

ORIGINAL ARTICLE

Study on Uroliths Composition in Tertiary Care Hospital of Pakistan

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ABSTRACT

Background: Identification of risk factors for urolith stones formed in the urinary tract could help in preventing the recurrence. Urolith stones analysis utilized modern technology which is unfortunately not done in Pakistan on a routine basis. Development of renal failure may occur due to complications and urinary tract affected by uroliths.

Objective: The current study aims to determine the composition of urolith stones seen in patients admitted in single Centre in Pakistan.

Materials and Methods: This cross-sectional study was carried out on urolithstones composition surgically removed through minimum access procedure at Urology department of Ayub Teaching Hospital, Abbottabad for period of six months from October 2020 to March 2021. Urinary stones composition was measured through qualitative tests such as infrared and crystallography spectroscopy. Statistical analysis was performed in SPSS version 20.

Results: A total of 82 patients with mean age \pm SD 45.3 \pm 11.7 years having urinary stones were investigated in this cross-sectional study. Male to female ratio was 1.9:1. Male patients (54) (65.85%) were dominant over females (28) (34.15%) in term of stones removal. A high occurrence for urinary stones was bladder or upper urinary tract (81.6%) irrespective of their gender. Calcium containing stones were predominant in ureter, urethra and renal followed by struvite stones (56.8%). Two-third stones in struvite stones were in lower tract while uric acid, calcium phosphates and calcium oxalate were found in upper tract. Calcium oxalate account for 92.60% with mixed composition stones.

Conclusion: Our study concluded that the majority of uroliths constitute calcium oxalate or phosphates and struvite stones in our setting. Uroliths formation is caused by urinary tract infection as indicated in our study. Calcium oxalate was the most common among these stones. Struvite stones were the least common one. The prevalence of stones was dominant in male patients compared to female patients. The anatomical location for calcium oxalate and struvite stones was lower tract and bladder respectively.

Keywords: Uroliths, Composition, Calcium oxalate, Struvite stone

INTRODUCTION

Majority of referral to Urology clinics presents urolithiasis as a common cause. Uroliths comprise of renal, bladder and urethral calculi or stones in the urinary tract [1]. These tiny solid masses formed from minerals present in urine. The excessive quantities form stones through precipitation [2]. Calcium oxalate existing in these substances could be either monohydrate or dehydrate form, magnesium ammonium phosphates known as struvite, uric acid and calcium phosphate. Urolithiasis is most common among developed countries and their prevalence increases day by day throughout the world [3-5]. In the USA, kidney stones prevalence among the adult population increased by 9% within three years' time span from 2007 to 2010 [6]. Worldwide as well as in Pakistan, uroliths proportions are dominant in male patients compared to females [7, 8]. Recurrence of stones occurs in 50% cases within 10 years and 75% within 20 years without metapylaxis as estimated by another study [10]. Urinary stones composition can assist in risk factors identification for their development, proper treatment and recurrence prevention [11]. Prime cause of stones formation should be analyzed as suggested by both American Urologist Association (AUA) and European Urology Association (EUA) [12]. Kidney stones analysis could be carried out with various

techniques having particular advantages and limitations over each other. Wet chemical analysis is the exceptionally poor method due to higher error ratio and lower accuracy in differentiating calcium oxalate stones besides its only ability to identify single radicals and ions [13, 14]. X-rays diffraction and Infrared spectroscopy are the effective techniques among all and suggested by EUA besides a reliable polarization microscopy [15, 16]. In Pakistan, kidney stones analysis is not carried out on routine basis despite recognized Urological authorities recommendations. One study conducted in Pakistan based on kidney stone analysis reported that more than 50% doctors did not do stone analysis and 40% consider it unnecessary [17]. Wet chemical analysis is utilized with numerous limitations while attempting stones analysis. With increasing trend of stone disease being on the verge, Etiology, recurrence prevention and management are the key parameters to look upon for determining the stones composition. Types of stone vary based on the presence of cystine, calcium phosphate, struvite (magnesium ammonium phosphate), uric acid and calcium oxalate. Family history, prior occurrence, dehydration, metabolic disorder such as hyperparathyroidism, diuretics drugs and urinary tract infection are the common risk factors for urolithiasis. The current study aims to determine major

composition of urolith stones and their retrieval during surgeries for urolithiasis in Pakistan. This study will compare the stones composition methods in Pakistan with other parts of world.

