



**A PROSPECTIVE OBSERVATIONAL STUDY ON PREVALENCE AND PRESCRIBING
PATTERN OF DRUGS IN UROLOGICAL CONDITIONS IN TELANGANA REGION**

P. Kishore^{1*}, Madetipati Nethaji¹, Beri Sandeep¹ and Kasireddy Vijay Kumar¹

¹Department of Pharmacy Practice, Care College of Pharmacy, Oglapur(V), Damera(M), Warangal Rural, Telangana, INDIA.

*Corresponding Author: P. Kishore

Department of Pharmacy Practice, Care College of Pharmacy, Oglapur(V), Damera(M), Warangal Rural, Telangana, INDIA.

Article Received on 16/05/2017

Article Revised on 06/06/2017

Article Accepted on 29/06/2017

ABSTRACT

Aim and objectives: To Assess the risk factors causing urologic conditions, study the prevalence, prescribing patterns and economic burden of various urologic conditions in a urology clinic. **Methodology:** It is a hospital based prospective observational study conducted in the outpatient department in a Urology clinic in Warangal. This Study was conducted for a Month from 1st May To 31st May. **Results:** A sample size of total 1094 cases of the outpatient department was taken. Of the total Patient population, the prevalence of various urological conditions was found to be, Hydronephrosis-32.3%, Urolithiasis is 29.08%, Lower backache-23.8%, Benign prostate hyperplasia-0.9%. The prevalence of urological conditions was mostly affected in the age group of 26-40 years (32.08%). Antispasmodics (19.79%), Antibiotics (18.28%), Natural diuretic-herbal medicine (11.24%), Analgesics (10.43%) and Muscle relaxants (12.57%) were the most prescribed drugs. We found that Average cost of each prescription of hydronephrosis was Rs.1140/-, Urolithiasis-Rs. 1038/-, Benign prostate hyperplasia- Rs 310/- and Lower backache-Rs.460/-. **Conclusions:** Males were predominantly affected by Urologic conditions compared to females. There was an increase in the prevalence of Urolithiasis and Hydronephrosis in our study compared to the other studies. Patient education programs and counseling helps the patient take necessary precautions to prevent urologic conditions. The Presence of clinical pharmacist in the hospital outpatient (OP) department may reduce recurrence rate and economic burden on patients.

KEYWORDS: Hydronephrosis, Urolithiasis, Prevalence, Prescribing pattern.

INTRODUCTION

Urology is the branch of medicine that focuses on surgical and medical diseases of the male and female urinary tract system and the male reproductive organs. Kidney stones and Hydronephrosis (HDN) are the majorly rising trends in Urology, It is estimated that at least 10% of the population in the industrialized part of the world is affected by urinary tract stones. The incidence and prevalence of these diseases are increasing globally over the past 20 years and is seen across different sex, race, and age. It is estimated that there will be an increase in kidney stones in the future.^[1]

Kidney stones are crystalline mineral deposits that develop from microscopic crystals in the loop of Henle, distal tubule, or the collecting duct. Some crystals grow enough to form visible crystals. Urine volume, urinary pH, concentrations of calcium, phosphate, oxalate, sodium, uric acid ions and concentrations of natural stone inhibitors, such as citrate and magnesium, these all play key role in the process of stone formation.^[2]

According to American Urology association (AUA), Urolithiasis is a common disorder in the United States

(US) that affects almost 1 in 11 people. At least half of the individuals who have one kidney stone will develop another one within 10 years of the first one. The prevalence of self reported kidney stones was 8.8% in the National Health and Nutrition Examination Survey (NHANES) from 2007 to 2010; The prevalence was 10.6% in men and 7.1% in women. The prevalence varies according to age, sex, race, and geographic location. Kidney stones are common in industrialized nations with an annual incidence of 0.5% to 1.1%. Life-time risk of urolithiasis varies from 1-5% in Asia, 5-9% Europe, 10-15% USA and 20-25% middle-east; lowest prevalence is reported from Greenland and Japan.^[3] In India, upper and lower urinary tract stones occur frequently but the incidence shows wide regional variation. The prevalence of urolithiasis is as high as 7.6% in Satpura part of Maharashtra.^[4]

Hydronephrosis refers to distension and dilation of the renal pelvis and calyces, usually caused by obstruction of the free flow of urine from the kidney. Untreated, it leads to progressive atrophy of the kidney, affecting either one or both kidneys.^{[5][6]}

MATERIALS AND METHODS

This study was conducted in a private secondary care hospital "Srinivasa kidney center hospital" Warangal. It is a hospital based observational study conducted in an outpatient (OP) department to assess the risk factors causing urologic conditions, study the prevalence and prescribing patterns, economic burden of various urologic conditions in a urology clinic in the Urology department in Warangal. This Study was conducted for a month from 1st May to 31st May.

