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PREVALENCE OF RISK FACTORS IN KIDNEY STONE PATIENTS IN TERTIARY CARE CENTRE IN JALGAON, MAHARASHTRA, INDIA

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ABSTRACT

Background: The formation of kidney stones is affecting a large number of people in various age groups worldwide. Identification of risk factors and preventive measures is of great importance in reducing the prevalence of kidney stone disease in the population.

Methods: A cross-sectional study involving a population of 100 renal stone patients was conducted in Dept. of Surgery, DUPMC&H, Jalgaon, Maharashtra, India. The objective of the study was to estimate the prevalence of risk factors for kidney stone patients.

Results: Among the sample of 100 patients of age group 4-75 years, the highest prevalence was noted among those of age 40 and above (S.D.= 17.661). CT scan findings suggested that the volume of renal stones ranged from a minimum of 0.5 cm^3 to maximum of 29.7 cm^3, with a standard deviation of 4.8884.

Conclusions: Study concludes that kidney stone formation is showing variability with age, sex, race, ethnicity, geography, climate, occupation, daily water intake and dietary habits in Jalgaon district. Cases were predominantly among males, those aged around 40, consuming less than 2 liters of water per day. Those who consumed foods rich in meat and oxalates were found to be at high risk. The right upper calyx of kidney was found to be the predominant location for the largest obstructive calculi.

Index terms: Epidemiology, Kidney stone, Calculi, Risk factors

Introduction

- Kidney stone disease is a common clinical problem worldwide. It is the formation of stones in kidney by the successive physicochemical events of supersaturation, nucleation and aggregation, which eventually culminates in retention of stone.[2]

  The epidemiology of nephrolithiasis differs according to geographical area in terms of prevalence and incidence, age and sex distribution, eating habits, sources of drinking water etc. Data studies show rising global prevalence of nephrolithiasis. Risk of developing nephrolithiasis in adults appears to be higher in the West (4% in Germany, 5-9% in Europe, 10-12% in Canada and 13-15% in US) than in the East.[5] Nephrolithiasis is common in ages of 40-49 years in the US; 50-59yrs in Japan.[3] High risk of nephrolithiasis has also been found in Asian and third world countries such as Saudi Arabia, India, Malaysia, Thailand etc.[3]

  In India, urolithiasis affects 2 million people every year. The "stone belt" occupies parts of Maharashtra, Gujarat, Rajasthan, Punjab, Haryana, Delhi and states of North east.[1] Stone patients from North India were found to have a high rate of consumption of oxalate rich foods, dairy products, and alcohol.[6] In India, 12% of population is estimated to have renal stones, out of which 50% may progress to renal damage or loss of renal function.[1] Nearly 15% of people from Northern India are affected with kidney stones. Prevalence of nephrolithiasis in Indian males is 10.60% while that is females is 7.10%.[3]

  Kidney stone disease has gained increasing significance because of its rising prevalence, and also due to its tendency to recur within 5 to 10 years.[3] Epidemiological studies indicate that factors like age, sex, race, ethnicity, geography, climate, occupation, socioeconomic status, daily water intake and dietary habits of an individual influence kidney stone formation and recurrence.[1]

  Food patterns are among the major factors for renal stone formation. In the context of Indian diet, there is a collection of different tastes and food products. Several communities in the country are vegetarian, although there is still a large range of non-vegetarian recipes. Increased urinary calcium excretion is attributed to animal proteins. Oxalate stones are a result of diets rich in spinach, tomatoes, beetroot, sweet potatoes and almonds. This food pattern in Indian culture attributes to high incidence of nephrolithiasis specially in the "stone belt".[1] An equally crucial factor is the frequency or amount of water consumption, hard/soft water and the sources from which these populations obtain drinking water.

- **METHODOLOGY**

Sample Collection and Preparation

This hospital-based study conducted in Department of Surgery, DUPMC&H, Jalgaon, Maharashtra, India involved voluntary and symptomatic patients who were admitted to the Surgery Ward with diagnosis of renal calculi. It was conducted for a duration of 9 months from May 2021 to February 2022. Printed form of questionnaire was used and some of the relevant information about the patients was obtained from case history. After taking informed consent, patients were given a self-administered questionnaire, details of which included age,

sex, smoking habit, food habits, residing area, daily intake of water, previous history of kidney stone and heredity of kidney stone disease.

Statistical Analysis

Statistical analysis was performed using Minitab-13 & MS-Excel.
The results were expressed as mean & standard deviation for quantitative data. The qualitative data was presented with frequency and percentage.

1. Qualitative data analysis according to source of drinking water, frequency of urination, presence of comorbidity, freq. of intake of meat and oxalate rich foods, daily water intake and total no. of stones found, expressed in terms of frequency and percentage.

