It is more critical to analyze stones in treating metaphylaxis of residual and repeated stones.[4] In India, mainly calcium oxalate crystals had formed in living beings, and the composition of stones differs from Western countries. In the productive age group, kidney stone affects about 3% of the population.[5] The prevalence means the number of calculi present in a masked population at a particular time. The incidence of stones is described as the number of new stone formations in patients in a given population in the same period.[6]

Males and females suffer from urolithiasis in their productive age group.[7] Prevention of stones mainly depends on the mechanisms of the stone formation, daily water intake, and food habits.[8] Urolithiasis is mainly associated with several risks of end-stage renal failure,[9] end-stage of chronic kidney diseases,[10] cardiovascular diseases,[4] diabetes, and hypertension. Sometimes kidney stones are considered a systemic disorder linked to metabolic syndrome.[11] The common etiology of urolithiasis are the patient's occupation, dietary and lifestyle habits, previous medications history, family history of frequent attacks of UTI, and some underlining disorders predisposing to renal calculi formation.[12] Calcium is the main component of oxalate stone in human beings. Supplemental calcium plays a more significant function in kidney stone formation than high dietary calcium intake.

A kidney stone may exist asymptomatically and painless until they travel from the kidney to the ureter and bladder.[13] Based on the size and movement of stones through the urinary tract, signs and symptoms are sudden onset of severe pain, sharp pains in the back and side, lower abdominal pain, hematuria (red or brown blood in urine), constant urination, painful urination, Inability to urinate or a small amount of urine, and The urine looks cloudy,

DOI: 10.5530/ijpi.13.4.112

pain in the lower back, bad-smelling urine, nausea, vomiting, fever, and chills.

MATERIALS AND METHODS

A prospective hospital-based observational study was conducted from August 2022 to February 2023 in general surgery and non-surgical departments of tertiary care hospitals in Khammam region, Telangana, after obtaining IEC (Institutional Ethical Committee). Cases of confirmed urolithiasis by ultra-sonogram were included in the study after fulfilling the inclusion criteria. Bellow 18 years and above 60 years patients were excluded. Written informed consent was taken from the patients with clinical features of urolithiasis and radiological confirmation of calculus disease. USG (Ultra-Sonogram) of the abdomen test was done further to confirm renal calculi and their size and exact location. Based on ultrasound and KUB reports, the management of urolithiasis was divided into surgical and non-surgical treatment. Signs and symptoms of any infections were noted and well documented. All data were recorded in a data collection form specially designed for the study. The data collection form includes the symptoms, site and number of stones, family history of urolithiasis, any habit of alcohol, smoking, and tobacco chewing, surgical history and post-surgical complications. Descriptive data analysis was performed in percentage of demographic variables using MS office.

RESULTS

We included 200 cases that met the inclusion and exclusion criteria. Parameters we assessed in that study are - age, gender, social habits, physical activity, water consumption, body mass index, previous history of surgery, post-surgical complication, site of stone, number of stones, risk factor, symptoms, diseases diagnosed, complications, co-morbidities, category of drugs, drug name, surgery.

Among 200 patients, we found 61 patients under the age group of 18-30 years, 74 patients under the age group between 31-40 years, 42 patients under the age group of 41-42 years, and 23 patients under the age group between 51-60 years. Under the age of 31-40 years, we found the maximum number of urolithiasis patients was 74 (Table 1).

Among 200 patients, 121 were males, and 79 were female. Male patients were more prone to develop urolithiasis than females, according to our study (Table 1).

Out of 200 patients, 46 patients were alcoholic, ten patients had the habit of eating betel leaf, 82 patients did not have social habits, 67 patients were a smoker, and 18 patients had habits like eating gutka (Table 1).

Among 200 patients, 117 drank 1-2 L water daily, and 23 drank 2.5-3.5 L water in our study. According to this study, those patients who drink less water are more prone to develop kidney stones (Table 1).

One hundred ninety-two cases had BMI under 22-25, and 8 had BMI under 26-32. The maximum number of patients had average body weight, and fewer were overweight (Table 1).