All the age groups of patients who approached to urology clinic were considered. Demographic data, occupational status, Past medical history, Family history, food habits, social habits and treatment information was collected and analyzed. Patients who had severe infections, non cooperative and inpatients(IP) were excluded from the study. A total 1094 OP from different regions of Warangal were considered and the patient's pertinent information was collected.

RESULTS

Distribution of the observed conditions

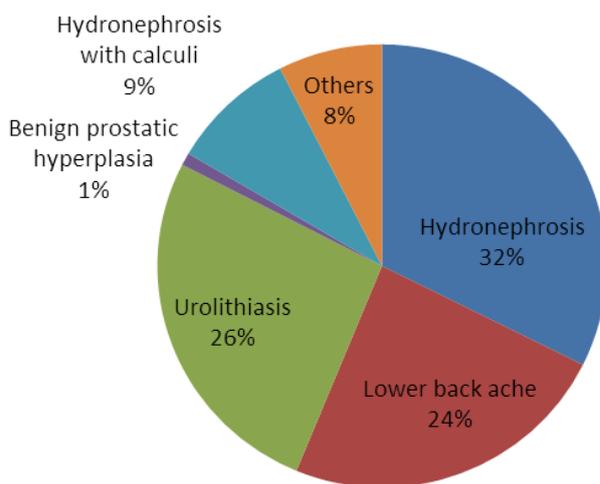


Table 1: Distribution of data according to age and gender of patients.

S.No	Age	Hydronephrosis (HDN)	Urolithiasis	Benign prostate hyperplasia (BPH)	Hydronephrosis with Calculi	Lower back ache
1	0-16	7	2	0	4	1
2	17-25	67	53	0	13	35
3	26-40	161	133	0	49	136
4	41-50	79	59	0	20	51
5	51-60	31	27	1	13	22
6	61-70	9	10	2	0	12
7	>70	0	4	7	0	4

Among 1094 cases, Males were 54.7% and Female were 45.3%. Of the total cases, 32.08% were in the age group of 26- 40 years, followed by 19.4% in the age group of 41-50 years.

Urolithiasis: Out of 288 cases, 58.33% were males and 41.6% were females. Among the total cases 46.18% were in the age group of 26-40 years followed by 20.48% in age group 41-50 years.

Hydronephrosis: Out of 354 cases, 58.4% were males and 41.6% were females. Among the total cases 45.48% were in the age group of 26-40 years followed by 22.31% in the age group of 41-50 years.

Lower backache: Out of 261 cases, 32.5% were males and 67.4% were females. Among the total cases 52.1% were in the age group of 26-40 years followed by 19.5% in the age group of 41-50 years.

Benign prostate hyperplasia: Out of 10 cases, 70% were in age group above 70years, followed by 20% in the age group of 50 - 60 years.

Table 2: Distribution of drugs according to specific condition: Urolithiasis.

Sr.No	Drug name	No of patients
1	T.Hyoscine butyl bromide	168
2	T.Cefuroxime	106
3	T.Rabeprazole+Domperidone	137
4	Inj.Diclofenac	100
5	Inj.camyloffin	104
6	C.staghorn (Herbal diuretic)	129
7	T.Drotaverin+mefenamic acid	69
8	T.Nitrofurantoin	36
9	T.Pregabalin+Methylcobalamine	79
10	T.Gamma linolenic acid	76

Table 3: Distribution of drugs according to specific condition: Hydronephrosis.