MATERIALS AND METHODS

Study Design, Setting and Population: This cross-sectional study was carried out in the Urology department of Ayub Teaching Hospital, Abbottabad for period of six months from October 2020 to March 2021. Stones cleaning with distilled water, dried with air and weighting are the pre-requisite for chemical analysis. Nucleus was examined in each stone by cutting in two parts. Periphery and nucleus analysis must be carried out separately in the presence of nucleus. Pestle and porcelain mortar was used to crush the stone and Salter and McIntosh techniques were used for chemical analysis of stones in powder form. Demographic parameters such as stone location, gender and age were reviewed for each individual. Consecutive selection technique was used for adult patient's age above 18 years who underwent through urinary tract stone retrieval surgeries. The retrieved stones were sent for chemical analysis within the study duration. Urinary stones composition was measured through qualitative tests such as infrared and crystallography spectroscopy. Statistical analysis was performed in SPSS version 20.

Inclusion and Exclusion Criteria: History of surgery for stone retrieval and consenting adult patients aged above 18 years were enrolled in this study. Paediatric and adult patients who declined consent form and had gall bladder stones were excluded.

Ethical Considerations: Prior to conduct the study, ethical approval were taken from the respective institute ethical board. Consent form was obtained from each individual participant in written form.

Statistical Analysis: SPSS version 20 was used for data analysis. Categorical variables such as age, gender and stone size were calculated in term of frequency and percentage. Categorical variables were compared using chi-square test. Statistical significance value for p was set < 0.05 .

RESULTS

A total of 82 patients with mean age \pm SD 45.3 ± 11.7 years having urinary stones were investigated in this cross-sectional study. Male to female ratio was 1.9:1. Male patients (54) were dominant over females (28) in terms of stones removal. A high occurrence for urinary stones was bladder or upper urinary tract (81.6%) irrespective of their gender. Calcium containing stones were predominant in ureter, urethra and renal followed by struvite stones (56.8%). Two-third stones in struvite stones were in the lower tract while uric acid, calcium phosphates and calcium oxalate were found in the upper tract. Calcium oxalate accounts for 92.60% with mixed composition stones. Of 83 urolith stones received during study period, one patient with three stones at bladder, ureter and renal anatomical location was excluded. All the participants had aged above 18 years. Patients within the age limit 30-49 years group had proportion of stones in both genders. Table 1 demonstrates the gender and agewise distribution among total participants of the urinary stones. The urinary stones'

anatomical location varied with age and gender but with no statistical significance.

Table 1. Demographic distributions among total participants (82)

Age groups (years)	Male (%)	Female (%)	Total Number (%)
18-30	4 (7.4)	2 (6)	6 (7.3)
31-49	28 (51.9)	16 (58.26)	44 (53.7)
50-69	17 (31.5)	9 (32.14)	26 (31.7)
>70	5 (9.20)	1 (3.6)	6 (7.3)
Total	54 (100)	28 (100)	82 (100)

Comparison made based on urinary stones anatomical location between male and female as shown in Table 2 reported that prevalence of stones among male and female in bladder were 35.7% and 50% respectively. However, ureteric stones proportions were 21.4% and 41.7% among males and females respectively. Renal stones follow bladder stones with 31.4% in male patients. Bladder stones were in highest number except for those patients whose age fell within the 50-69 years age group.

Table 2: Gender distribution based on stones anatomical location

Gender	Renal n (%)	Ureteric n (%)	Urethral n (%)	Bladder n (%)	Total n (%)
Male	12 (60)	11 (64.70)	8 (100)	23 (62.12)	54 (65.85)
Female	8 (40)	6 (35.30)	0 (0)	14 (37.88)	28 (34.15)
Total	20 (100)	17 (100)	8 (100)	37 (100)	82 (100)

Table 3: Bladder stones composition

S. No	Compositions	Frequency (%)
1	Calcium Oxalate + Magnesium Ammonium Phosphate	7 (18.9)
2	Magnesium Ammonium Phosphate+ Calcium Phosphate	15 (40.54)
3	Magnesium+ Calcium Phosphate+ Calcium Oxalate	1 (2.7)
4	Ammonia + Calcium Phosphate	2 (5.4)
5	Magnesium Ammonium Phosphate	11 (29.72)
6	Calcium + Ammonia + Magnesium	1 (2.7)
Total		37 (100)