Among 200 patients, 123 cases had undergone surgery, and the remaining 77 patients had not done the surgery (Table 2).

Among 200 patients, 13 had done ESWL surgery technique, 57 had PCNL + DJS surgery technique, 62 had URSL + DJS surgery technique, and the remaining 68 had not done any surgery (Table 2).

In our study, out of 200 patients, the maximum number of patients (125) had post-surgical complications like frequent painful and incomplete urination, difficulties and burning urination, and fever. The remaining 75 patients had no post-surgical complications (Table 2).

In this study, out of 200 patients, 121 patients had stones in the kidneys, 74 patients had stones in the ureter, and only five had urinary bladder stones (Table 2).

In our study, 57 had single stones, 90 patients had two stones, 45 patients had three stones, four patients had four, and only two patients had five (Table 2).

In this study, 41 patients have symptoms like abdominal pain, 13 patients have lower back pain, 51 patients have loin pain, 97 patients have flank pain, 71 patients vomiting, 57 patients have nausea, 31 patients have a fever, and 117 patients were very weakness (Table 3).

In this study, the risk factors identified where 168 patients had a family history, 149 patients had dehydration, 132 patients had taken frequent non-veg, 50 patients had taken more salts in their diet, and only 8 cases had overweight (Table 3).

Out of 200 patients, 122 had been diagnosed with renal calculi, 73 with ureteric calculi, and only five with urinary bladder stones (Table 3).

Out of 200 patients, only 27 patients had complications like AKI, and the remaining 173 patients did not have any complications (Table 3).

Out of 200 patients, 91 patients have co-morbidities like hypertension, 19 patients have diabetes mellitus, and the remaining 95 patients do not have any co-morbidities (Table 3).

Out of 200 patients, a maximum number of patients prescribed the category of drugs like Antibiotic (237, 15%), Analgesic (190, 20%), Proton pump inhibitor (115, 12%), Xanthine Oxidase inhibitor (10, 1%), Anti-emetic (71, 7%), Multivitamin (77, 8.2%), Antipyretic (27, 2%) and alkalinizer (145, 15%). In this study, the maximum number of patients prescribed with following drugs: Tramadol hydrochloride (85, 9.05%), Ceftriaxone (85,

Table 1: Factors Associated with the Prevalence of Urolithiasis Patients.

Age (in yrs)	N	%
18-30	61	30.5
31-40	74	37
41-50	42	21
51-60	23	11.5
Gender	**N**	**%**
Male	121	60.5
Female	79	39.5
Social habits	**N**	**%**
Alcoholic	46	20.62
Betel leaf	10	4.48
Gutka	18	8.07
Smoking	67	30.04
Water intake (L)	**N**	**%**
1-2 L	177	88.5
2.5-3.5 L	23	11.5
BMI (kg/m2)	**N**	**%**
Normal weight	192	96
Over weight	8	4

Table 2: Surgical details classified based on the site of calculi.

Surgery	N	%
ESWL	13	6.5
PCNL + DJS	57	28.5
URSL + DJS	62	31
Post Surgical Complication	**N**	**%**
Abdominal pain	2	0.79
Difficulty burning urination	31	12.30
Stent discomfort	7	2.77
Fever	46	18.25
Frequent painful and incomplete urination	43	17.06
Pain	48	19.04
Site of stone	**N**	**%**
Kidney	121	60.5
Ureter	74	37
Urinary bladder	5	2.5
Number of stone	**N**	**%**
1 Stone	57	28.5
2 Stone	90	45
3 Stone	45	22.5
4 Stone	6	3
5 Stone	2	1

9%), Nitrofurantoin (47, 5%), Piperacillin (42, 4%), Tazobactum (68, 7%), Pantoprazole (100, 10.65%), Allopurinol (10, 1%), Diclofenac sodium (44, 4.69%) and paracetamol (33, 3%) (Table 4).