Sr.No	Drug name	No of patients
1	T.Hyoscine butyl bromide	299
2	T.Cefuroxime	265
3	T.Rabeprazole+Domperidone	131
4	Inj.Diclofenac	196
5	Inj.camyloffin	196
6	C.staghorn (Herbal diuretic)	202
7	T.Drotaverin+mefenamic acid	81
8	T.Nitrofurantoin	53
9	T.Gama linolenic acid	16

Table 4: Distribution of drugs according to specific condition: Lower Backache.

Sr.No	Drug name	No of patients
1	T.Hyoscine butyl bromide	68
2	T.Cefuroxime	22
3	T.Rabeprazole+Domperidone	195
4	Inj.Diclofenac	15
5	Inj.camyloffin	12
6	T.Thiocolchicoside	13
7	T.Calcium carbonate	54
8	T.Nitrofurantoin	21
9	T.Pregabalin+Methylcobalamine	140
10	T.Gamma linolenic acid	133
11	T.Diclofenac+Thiocolchicoside	162

Table 5: Distribution of data according to average number of drugs for each disease.

Sr.No	Disease	Average
1	Hydronephrosis	5
2	Urolithiasis	4
3	Lowerbackache	4
4	Benign prostate hyperplasia	2

Water intake: 70.99% of the male and 57% of the females drank less than 2 liters of water per day.

Diet: 77.4% of the total population were on mixed diet (vegetarian and non vegetarian) and 22.6% of population were on a vegetarian diet.

DISCUSSION

In the present study, 1094 patients demographic and other pertinent information was collected. Males are

mostly affected with urology problems because they have an unhealthy life style without any diet restrictions and fluid intake was also less compared to females.

In the present study, we found that major risk factors in the patients with urologic conditions was improper dietary habits and decreased fluid intake. Most of the patients diet constituted foods that precipitate the stone formation. Rural population was affected more than urban and the reason could be decreased frequency of water intake.

1.Urolithiasis

Prevalence: According to European Association of Urology Guidelines (EAU) – 2015, Prevalence in two European countries Germany and Spain was found to be 4.7% and 5.6%. Higher prevalence is observed in males.^[9] According to the American Urological Association 2014, the overall prevalence of self-reported kidney stones in the period 2007-2010 was 8.8%, with a

higher prevalence among men (10.6%) than among women (7.1%).^[10] Bakane *et al*^[4] concluded that the incidence of Urolithiasis is fairly high in South East Asia including several regions of India. In India, upper and lower urinary tract stones occur frequently but the incidence shows wide regional variation. Similar to above observation, prevalence of Urolithiasis in our study was found to be 29.08%. It reveals that Asian population has the higher prevalence of Urolithiasis. The increase in prevalence may be due to modified dietary conditions, decreased fluid intake, and high intake of calcium and oxalate-containing foods.

Age: Peak incidence (both males and females) rates were similar among Korea, United States, and Japan, ranging from 40 to 49 years, except for Japanese women for whom the peak incidence ranged between age 50 to 59 years. The incidence rate for men varied from age 40 to 49 years in the United States and Japan but lower in Iran.^[7] In India, Durgawale *et al*^[11] reported that Urolithiasis was more prevalent among individuals between the age group of 30 to 60 years in Karad, a South West region in Maharashtra (India). Kaur *et al*^[12] observed that the highest incidence of renal stones in patients of Patiala, India was in the age group of 31-60 years. Apurba Marak *et al*^[13] also concluded that prevalence of urolithiasis is maximum in the age groups between 26-44 years in a Rural Area of Manipur and the total prevalence of urolithiasis was found to be 22.4%. Similarly in our study, occurrence of urolithiasis is maximum in the age group between 26 -40 (41.8%) years. From the above studies, it can be inferred that, Indians are more prone to urolithiasis than westners and the reasons could be food habits, drinking habits, environmental and genetical factors as observed by present and western studies.^[14]

Gender: In developing countries male-to-female ratio ranges from 1.15 to 1 in Iran^[15], 2.5 to 1 in Iraq^[16] and in developed countries 5 to 1 in Saudi Arabia^[17] and in U.S 1.3:1 male-to-female ratio^[18], Kaur *et al*^[12] reported that incidence in male and female was in the ratio of 3.3:1, in patients of Patiala, India. Durgawale *et al*^[11] reported urolithiasis was more predominant in males than females in Karad, South West region in Maharashtra (India). Males are predominately affected with urolithiasis in our study with a male to female ratio of 1.21 to 1 and the reason for predominance of urolithiasis in males was found to be very less water intake during working hours and mixed diet (vegetarian and non vegetarian) which mostly consists of fats, calcium and oxalate containing foods.