Variable	Groups	Frequency	Percent
SOURCE OF DRINKING WATER	BOREWELL	22	22.0
	TAP WATER	78	78.0
FREQ. OF URINATION	< 5 PER DAY	7	7.0
	> 5 PER DAY	93	93.0
ANY COMORBIDITY	NO	80	80.0
	HYPERTENSION	18	18.0
	DIABETES	2	2.0
FREQ. OF INTAKE OF OXALATE RICH FOOD	< 3 PER WEEK	8	8.0
	> 3 PER WEEK	92	92.0
FREQ.OF INTAKE OF MEAT	<1 PER WEEK	16	16.0
	> 1 PER WEEK	76	76.0
	VEGETARIAN	8	8.0
DAILY WATER INTAKE	< 2 L PER DAY	85	85.0
	> 2 L PER DAY	15	15.0
TOTAL NO. OF STONES	1	74	74.0
	2	20	20.0
	3	6	6.0

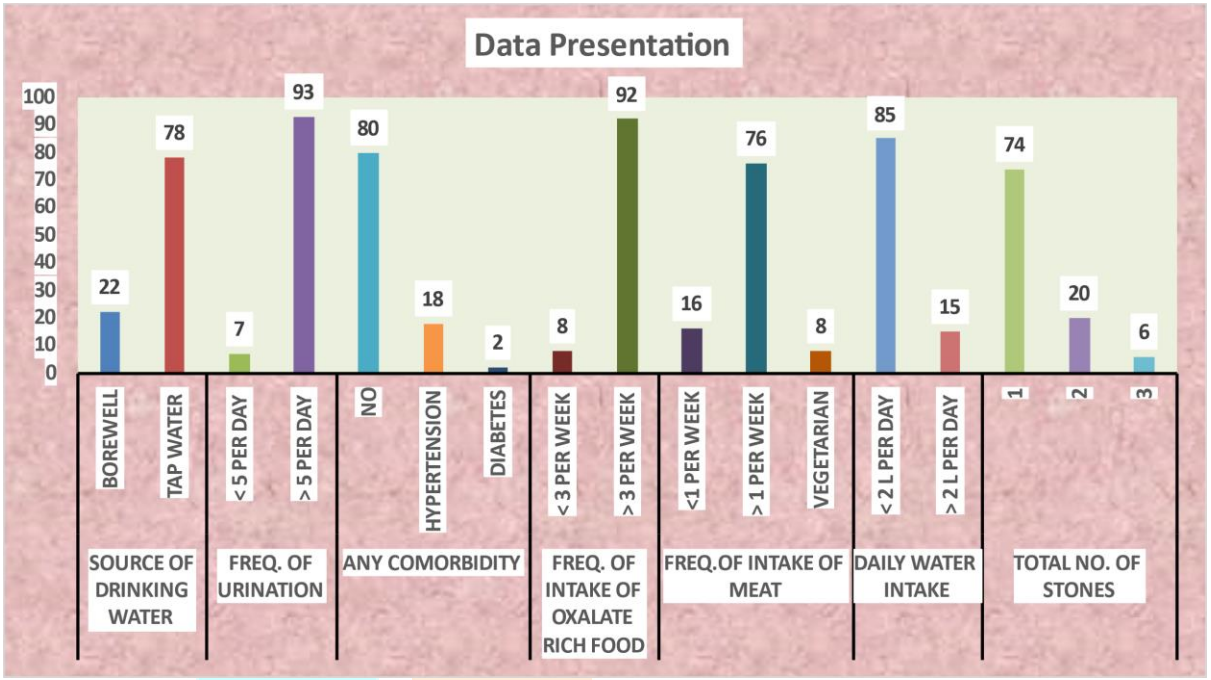
2. Distribution of patients according to sex, occupation, type of family, family history and use of tobacco and alcohol.

Variable	Groups	Frequency	Percent
SEX	MALE	57	57.0
	FEMALE	43	43.0
OCCUPATION	CARPENTER	6	6.0
	FARMER	29	29.0
	HOUSEWIFE	26	26.0
	LABOURER	14	14.0
	STUDENT	13	13.0
	TAILOR	10	10.0
TYPE OF FAMILY	NUCLEAR	13	13.0
	JOINT FAMILY	87	87.0
FAMILY HISTORY	NO	79	79.0
	1 RELATIVE	18	18.0
	2 RELATIVES	3	3.0
TOBACCO USE	NO	92	92.0
	YES	8	8.0
ALCOHOL USE	NO	94	94.0
	YES	6	6.0