DISCUSSION

Urolithiasis is a clinical condition with a high incidence of recurrence. The difference in the incidence and prevalence of urolithiasis is related to differences in climatic conditions, genetic factors, and dietary habits. The site of stone development was noticed with changes in the lifestyle. We had done a study among 200 urolithiasis cases in the area of Khammam, Telangana, and the climate condition of this area is moderately hot. Our study observed that 31 to 40 (37%) years' patients were more prone to develop urolithiasis. A previous study on urolithiasis was carried out, and they mentioned that urolithiasis usually occurs between the third and fourth decades of an individual's life.[14]

According to our study, males were more commonly suffering from urolithiasis than females. Male cases were 121 (60.5%), and female cases were 79 (39.5%). Both males and females are affected by urolithiasis, which is more predominant among males in a proportion of approximately 2:1. Social habits like smoking also cause the formation of stones in the urinary tract, was reported by Tamadon *et al.*[15] Sometimes serum cadmium level also increases due to cigarette smoking and decreased urinary output in healthy volunteers, leading to urolithiasis development.[16] Therefore, out of 200 patients, 177 (88.5%) had drunk less than 2 L of water and developed urolithiasis. So, water intake also significantly affects the formation of stones in the urinary tract. BMI (Body Mass Index) also causes the development of urolithiasis. In our study, those participants who had over body weight developed urolithiasis. Similarly, Taylor *et al.* also reported that high BMI causes the development of urolithiasis.[4]

In our study, major post-surgical complications reported are frequently painful and incomplete urination and stent discomfort. To avoid post-surgical complications like stent discomfort, a surgeon should provide precautions to the patients, like "Be always stable and do not move your body too much." The right-sided kidney (upper pole) is our study's common site for forming stones. Safarinejad MR *et al.* reported a similar, while few studies mentioned both kidneys.[17]

In this study, the concerned data collection parameters such as non-vegetarian food habits, dehydration, and obesity act as significant risk factors in the formation of urolithiasis. Kidney stone formation directly relates to non-vegetarian food habits.[18] We assessed a significant relationship between stone formation and high dietary animal protein intake. This study suggests that non-vegetarians were at greater risk for developing urolithiasis.

Out of 200 cases, 97 patients had symptoms like flank pain, abdominal pain, fever, and nausea in our present study, similarly

Table 3: Distribution of Urolithiasis Cases by Selected Variables.

Symptoms	N	%
Abdominal pain	41	11.02
Lower back pain	13	3.49
Loin pain	51	13.70
Flank pain	97	26.07
Vomiting	71	19.08
Weakness	11	2.95
Nausea	57	15.32
Fever	31	8.33
Risk factor	**N**	**%**
Non-Vegetarian	132	26.03
Dehydration	149	29.38
Family history	168	33.13
Heavy salt intake	50	9.86
Obesity	8	1.57
Disease diagnosed	**N**	**%**
Renal calculi	122	61
Ureteric calculi	73	36.5
Urinary bladder	5	2.5

reported by Baker *et al.*[19] The effect of calcium, renal handling of ammonia, and insulin resistance on urine pH, clearly explains that renal calculi had a relationship with diabetes.[20] Our study recorded that the prevalence of renal calculi in hypertensive patients is higher, and it is a significant co-morbidity in the development of urolithiasis.

According to the patient's condition and degree of illness, both conservative medical treatment and surgical intervention had given to each patient. At the beginning of treatment, pain control is an essential intervention in each urolithiasis patient. For pain management, oral and intravenous NSAIDs (Non-Steroidal Anti-Inflammatory Drugs) are indicated as first-line drugs.

In our study, more frequently prescribed analgesics are Diclofenac sodium 75 mg twice daily for seven days, Aceclofenac 100 mg twice daily for seven days, Tramadol HCl 50 mg twice daily for one week, and paracetamol 650 mg twice a day for one week.[21] To relieve the symptoms like nausea and vomiting, oral and IV anti-emetic medications had prescribed, such as Ondansetron 4mg twice a day for four days. Some other drug prescribed in this study, Allopurinol 100 mg BD for ten days. The mechanism action of Allopurinol is to reduce uric acid formation by inhibiting the

Table 4: Prescription Pattern in Urolithiasis Patients.

