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Chemical Analysis of Urinary Stones at Tribhuvan University Teaching Hospital.

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Abstract

Introduction: Urinary Stone (Urolithiasis) is a common problem all over the world, and its prevalence is higher in those who lives in mountains, deserts, tropical and subtropical areas. The notorious nature of its recurrence is a great challenge to the treatment of urinary stone disease.

Urinary stone is the third most common problems of urinary tract, exceeded only by urinary tract infection, and pathological conditions of the prostate. Worldwide prevalence of urinary stone disease is increasing day by day. The present study focuses on the demographic distribution and chemical analysis of the urinary stones of the patients undergoing surgical intervention.

Methods: A prospective, descriptive study was carried out over a period of one year from July 2006 to July 2007 at department of General Surgery, Urology unit, Tribhuvan University Teaching Hospital Kathmandu. There was a total of 4124 patients admitted in surgical ward. Among them 153 patients were admitted at Urology unit and stones of 50 patients who underwent surgical intervention were sent for biochemical analysis of stone at National Reference Laboratory Kathmandu.

Results: Urinary stones with the male to female ratio was 1.5:1. Urinary stone was found more common in hilly area of Nepal which was 64.0%. The most common urinary stone was Calcium Oxalate, 66.0%.

Conclusion: The study revealed that majority of the patients were between 20 to 29 years of age in which 60.0%were male and 40.0%female. 64.0 % of stones were seen in Hilly area of Nepal, and calcium oxalate was the most common types of urinary stone.

Keywords: Urinary stone, RAHS.

Introduction

Urinary stones have affected humankind since antiquity. The earliest recorded case of bladder and kidney stone detected was in Eygyptian mummies at 4800 B.C.[1]Urinary stone disease is worldwide, and prevalence is higher in those who live in mountains, deserts, tropical and subtropical areas. The etiology of urinary stone is not established yet, and is thought to be multifactorial such as low socioeconomic status, hot/humid climate, dietary habits and low fluid intake etc.

Urinary calculi are third most common problems of urinary tract, exceeded only by urinary tract infection, and pathological conditions of the prostate.[2] Prevalence in India is 15%, Pakistan 12%, Bangladesh 4%[3] and Nepal is not an exception. Worldwide prevalence of urinary stone disease is estimated 1 to 5 %. In developed countries 2-13% and developing countries 0.5-1%.[4]The recurrent rate without treatment of calcium oxalate stone is about 10% at one year, 35% at five year and 50% at ten years.

Tribhuvan University Teaching Hospital is one of the referral center of Nepal where major urological and urological stone surgery has been conducted since 1982. The present study focuses on the demographic distribution and chemical analysis of the urinary stones of the participants.

Methods:

This study was conducted at the Tribhuvan University Teaching Hospital, Department of General Surgery, Urology unit, Kathmandu. The study proposal was approved by Tribhuvan University Teaching Hospital. Total 4124 patients were admitted in surgical ward. Among them 153 patients were admitted at Urology unit, among them 50 patients underwent surgical intervention for urinary stones. Sones of these patients were sent for biochemical analysis at National Reference Laboratory Kathmandu from July 2006 to July 2007. The recommended sample size was 50.

Analysis of Urinary Stones

- Morphological analyses were done before pulverizing the calculus for chemical analysis.
- The stone was made powder form for testing.

Procedure

Flame test:

A metallic seeding loop was immersed into distilled water, then into the calculus powder, and then brought to the flame. The carbonization or the disappearance of the powder was the sign that the components are mostly of organic origin. The absence of carbonization showed that calculus was mineral origin.