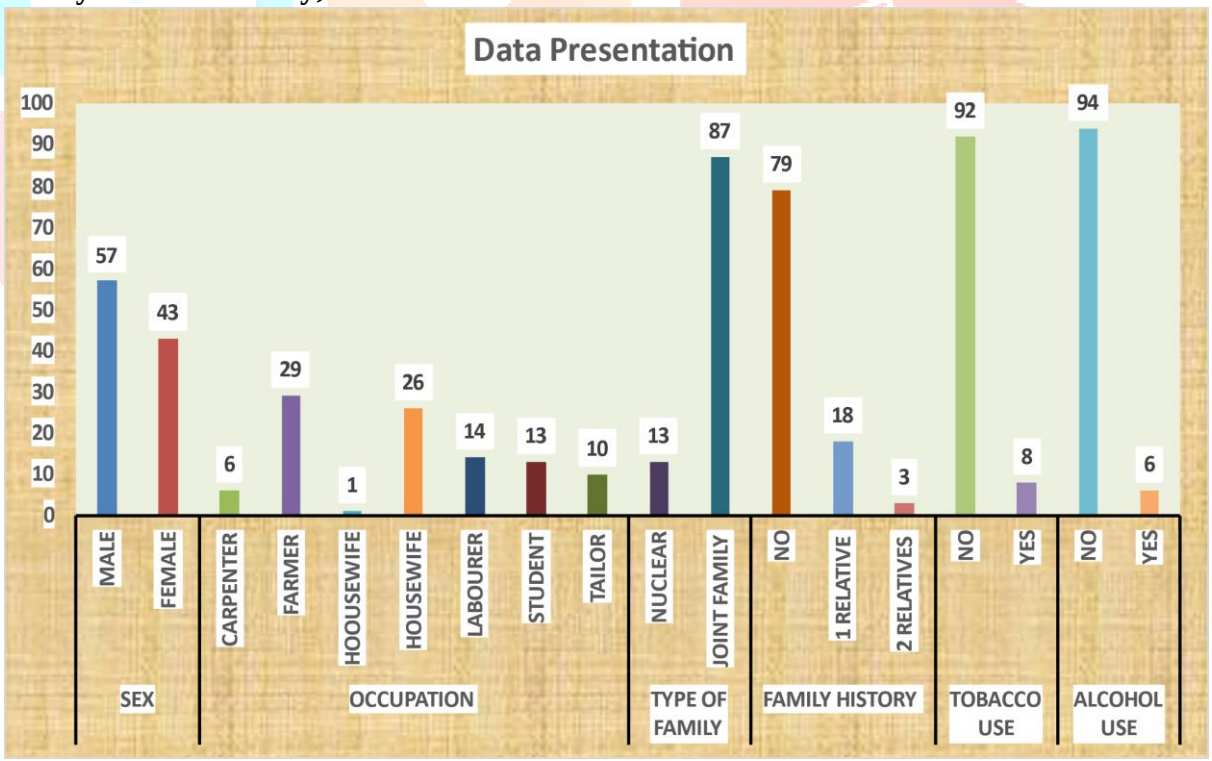
3. Quantitative data analysis for age of patients, total no. of stones, Sr. urea and creatinine and largest stone size as found on CT scan expressed as mean and standard deviation.

	Minimum	Maximum	Mean	SD
AGE	4	75	39.47	17.66
TOTAL NO. OF STONES	1	3	1.32	0.58
SR. UREA(IU/L)	17	39	24.44	4.18
SR. CREATININE (mg/dl)	0.6	2.0	1.26	0.26
CT SCAN FINDING (cm) largest stone size	0.5	29.7	6.10	4.89

4. Bar graph depicting distribution of patients according to source of drinking water, freq. of urination, presence of comorbidity, freq. of intake of oxalate and meat rich foods, daily water intake and total no. of stones.



5. Bar graph showing distribution of patients according to gender, occupation, type of family, family history, use of tobacco and alcohol.



6. Qualitative data analysis showing gender wise distribution of patients of various age groups, occupations and location of obstructive calculi

Variable	Groups	Male		Female	
		Frequency	Percentage	Frequency	Percentage
Age	below 10	0	0.00	5	5.00
	11-30.	14	14.00	16	16.00
	31-50	22	22.00	11	11.00
	51 & above	21	21.00	11	11.00
Occupation	CARPENTER	6	6.00	0	0.00
	FARMER	26	26.00	3	3.00
	HOUSEWIFE	0	0.00	28	28.00
	LABOURER	13	13.00	1	1.00
	STUDENT	9	9.00	4	4.00
	TAILOR	3	3.00	7	7.00
LOCATION OF OBSTRUCTIVE CALCULI	B/L LOWER CALYX	1	1.00	0	0.00
	B/L MIDDLE CALYX	1	1.00	0	0.00
	B/L PUJ	2	2.00	3	3.00
	B/L UPPER CALYX	3	3.00	0	0.00
	LEFT LOWER CALYX	1	1.00	0	0.00
	LEFT MIDDLE CALYX	0	0.00	2	2.00
	LEFT PUJ	1	1.00	1	1.00
	LEFT UPPER CALYX	0	0.00	4	4.00
	RIGHT LOWER CALYX	10	10.00	3	3.00
	RIGHT MIDDLE CALYX	9	9.00	6	6.00
	RIGHT PUJ	4	4.00	4	4.00
	RIGHT UPPER CALYX	25	25.00	20	20.00