Drug Name	Dosage form	Dose	N	%	Drug Name	Dosage form	Dose	N	%
Tramadol HCl	Injection	40mg	85	9.05	Ceftriaxone	Injection	1gm	85	9.05
Aceclofenac	Tablet	100mg	15	1.60	Multivitamin	Syrup	200mL	77	8.20
Diclofenac Sodium	Injection	75mg	44	4.69	Tazobactam	Injection	4.5mg	68	7.24
Paracetamol	Injection	150mg	33	3.51	Piperacillin	Injection	4.5mg	42	4.47
Allopurinol	Tablet	100mg	10	1.06	Amoxicillin	Tablet	625mg	13	1.38
Magnesium Citrate	Syrup	200mL	47	5.01	Ondansetron	Tablet	4mg	71	7.56
Droteverine HCl	Tablet	80mg	25	2.66	Ranitidine	Injection	150mg	30	3.19
Anti-oxidant	Syrup	200mL	15	1.60	Pantoprazole	Injection	40mg	100	10.65
Betahistine	Tablet	16mg	2	0.21	Omeprazole	Capsule	20mg	15	1.60
Levofloxacin	Tablet	500mg	2	0.21	Multiminerals	Syrup	200mg	15	1.60
Dicyclomine HCl	Injection	20mg	3	0.32	Nitrofurantoin	Tablet	100mg	47	5.01
Potassium Clavulanate	Tablet	625mg	13	1.38	Potassium Citrate	Syrup	200mg	47	5.01
Amino acid	Syrup	200mL	15	1.60	Metformin	Tablet	500mg	2	0.21
Disodium Hydrogen Citrate	Syrup	200mL	5	0.53	Telmisartan	Tablet	40mg	2	0.21
Cefuroxime Axetil	Tablet	250mg	1	0.11	Rabeprazole	Injection	20mg	2	0.21
Flavoxate HCl	Tablet	100mg	1	0.11	Amlodipine	Tablet	5mg	1	0.11
Metronidazole	Injection	400mg	1	0.11	Meropenem	Injection	500mg	1	0.11
Montelukast	Injection	4mg	1	0.11	Metoprolol	Tablet	25mg	1	0.11
Hydralazine HCl	Injection	20mg	1	0.11	Domperidone	Capsule	30mg	1	0.11

enzyme Xanthine Oxidase which is responsible for the conversion of oxypurinol to uric acid.[22]

Patients presenting with smaller size stones, either symptomatic or asymptomatic, and not done surgery, had been given antibiotics and alkalinizing agents. In this study, a frequently prescribed Antibiotic for a non-surgery patient is Nitrofurantoin 100mg twice a day for ten days, and the alkalinizing agent is syrup potato MB6 or alkali B6, have a similar composition such as potassium citrate + magnesium citrate + vitamin B6. The mechanism of Nitrofurantoin involved in urolithiasis inhibits the citric acid cycle and synthesis of DNA, RNA, and protein in bacteria, preventing infection in urolithiasis patients. The mechanism of syrup potato MB6 is involved; it reduces the further formation of kidney stones by increasing urine pH and preventing the growth and aggregation of crystals in the kidney.

Patients attended in hospital with large stone size moderate to severe conditions with some other complications like AKI were given surgical intervention, and frequently used surgical technique was Ureteroscopic Lithotripsy (URSL) and DJ stent. A flexible ureteroscope passes the lower urinary tract into the ureter and calyx. The surgical process requires visualizing the urinary tract to retrieve an obstructing stone.[23] Other surgical procedures include Percutaneous Nephrolithotomy (PCNL) and Extracorporeal Shock Wave Lithotripsy (ESWL). After surgery, the most commonly prescribed medication, such as an Antibiotic injection of Piperacillin + Tazobactum 4.5gm twice a day for seven days. MOA is the inhibition of bacterial cell wall synthesis and beta-lactamase enzyme. Therefore, prevent the infection after surgery, some other drugs, such as Pantoprazole, Tramadol hydrochloride, Ranitidine, and Paracetamol, were prescribed best on the patient's symptoms.