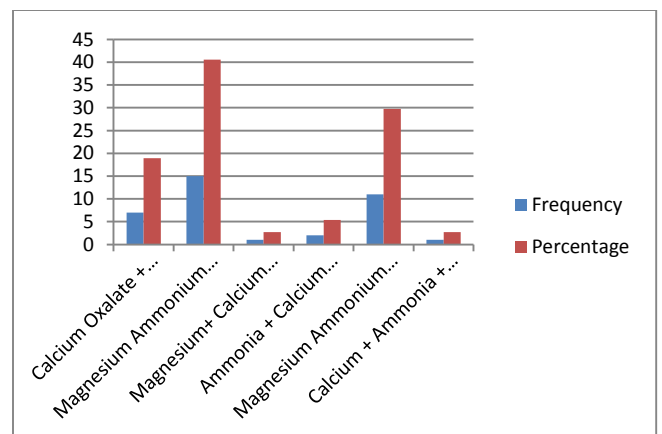


Figure 1 Composition of Bladder Stones

Mixed compositions were found among all the 82 (100%) stones. None of the stones was pure one. The highest prevalence of calcium containing stones was 92.60% with exception of struvite made of magnesium ammonium phosphates. Separate analysis was carried out

in both genders with highest bladder stones composition. The higher occurrence accounts for (92.60%) in magnesium ammonium phosphate alone or combined with others. The chemical composition of stones present in the bladder is shown in Table 3 and Figure 1.

DISCUSSION

The present study reports higher urolithiasis was found in male patients compared to females. Other researchers [18] found similar findings in their study with male to female ratio 3.3:1, 1.35:1 and 1.8:1 respectively. The reason for higher prevalence in male patients might be stone formation promoted by androgens at high levels in male compared to female suppressive estrogens in stone formation [19]. Another study conducted on a higher male to female ratio of 6:1 found male strenuous activities are the key contributor in higher prevalence of stones formation in male. Genetic factors and climate changes especially in African countries cause dehydration in male and stone formation recurrence [20]. However, this could not explain the high incidence of urolithiasis. Our study finding that stones formation occurs in the majority of middle-aged patients was reported by many researchers with the argument that urinary stones disease peaks in 5th decades of life [21]. This could be explained by providing evidence that mostly male in this decade go out for outdoor work and exposure to tropical heat and dehydration for a long period of time. This age group also has a high risk factor of obesity [22].

Many researchers from India, China and Kenya found that stone mostly lie in the upper tract so as in our study [23]. Another study conducted in Nigeria showed contradictory results that 55.7% stones [24] and 75.6% [25] form in the lower urinary tract. Patients presented to surgery might miss small stones if open surgery procedure was followed. Open surgery is the main modality of treatment for stones. Prostate enlargement and urethral stricture surgery found stones in the lower urinary tract incidentally. In our study 67.3% (55) stones were located in the kidney irrespective of endoscopic surgical procedure contrasting the other studies. Urolithiasis constitutes mainly monohydrated or dehydrated or mixed form with other stones. Similar findings were reported in studies conducted in the USA [26] and Europe [27]. Some studies reported calcium oxalate stones were the most prevalent type followed by uric acid stones [28, 29].

The peak age for calcium oxalate stones being the commonest stones were 41-50 years as observed in our study. Study conducted in Asia found calcium oxalate in both genders as a commonest stones similar to our findings [30]. But the age range for peak calcium oxalate was between 31 and 40 years. Struvite stones are most common among women and patients having more than 50 years of age due to more susceptibility to urinary tract infections [31]. In our study, the frequency of male patients above 50 years had two or three cases with struvite stones. The third patient was a female. Obstruction of bladder outlet among elder male patients is more susceptible to urinary infection and stasis which explain struvite stones higher proportion among patients. Most of the stones in the upper urinary tract are calcium oxalate stones while bladder constitutes two out of third struvite stones. In our

study, no rare stones like matrix, cystine and drug-induced were found. Cystinuria is found to be existing in 1:600 to 1:17000 individuals [32]. Diagnostic dilemma often presented by rare existing stones known as matrix stones [33].

CONCLUSION

Our study concluded that the majority of uroliths constitute calcium oxalate or phosphates and struvite stones in our setting. Uroliths formation is caused by urinary tract infection as indicated in our study. Management options must be defined for advance analysis of urolith stones. Most stones in our study were of mixed composition. Calcium oxalate was the most common among these stones. Struvite stones were the least common one. The prevalence of stones was dominant in male patients compared to female patients. The anatomical location for calcium oxalate and struvite stones was lower tract and bladder respectively.

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