RESULTS

The study included 100 patients with kidney stone disease between the ages 4 to 75 years, with a mean age of 39.47 $\pm$ 17.661. The majority of patients were male, consisting of 57% of the sample, while female patients amounted to 43%. Males in the age group of 31-50 years were affected the most (22%), closely followed by those above 50 (21%). Most of the female patients affected were from age group 11-30 years (16%) and above (22%). The male: female ratio was 1.32. In our study, majority of the patients of renal calculi among males were farmers (26%), while those among females were housewives (28%). 87% of the patients were from joint families. We found that out of 100, 21 patients had a positive family history for nephrolithiasis, while 20% of the patients had a comorbid history of hypertension (18%) and diabetes (2%). Only 8% of the population had a vegetarian diet, while 76% had a high intake of meat (>1day/week) and 16% had a moderate to low intake of meat (<1day/week). The sample population in Jalgaon district was noted to have a high intake of oxalate rich food, especially tomatoes- as seen in 92% population (>3times/week), and 8% had a lesser intake (<3times/week). 93% of patients complained of increased frequency of micturition (>5times/day). 85% of the population had a poor daily water intake (<2litres/day). We also found that the drinking water source for 78% of the population was derived from Municipal Tap water while 22% derived water from borewells. The study also observed that the location

of obstructive calculi was predominantly the right kidney, precisely in the upper calyx in both males (25%) and females (20%). Bilateral obstructive calculi were found to be commonly located in the pelviureteric junction (PUJ). Quantitative data analysis showed the mean number of stones in sample size to be 1.32 $\pm$ 0.58, with a maximum value of 3 and minimum of 1. CT finding for the volume of largest obstructive calculus was found to be 6.10 cm^3 (mean), with a standard deviation of 4.89. Serum creatinine and urea values showed a mean of 24.44 $\pm$ 4.18 and 1.26 $\pm$ 0.26 respectively.

DISCUSSION

Renal stone formation has been recognized for thousands of years, but during the last few decades, the pattern and incidence of disease have changed markedly. It has affected a greater population in the West. The lifetime risk of stone formation has been reported to be 5-10%.[4] In our study, a population of 100 patients diagnosed with Renal Stone Disease were studied. The mean age was found to be 39.47$\pm$ 17.661. Majority (57%) were males. Kidney stones develop frequently in individuals with a family history of the same. In our study, 18% of patients had a family member suffering from renal stones, while 3% of individuals had more than one close relative who were known cases of renal stone disease. 87% of the sample population hailed from joint families, consisting of more than 5 members under one roof. All of these reside in villages and rural settlements. In our study, we found significant relationship between dehydration and kidney stone. This is particularly aggravated in the tropics, where high temperatures and humidity attribute to enhanced water loss from the body via sweating. 93% of patients in our study complained of increased frequency of urination (>5times/day). Majority of the sample (85%) was found to have a poor daily water intake of <2 litres/day. 6% patients were also reported to be regular consumers of alcohol. However, the relationship between tobacco use (tobacco chewing and smoking), and nephrolithiasis was not significant, as only 8% of patients were reported to be tobacco users. Occupation can have an impact on the incidence of renal stones.[6] This study set on rural population reveals that farmers (29%) were at a greater risk, followed by manual labourers and housewives. The predominant location of obstructive calculi was found to be the right kidney in both males (25%) and females (20%). In this study, significant relationship can be established between dietary habits and nephrolithiasis. Majority of patients (92%) were reported to have a high intake of oxalate rich foods (mainly tomatoes and spinach) more than 3 days per week, and non-vegetarians constituted 92% of the patients. The frequency of intake of meat, and not just the type of diet, was found to be a crucial factor. Prevalence in frequent and heavy consumers of meat (>1 day/week) was 76% while that in patients with low to moderate frequency of consumption of meat (<1day/week) was 16%. Diet plays an important role in development of kidney stones. Vegetarians have a decreased risk of developing kidney stones.[4] Studies have shown that even among meat eaters those who have a high intake of fruits and vegetables are found to be at lower risk for renal stone disease.[4]

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