Qualitative Chemical tests

Results	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
	Carbonate Calculus Powder 50 mg+ R110 drops =M1 ↓	Cystine 1 drop M1 +R3 1 drops Mix & let stand for 5 minutes + R4 1 drop ↓	Phosphate 1 drop M1+R5 2 drops Mix & let stand for 5 minutes ↓	Magnesium 1 drop M1+ R6 1 drop + R2 % drops Mix ↓	Calcium 1 drop M2+R2 1drop + R7 2drops Mix ↓	Ammonium 1 drop M1+ R2 1 drop + R8 1 drop Mix ↓	Uric acid 1 drop M1 + R2 1 drop + R9 1 drop Mix ↓	Oxalate Remaining mixture M1 +R10 10 mg approx . Wait for few seconds
Positive Result	Effervescence Note 2	Red color	Blue color	Blue precipitate	Yellow color	Orange brown precipitate	Orange color	Effervescence Note 2
Negative Result	Absence of Effervescence	Yellow color	No change in color	Absence of precipitate purple color	Orange color	Yellow color	No change in color	Absence of Effervescence

1. M1= Mixture of calculus powder (50mg)+R1 (10 drops)
2. M2= Mixture of 50ml M1+ 5 ml distilled water
3 Reagent solutions:

a. a. R1: Hydrochloric acid
b. R2: Sodium hydroxide
c. R3: 1st reagent for cysteine determination (NaOH, Sodium cyanide)
d. R4: 2nd reagent for cysteine determination (Sodium nitroprusside)
e. R5: Reagent for phosphate determination (Sulphuric acid, ammonium molybdate, Ferrous sulphate)
f. R6: Reagent for magnesium determination (NaOH, Paranitrophenylazoresorcinol)
g. R7: Reagent for calcium determination (KOH, Calcein)
h. R8: Reagent for ammonium determination (Potassium iodide, Mercuric iodide)
i. R9: Reagent for uric acid determination (Acetic acid, Neocuproine, Copper sulphate)
j. R10: Reagent for oxalate determination (Manganese dioxide)

Statistical Analysis

Data entry was done in Epi-data 3.1 version. After collection of data, it was checked out systematically then edited, coded and entered. A data analysis was done in IBM SPSS 16.0 version. Quantitative data were summarized by using mean and standard deviation but for categorical data was summarized by frequency and percentage.

Results

Table 1: Sex wise distribution of urinary stone (n=50)

Sex	Number	Percentage
Male	30	60.00%
Female	20	40.00%
Total	50	100%

Table 2: Age wise distribution of urinary stone (n=50)

Age in year	Ecological Zone			Total
	Mountain	Hill	Terai	
10-20	1 (20.00%)	2 (40.00%)	2 (40.00%)	5 (10%)
20-30	0 (0.00%)	9 (90.00%)	1 (10.00%)	10 (20%)
30-40	11 (11.11%)	6 (66.67%)	2 (22.22%)	9 18%
40-50	0 (0.00%)	7 (58.33%)	5 (44.67%)	12 24%
50-60	1 (8.33%)	6 (50.00%)	5 (41.67%)	12 24%
60-70	0 (0.00%)	1 (100%)	0 (0.00%)	1 2%
70-80	0 (0.00%)	1 (100%)	0 (0.00%)	1 2%
Total	3 (6.00%)	32 (64.00%)	15 (30.00%)	50 (100%)

The above table 1 and 2 shows that, the almost three fifth of the population are male and remaining of the two fifth of the population are female. 40-60 years of age have more urinary stone. The hilly population (64.00%) have almost two times more common urinary stone than terai(30.00%) and mountain (6.00%) respectively.

Table 3: Urinary stone according to sex and ecological belt (n=50)

Ecological Zone	Sex		Total
	Male	Female	
Mountain	**2 (66.67%)**	**1 (33.33%)**	**3 (6.00%)**
Hill	**19 (59.38%)**	**13 (40.62%)**	**32 (64.00%)**
Terai	**9 (60.00%)**	**6 (40.00%)**	**15 (30.00%)**
Total	**30 (60.00%)**	**20 (40.00%)**	**50 (100%)**

Table 4: Chemical composition of urinary stone (n=50)