Symptoms: Sharma *et al*^[19] reported that majority of patients were admitted with the complaint of burning micturition (85%) and fever (77.5%). 30% of patients had gross haematuria and around 11.25% of patients were admitted with acute retention of urine. In the study conducted by Sepahi *et al*^[20] the main clinical presentations were fever, pain, irritability, dysuria and

haematuria. In contrast our study, patients complained about lower abdominal pain(76%) and burning micturition(13.7%).

Diagnosis: Primary diagnosis tool in our study was Ultra sound imaging, similar to the diagnosis and evaluation of European Association of Urology Guidelines^[9], where as a different format of diagnosis and evaluation was followed by the AUA.^[10]

Treatment: According to EUA guidelines, treatment was mainly based on stone size, type of stone and location of stone. NSAIDs and Opioids are primarily prescribed to the Urolithiasis patients. Alpha blockers are also used as a part in the Medical Expulsive Therapy(MET) to reduce the stone size.^[9] Whereas, AUA guidelines treatment approach was different from the above patterns. It is based on stone analysis review and follow up. Treatment pattern includes Diet therapy, Pharmacological therapy and follow up. Thiazide diuretics and Urinary alkalizers are mainly used in expulsion of stones and avoiding recurrent stone formation.^[10] In Contrast present study prescribing pattern for Urolithiasis was based on stone size only and drugs given were Non-steroidal anti-inflammatory drugs (NSAIDs) and antispasmodics for pain relief. A natural diuretic (staghorn) is recommended for reducing the formation of kidney stones and passing of stones. Antibiotics were given as prophylaxis. It was observed that the treatment pattern followed by the physician in our study reduces most of the symptoms of the patients.

Diet: We observed that majority of our patients with Urolithiasis were on a mixed diet (81.44%) that constitutes vegetarian and non-vegetarian food. Vegetarian(13.20%) and Non-vegetarian (4.37%). Dietary factors play a vital role in the formation of stones. Mixed diet contains high amount of calcium and oxalate which in turn form crystals in the kidney.

2. Hydronephrosis

Males are mostly affected with hydronephrosis. Most of the patients with hydronephrosis were observed to be in the age group between 26-40 years (45.48%). Occurrence of hydronephrosis in patients is due to decreased water intake and high intake of meat and leafy vegetables.

Prevalence: In U.S an autopsy series of 59,064 subjects ranging in age from neonates to geriatric persons reported hydronephrosis in 3.1%. In this series, differences based on sex did not become apparent until age 20 years. At age 20-60 years, hydronephrosis was more common in women, which was suggested to be due to pregnancy and gynaecologic malignancy. In men, prostatic diseases were indicated as the cause of the rise in prevalence after age 60 years. Autopsy studies also indicate that hydronephrosis is present in 2-2.5% of children. During pregnancy, this condition is identified in 1 percent of males and 0.5 percent of females. Typically, this condition is not associated with abnormalities in

other organ systems. The prevalence is slightly increased in children, most of them were less than age 1 year.^[21] Ester Garne *et al*^[22] reported that there were 3648 cases of neonatal hydronephrosis with an overall prevalence of 11.5 cases per 10,000 births in Europe. Prevalence in our study was found to be 32.3% in the adult population.

Symptoms: Rose BD *et al*^[23] concluded that symptoms vary depending on whether the hydronephrosis is acute or chronic. In acute obstruction, pain is frequently present due to distention of the bladder, collecting system or renal capsule. Pain is typically minimal or absent with partial or slowly developing obstruction. Along with above symptoms we also observed dysuria in our hydronephrosis patients.

Diagnosis: Ellenbogen PH *et al*^[24] stated that ultrasound imaging is very sensitive in diagnosing obstruction by demonstrating hydronephrosis in neonatals and adults. Carmody, JB *et al*^[25] stated that ultrasound imaging along with urine analysis is usually performed to determine the presence of infection, where as clinical manifestations of the patients and ultrasound imaging were primarily considered to diagnose the hydronephrosis in our study.