CONCLUSION

Our study shows urolithiasis occurs mainly due to dietary habits (frequent non-vegetarian, drinking significantly less water, high salt intake), obesity, and family history. 31 to 40 years individuals are more prone to develop urolithiasis. Males are at greater risk than females in the case of renal calculi. The maximum number of patients showed symptoms like flank pain and nausea. Complication does not have a significant impact on urolithiasis, but co-morbidities like hypertension can influence the happening of renal calculi. Maximum patients were done surgery. URSL and PCNL techniques were mainly used. Patients with larger calculi than 5mm underwent surgical management and PCNL, URSL, and ESWL techniques. Those patients with stones smaller than 5mm undertook non-surgical treatments followed by commonly prescribed medication such as Allopurinol, Aceclofenac, Tramadol HCl, Nitrofurantoin, Sodium citrate, potassium citrate, and vitamin B-6. All cases were carefully managed till discharge and routinely observed for any complications. The prescribed medications for patients undergoing surgery are Piperacillin and Tazobactam, Ceftriaxone and Tazobactam, and Tramadol HCl. Prevention is better than cure, so we should avoid frequently eating non-veg food items and drinking plenty of water.

ACKNOWLEDGEMENT

The authors would like to thank the patients for their participation. We would also like to M. Chinnaeswaraiah, Principal of Anurag Pharmacy College, Kodad, for his continuous support and guidance in completing the work.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

AKI: Acute kidney injury; **BMI:** Body mass index; **PCNL:** Percutaneous nephrolithotomy; **ESWL:** Extracorporeal shock wave lithotripsy; **DJS:** Double J stenting; **URSL:** Ureteroscopic Lithotripsy; **HCl:** Hydrochloride, **DNA:** Deoxyribonucleic acid; **RNA:** Ribonucleic acid; **UTI:** Urinary tract infection; **IEC:** Institutional ethical committee.

REFERENCES

1. Alelign T, Petros B. Kidney stone disease: an update on current concepts. Adv Urol. 2018;2018:3068365. doi: 10.1155/2018/3068365, PMID 29515627.
2. Moe OW. Kidney stones: patho-physiology and medical management. Lancet. 2006;367(9507):333-44. doi: 10.1016/S0140-6736(06)68071-9.
3. Pearle MS, Calhoun EA, Curhan GC. Urologic Diseases of America Project: urolithiasis. J Urol. 2005;173(3):848-57. doi: 10.1097/01.ju.0000152082.14384.d7.
4. Taylor EN, Stampfer MJ, Curhan GC. Obesity, weight gain, and the risk of kidney stones. J Am Med ASC. JAMA. 2005;293(4):455-62. doi: 10.1001/jama.293.4.455, PMID 15671430.
5. Prakash R, . A, . N. Prevalence and socio-demographic status on kidney stone patients in Thanjavur district, Tamil Nadu, India. Int J Community Med Public Health. 2019;6(5):1943-7. doi: 10.18203/2394-6040.ijcmph20191614.
6. Mahmoud MH, Ramadan EN, Taha AS. Effectiveness of self-care intervention for patients with urolithiasis on their practices regarding nutrition. Am J Nurs Res. 2019;7(5):856-69. doi: 10.12691/ajnr-7-5-19.
7. Moe OW, Pearle MS, Sakhaee K. Pharmacotherapy of urolithiasis: evidence from clinical trials. Kidney Int. 2011;79(4):385-92. doi: 10.1038/ki.2010.389, PMID 20927039.
8. Khan SR, Pearle MS, Robertson WG, Gambaro G, Canales BK, Doizi S, *et al*. Kidney stones. Nat Rev Dis Primers. 2016;2(1):16008. doi: 10.1038/nrdp.2016.8.
9. Sigurjonsdottir VK, Runolfsdottir HL, Indridason OS, Palsson R, Edvardsson VO. Impact of nephrolithiasis on kidney function. BMC Nephrol. 2015;16(1):149. doi: 10.1186/s12882-015-0126-1, PMID 26316205.
10. Rule AD, Roger VL, Melton LJ, Bergstralh EJ, Li X, Peyser PA, *et al*. Kidney stones associate with increased risk for myocardial infarction. J Am Soc Nephrol. 2010;21(10):1641-44. doi: 10.1681/ASN.2010030253, PMID 20616170.
11. Courbebaisse M, Prot-Bertoye C, Bertocchio JP, Baron S, Maruani G, Briand S, *et al*. Nephrolithiasis of adult: from mechanisms to preventive medical treatment. Rev Med Interne. 2017;38(1):44-52. doi: 10.1016/j.revmed.2016.05.013, PMID 27349612.
12. Johri N, Cooper B, Robertson W, Choong S, Rickards D, Unwin R. An update and practical guide to renal stone management. Nephron Clin Pract. 2010;116(3):c159-71. doi: 10.1159/000317196, PMID 20606476.
13. Thomas B, Hall J. Urolithiasis. Surgery. 2005;23(4):129-33. doi: 10.1383/surg.23.4.129.65330.
14. Marak A, K S, Singh TA, Singh RN, Singh LS. Urolithiasis: prevalence and related factors in a rural area of Manipur. Int J Med Sci Public Health. 2013;2(4):956-60. doi: 10.5455/ijmsph.2013.220720131.
15. Tamadon MR, Nassaji M, Ghorbani R. Cigarette smoking and nephrolitiasis in adult individuals. Nephrourol Mon. 2013;5(1):702-5. doi: 10.5812/numonthly.5251, PMID 23577335.
16. Joo SH, Seo S, Cho MH, Kim KS. Environmental exposure to lead, mercury, and cadmium is not associated with abnormal kidney function in Korean adolescents. Pediatr Nephrol. 2022;37(3):625-31. doi: 10.1007/s00467-021-05215-4, PMID 34448022.