Chemical composition of urinary stone	Number	Percentage
Calcium oxalate	**33**	**66.00%**
Calcium phosphate	**4**	**8.00%**
Magnesium carbonate oxalate	**3**	**6.00%**
Magnesium ammonium oxalate	**3**	**6.00%**
Calcium carbonate phosphate	**2**	**4.00%**
Calcium carbonate	**1**	**2.00%**
Struvite	**1**	**2.00%**
Calcium magnesium oxalate	**1**	**2.00%**
Ammonium oxalate	**1**	**2.00%**
Calcium carbonate oxalate	**1**	**2.00%**
Total	**50**	**100%**

Table 3 and 4 shows that, the hilly population have higher incidence rate of urinary stone (64.00%), in which male have higher incident rate (59.38%) than female (40.62%). The urinary stone of calcium oxalate is more common (66.00%) whereas calcium carbonate, struvite, calcium magnesium oxalate, ammonium oxalate and calcium carbonate oxalate were the least common ones (2.00%).

Discussion

Urolithiasis is one of the most common problems all over the world. It is the third most common urological disease after urinary tract infection and prostatic disease all over the world and also in T.U. Teaching Hospital (Annual report 2062-63 TUTH, Medical record).

The study has shown that urolithiasis is more common in male than female. Peters et al reported that, it is 4:2 times more in male as compared to female.[6] In our study, male: female ratio of urolithiasis is 1.5:1 which is similar to 1.64:1, a study conducted at B.P.K I.H.S, Dharan, Nepal, department of surgery.[7] Study conducted at NMCTH, Kathmandu male to female ratio of urolithiasis was 2:1 in 47 participants.[10] In Saudi Arabia male to female ratio was 5:1 where urolithiasis was high among male.[7]

In a study conducted in India, in 1989 by Sharma R.N et al, which is one of the high- incidence zones for urinary stone disease in this subcontinient[5,8,9],calcium oxalate stones were 86.1%, phosphate 4.9% of cases. Magnesium ammonium phosphate(2.7%), pure calcium phosphate(1.9%), uric acid(1.2%) and cysteine was found to be prevalent in 0.4% cases while 0.4% were the other types. A study conducted by S.A.H Rizvi et al showed the calcium oxalate urinary stone as the most common urinary stone in this region (India 74%, Pakistan 65%, Bangladesh 87%) and in Saudi Arabia 66%.[3]

In our study also, the prevalence of calcium oxalate was the most common among the urinary stone types (66%). The mixed phosphate stone were in 6%, mixed oxalate were 6%, magnesium ammonium phosphate (Struvite) in 2%.

In a study conducted at NMCTH, Kathmandu, calcium oxalate plus calcium phosphate stones were found in 31 patients (65.9%). The other findings were calcium oxalate plus calcium phosphate and uric acid (21.2%), calcium oxalate and uric acid 8.5%, and calcium phosphate plus uric acid 4.2%.[10]A study conducted over 66 patients, at BPKIH, Dharan showed calcium oxalate plus calcium phosphate 48.43%, magnesium ammonium phosphate 12.5%, calcium oxalate 17.18%, calcium phosphate 16.25%, calcium carbonate 1.65% and other mixed types.[7]

In astudy conducted in Saudi Arabia, a majority of the urinary stones were composed of calcium oxalate (78%) followed by uric acid (19%) and phosphate stones (3%). No cysteine stone was found the series.[11] Similarly study conducted in 2000 at Multan region of Pakistan by Rafique et al, the commonest variety of urinary stone were uric acid (28.1%) calculi, followed in frequency by calcium oxalate calculi (26.1%), mixed calculi containing calcium oxalate and uric acid (21.8%) and calculi containing calcium oxalate and calcium phosphate (10.4%).[12]

Conclusion

The study revealed that majority of the patients were between 20 to 29 years of age in which 60.0%. Most common age group were between 40-59 years of age which was 48%,were male and 40.0% female. 64.0 % of stones were seen in Hilly area of Nepal, and calcium oxalate was the most common types of urinary stone.

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