Treatment: Infants with severe hydronephrosis who are at greater risk for an underlying urologic abnormality, antibiotic prophylaxis (amoxicillin, 12 to 25 mg/kg PO daily) is started after delivery. Antibiotic prophylaxis in children with mild or moderate hydronephrosis confirmed postnatally has not been studied prospectively. In a retrospective study with mild persistent hydronephrosis, the use of prophylactic antibiotics reduced the risk of febrile urinary tract infections in patients who had vesiculo-urethral reflux.^[26]

Most commonly prescribed drugs for Hydronephrosis in our study were natural diuretic-57.06%(Herbal medicine-Staghorn) for destruction of newly formed stones, to clear the obstruction at urethra and decrease the accumulated fluid in the renal pelvices, Antispasmodics (34.39%) for pain relief, Antibiotics (22.08%) as prophylactic to treat infection, NSAIDs (13.62%) for Inflammation and Proton pump inhibitor+Anti emetic (9.10%) to prevent vomiting and gastric irritation.

Diet: In our study, most of the patients were on Mixed diet (82.76%) and fluid intake was very low (less than 1.5liters/day).

3. Benign Prostate Hyperplasia[BPH]

Age: According to AUA guidelines, the prevalence of BPH is age dependent, increasing from a prevalence of 6.8 episodes per 1000 patients to a high of 34.7 episodes in men aged 70 and older with moderate to severe Lower Urinary Tract Symptoms (LUTS).^[10] Another study has estimated that 90% of men between 45 and 80 years of age suffer some type of LUTS.^[27] Multiple observational studies from Europe, USA and Asia regions have demonstrated older age to be a risk factor for BPH onset

and clinical progression.^[28,29,30] Arright HM *et al*^[31] concluded similar prevalence rate of 20 % in 40 year old men and increases to 90% in seventies, similar findings of prevalence rate which is correlating our study, proving that BPH progresses with age.

Symptoms: According to EAU guidelines, typical symptoms of BPH are Bladder outlet obstruction (BOO) and Lower urinary tract symptoms such as urinary hesitancy, weak stream, nocturia, urinary incontinence, urinary retention, dysuria and recurrent urinary tract infections are observed^[9], similar to our patient complaints.

Diagnosis: According to AUA and EAU guidelines, Symptom Index (identical to the seven symptom questions of the International Prostate Symptom Score-IPSS) should be used as the symptom-scoring instrument in the initial assessment of each patient presenting with BPH. Digital rectal examination (DRE), urine analysis, prostate specific antigen (PSA) test and ultrasound imaging are also included in the initial evaluation of BPH.^[9,10] In Contrast we observed that diagnosis of BPH was based on symptoms followed by ultrasound imaging.

Treatment: According to AUA^[10] and EAU^[9] guidelines when LUTS, BOO symptoms predominate alpha-adrenergic blocking agents (Alfuzosin and Tamsulosin) are the first choice of treatment. Similarly, we observed same treatment pattern in our study.

4. Low backache

Prevalence: According to World Health Organization (WHO), lower backache is the most prevalent (50%), Musculoskeletal condition and according to American pain society, Low back pain is an extremely common condition. Though estimates vary widely, studies in developed countries such as U.S report point prevalence of 12% to 33%, one-year prevalence of 22% to 65%, and lifetime prevalence of 11% to 84%.^[32] Prevalence of Lower back ache in the present study was found to be 23.8%.\

In our study, Lower backache is not one of a Urologic condition but patients came to urology clinic with a symptom of lower back pain near kidney region with apprehension that it might be a kidney problem.

Treatment: Traditional NSAIDs, COX-2 inhibitors and muscle relaxant, accounted for 16.3%, 10%, and 18.5% respectively of total prescriptions for back pain in 2000. Among NSAIDs ibuprofen and naproxen accounted for most of the prescriptions (60%).^[33] Similar pattern of treatment was followed in our study.

In the present study, female are more affected with lower backache, because of household work, less calcium intake and due to hormones.

In our study, most of the patients with lower backache were observed to be in the age group between 41-50 years (36.95%). Strenuous work and lifting heavy weights without proper precautions are the two main reasons for lower backache. Patients with lower backache were mainly prescribed with NSAIDs and Muscle relaxant (19.4%), Anti-inflammatory agents (15.9%), Antispasmodics (9.57%), Proton pump inhibitor & Anti-emetics (23.35%) and Analgesics & Vit.B12 (16.76%).