17. Safarinejad MR. Adult urolithiasis in a populationbased study in Iran: prevalence, incidence, and associated risk factors. Urol Res. 2007;35(2):73-82. doi: 10.1007/s00240-007-0084-6, PMID 17361397.
18. Sandilya P, Sandilya P. A demographic study of urolithiasis in patients attending tertiary urological hospital in Dibrugarh, Assam, India. Int J Res Med Sci. 2019;7(2):417-20. doi: 10.18203/2320-6012.ijrms20190345.
19. Baker K, Costabile RA. Demographics, stone characteristics and treatment of urinary calculi at the 47th Combat Support Hospital during the first 6 months of Operation Iraqi Freedom. Mil Med. 2007;172(5):498-503. doi: 10.7205/milmed.172.5.498, PMID 17521097.
20. Zimmerer T, Weiss C, Hammes HP, Braun C, Hesse A, Alken P, *et al*. Evaluation of urolithiasis: a link between stone formation and diabetes mellitus? Urol Int. 2009;82(3):350-5. doi: 10.1159/000209371, PMID 19440027.
21. Gottlieb M, Long B, Koyfman A. The evaluation and management of urolithiasis in the ED: a review of the literature. Am J Emerg Med. 2018;36(4):699-706. doi: 10.1016/j.ajem.2018.01.003, PMID 29321112.
22. Gul Z, Monga M. Medical and dietary therapy for kidney stone prevention. Korean J Urol. 2014;55(12):775-9. doi: 10.4111/kju.2014.55.12.775, PMID 25512810.
23. Rajamahanty S, Grasso M. Flexible ureteroscopy update: indications, instrumentation and technical advances. Indian J Urol. 2008;24(4):532-7. doi: 10.4103/0970-1591.44263, PMID 19468513.

Cite this article: Islam J, Mannan A, Islam A, Praveenkumar T, Chinnaeswaraiah M. A Prospective Study on Risk Factors, and Prescription Patterns in Urolithiasis Patients in Tertiary Care Hospitals of Khammam Region. Int. J. Pharm. Investigation. 2023;13(4):889-94.