Economic burden

On average 4-5 drugs were prescribed in conditions like urolithiasis and hydronephrosis. We found that the average cost of each prescription in Urolithiasis was Rs.1038/, Hydronephrosis -Rs.1140/-, BPH - Rs.310/-, Lower backache-Rs.460/- for 10 days treatment period.

CONCLUSION

We found that prevalence of urological conditions was mostly affected in the age group of 26-40 years. Of the total Patient population, Hydronephrosis, Urolithiasis, Lower back ache, BPH were more frequently observed. Male were predominantly affected by urologic conditions compared to female. There was an increase in the prevalence of Urolithiasis and hydronephrosis in our study compared to other studies. This increase in prevalence could be due to unhealthy dietary habits, decreased fluid intake and lifestyle changes. It is important to know the factors which lead to urolithiasis and hydronephrosis conditions, so that preventable measures can be taken.

Drugs that were mostly prescribed in our study were Antispasmodics, Antibiotics, Natural diuretic-herbal medicine (staghorn), Analgesics and Muscle relaxant. Patient education regarding the disease and awareness may reduce the prevalence and recurrence of the urologic conditions. All the urologic conditions observed were diagnosed appropriately and suitable treatment regimen was given as mentioned in the guidelines. Availability of clinical pharmacist in the hospital and providing services such as patient education programs, counselling about disease, drugs, diet and life style modification suggestions will significantly reduce the prevalence, recurrent rate and also reduces the economic burden on the patients and Government.

ACKNOWLEDGEMENTS

We thank Dr. Muni Prasad for his cooperation and valuable support. We also thank all the patients and caregivers for their cooperation.

REFERENCES

- Victoriano Romero, Haluk Akpinar, G.Assimos. Kidney Stones: A Global Picture of Prevalence, Incidence and Associated Risk Factors. *Rev Urol*, 2010; 12(2/3).
- Pietrow PK, Karellas. Medical management of common urinary calculi. *SA Fam Physician*, 2007; 49(3): 44-48.
- Bartoletti R, Cai T, Mondaini N, Melone F, Travaglini F, Carini M, Rizzo M. Epidemiology and Risk Factors in Urolithiasis. *Urol Int*, 2007; 79: 3-7.
- Bakane, B.C, S.B. Nagtilak, and B. Patil. Urolithiasis: A tribal scenario. *The Indian Journal of Pediatrics*, 1999; 66(6): 863-865.
- Kumar, Vinay; Fausto, Nelson; Fausto, Nelso; Robbins, Stanley L.; Abbas, Abul K. Cotran, Ramzi S. Robbins and Cotran Pathologic Basis of Disease (7th ed.). Philadelphia PA: Elsevier Saunders, 1012-14.
- Tamparo, Carol. Fifth Edition: Diseases of the Human Body. Philadelphia, PA: F. A. Davis Company, 441.
- Romero, H. Akpinar, and D G Assimos, Kidney stones: a global picture of prevalence, incidence, and associated risk factors. *Reviews in urology*, 2010; 12(2-3): e86.
- Taylor, E.N, M.J Stampfer, and GC Curhan. Obesity, weight gain, and the risk of kidney stones. *Jama*, 2005; 293(4): 455-462.
- European Association of Urology Guidelines (EAU) -2015.
- American Urological association (AUA) - 2015.
- Pushpa Durgawale, Anissa Shariff, Anup Hendre, Sangita Patil, Ajit Sontakke Chemical analysis of stones and its significance in urolithiasis. *Biomedical Research*, 2010; 21(3): 305-310.
- Kaur, H., et al., Analysis of biochemical profile of renal stones referred to advanced Biochemistry laboratory of a multispecialty tertiary care Hospital in Punjab. *European Journal of Experimental Biology*, 2012; 2(3): 543-546.
- Apurba Marak, Shantibala K, Th. Achouba Singh, RK Narendra Singh, L Shantikumar Singh. Urolithiasis: Prevalence And Related Factors In A Rural Area Of Manipur. *jmsph*, 2013; 22(07): 201-31.
- Alberto N. Epidemiology of urolithiasis:an update. *Clin Cases Miner Bone Metab*; 2008; 5(2): 101-6.
- Safarinejad MR. Adult urolithiasis in a population based study in Iran: prevalence, incidence and associated risk factors. *Urol Res*, 2007; 35: 73-82.
- Qader DS, Yousif SY, Mahdi LK. Prevalence and etiology of urinary stones in hospitalized patients in Baghdad. *East Mediterr Health J*, 2006; 12: 853-61.
- Khan AS, Rai ME, Gandapur G, Pervaiz A, Shah AK, Hussain AA. Epidemiological risk factors and composition of urinary stones in Riyadh, Saudi Arabia. *J Ayub Med Coll Abbottabad*, 2004; 16: 56-8.
- Scales CD, Curtis CH, Norris RD, Springhart WP, Sur RL, Schulman KA. Changing gender prevalence of stone disease. *J Urol*, 2007; 177: 979-82.
- Sharma, GR. Clinical presentations of urolithiasis: a prospective study in Referral Centre. *Pain*, 77: 96.3.

20. Sepahi, M.A, A Heidari and A Shajari. Clinical manifestations and etiology of renal stones in children less than 14 years age. *Saudi Journal of Kidney Diseases and Transplantation*, 2010; 21(1): 181.
21. Strandhoy JW, Assimis, DG. Kavoussi LR, Novick AC, Partin AW, Peters CA, Wein AJ, eds. Pathophysiology of urinary tract obstruction. *Campbell-Walsh Urology*, 2007; 2: 2: 27-73
22. Ester Garne, Maria Loane, Diana Wellesley, Ingeborg Barisic. Congenital hydronephrosis: Prenatal diagnosis and epidemiology in Europe. *Journal of Pediatric Urology*, 5(1): 47-52.
23. Rose BD, Black RM. *Manual of Clinical Problems in Nephrology*. Boston, Mass: Little, Brown & Co, 1988; 337-343.
24. Ellenbogen PH, Scheible FW, Tanner LB. Sensitivity of grayscale ultrasound in detecting urinary tract obstruction. *AJ R*, 1978; 130: 731-733.
25. Carmody, JB; Carmody, RB. "Question from the clinician: management of prenatal hydronephrosis". *Pediatric Rev*; 2011; 32(12).
26. Marangella M, Bagnis C, Bruno M, et al. Crystallization inhibitors in the pathophysiology and treatment of nephrolithiasis. *Urol Int*, 2004; 72(1): 61026.
27. Wasson J, Reda D, Bruskewitz R. A comparison of transurethral surgery with watchful waiting for moderate symptoms of benign prostatic hyperplasia. The Veterans Affairs Cooperative Study Group on Transurethral Resection of the Prostate. *N Engl J Med*, 1995; 332: 75.
28. Taylor BC, Wilt TJ, Fink HA, Lambert LC, Marshall LM, Hoffman AR. Prevalence, severity, and health correlates of lower urinary tract symptoms among older men. The MrOS study *Urology*, 2006; 68: 804.
29. Wei JT, Calhoun E, Jacobsen SJ. Urologic diseases in America project: Benign prostatic hyperplasia. *J Urol*, 2005; 173: 1256-61.
30. Kok ET, Schouten BW, Bohnen AM, Groeneveld FP, Thomas S, Bosch JL. Risk factors for lower urinary tract symptoms suggestive of benign prostatic hyperplasia in a community based population of healthy aging men: The Krimpen study. *J Urol*, 2009; 181: 710-6.
31. Arrighit HM, Metter EJ, Guess HA, Fozzard JL. Natural history of benign prostatic hyperplasia and risk of prostatectomy; The Baltimore Longitudinal Study of Aging. *Urology*, 1991; 38(1): 4-8.
32. Walker Bf. The Prevalence of Low Back Pain: A Systematic Review Of The Literature From 1966 To 1998. *J Spinal Disord*, 2000; 13(3): 205-217.
33. Luo X, Pietrobon R, Curtis LH, Hey LA. Prescription of nonsteroidal anti-inflammatory drugs and muscle relaxants for back pain in the United States; Health services research. *Spine*, 2004; 29(23): E531-E537.