Spectrum of stones composition: A chemical analysis of renal stones of patients visiting NMCTH

Sanjiv Risal,[1] Prabodh Risal,[2] Dipendra Raj Pandeya,[1] Deepak Adhikari,[3] Chandra Shekar Bhattachraya,[1] Prem Prakash Singh[3] and Manhar Lal Shrestha[1]

[1]Department of Biochemistry and Surgery, Nepal Medical College, [2]Department of Biochemistry, Dhulikhel Medical Institute, [3]Department of Biochemistry, Manipal Teaching Hospital

Corresponding author: Sanjiv Risal, Lecturer, Nepal Medical College, Department of Biochemistry
G.P Box: 13344 Attarkhel, Kathmandu, e-mail: srisall@hotmail.com

ABSTRACT

A general observation of clinicians suggests that the prevalence of urolithiasis is fairly high in Kathmandu but so far no systematic study has been undertaken here to explore the etiopathogenesis of disease in this region. In this preliminary communication, we present herewith the qualitative composition of 47 renal stones collected from surgical patients admitted to NMCTH over a period of 13 months (July 2005 to July 2006). All stones were of mixed type. Calcium was present in all stones. Oxalate, phosphate and uric acid were present in 95.7%, 87.2% and 34.0% patients respectively. The probable composition, as construed from analysis, suggests that calcium oxalate stones are predominant. Strikingly, the prevalence was very high in ≥20 yrs age group.

Keywords: Kidney stones, urolithiasis, calcium oxalate.

INTRODUCTION

Kidney stones are inorganic crystalline aggregates enmeshed in about 5.0% organic matrix.[1] This disease has tormented humans since the earliest records of civilization. As many as 10.0% of men and 3.0% of women have a stone during their adult lives.[2] In majority of kidney stones, calcium oxalate (CaOx) is the main constituent (80.0%) and calcium phosphate (CaP) is present in amounts ranging from 1.0% to 10.0% ; 10.0% of struvite, 9.0% uric acid (UA) and the remaining 1.0% are composed of cysteine or drug-related stones.[2,3] The prevalence of CaOx stones has been constantly increasing during past fifty years in industrialized as well as in developing countries and varies depending on race, sex and geographic locations.[4,5] The prevalence of renal stones in men varies from 4.0% to 9.0% and in women it ranges from 1.7% to 4.0%.[6] Although kidney stones can be traced to the earliest antiquity of human history, the primary causative factors remain obscure, but renal stones are suspected to have direct relationship to the composition of urine, which is mainly governed by nutrition and environment.[7] Nutritional factors, besides environmental and genetic factors, are important lithogenic risk factors. So excessive consumption of animal proteins, diet rich in oxalate or urates, sodium chloride, insufficient dietary intake of fruits and potassium rich vegetables effect urine chemistries: low urine pH, high urine calcium and uric acid excretion and low citrate excretion.[4,8] As consequences lead to urinary crystals and the renal stone formation.

Since qualitative studies on stone could furnish valuable information on both origin and etiology of renal stones, a study was therefore done to know the pattern of biochemical composition of stones in patients visiting Nepal Medical College Teaching Hospital, Attarkhel from July 2005 to July 2006.

MATERIALS AND METHODS

The present study was conducted at Department of Biochemistry, Nepal Medical College Teaching Hospital (NMCTH), Attarkhel, Kathmandu. The study population included patients diagnosed with renal stones and admitted in surgical unit of NMCTH. Forty-seven cases with renal stones in the age between 12-62 years were included for study. The study consisted of 13 months period (July 2005 to July 2006). Questionnaires were completed covering the information pertaining to age, sex, habits and health status. Renal stones were collected by surgical intervention and analyzed chemically by protocols described by Hodgkinson.[9]

RESULTS

Forty-seven (47) renal stones were analyzed qualitatively. It was found that 66.0% male patients had renal stones as compared to female counterparts (34.0%).The male to female ratio was 2:1 (Table-1).Qualitative chemical analysis of renal stones revealed the presence of mixed stones with highest percent of CaOx with

CaP stones (65.9%) and followed by CaOx with CaP and uric acid stones (21.2%) (Table-2).The highest incidence of CaOx and CaP stones was seen in the age group 30-39 years (88.8%) (Table-3).

DISCUSSION

The male to female ratio in this study was 2:1. Marshall *et al.* have reported that it is 2 times more in males than females.[10] Similarly Singh *et al* have also reported occurrence of renal stones is higher in males than in females.[11] Our findings are in close proximity to their reports. One of the interesting features of our study is the high occurrence of renal stones in the age group of 10-19 years. The reason/s is not clear but one of the strong possibility is high intake of non-vegetarian food accompanied with lower intake of water. The non-vegetarian food increases uric acid and the latter is known to promote calcium oxalate stone formation by epitaxial growth. The relative incidence of calcium oxalate and calcium phosphate stones (65.9%) in our study is on the higher side as compared to other type of stones. Some of the reasons for this high incidence of CaOx and CaP stones in this area might be as follows: (i) non-vegetarian diets (animal protein lowers citrate excretion and increases calcium and uric acid excretion)[12] (ii) diet with high oxalate content (iii) high carbohydrate intake (especially rice), which provides acidic medium to urine favoring calcium oxalate stone formation (iv) water quality; its mineral content and high fluoride levels.[13-15] Fluoride is said to be a mild promoter of urinary stone formation by increasing oxalate excretion in urine, excretion of insoluble calcium fluoride and mildly increasing the oxidative burden.[15] Besides nutritional and environmental factors, genetic factors also contribute to stone formation but the gene responsible for the heritable aspect of stone formation have not been delineated definitively.[16]

In conclusion, the incidence of CaOx with CaP stones predominates. It is useful to know the stone composition during the treatment of renal stone, which has a potential of recurrence as high as 50% at 5 years and can be considerably reduced by suitable reforms in diet and treatment regimen. Future studies in this direction are in progress.

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Table-1: Sex-wise distribution of stone formers

Sex	Number of stones	Percentage	Ratio
Male	31	66.0%	2:1
Female	16	34.0%	

Table-2: Different types of stone

Stone Types	Number of Stones	Percentage
CaOx + CaP	31	65.9%
CaOx +CaP +UA	10	21.2%
CaOx +UA	4	8.5%
CaP +UA	2	4.2%

CaOx= Calcium Oxalate, CaP= Calcium Phosphate, UA=Uric Acid

Table-3: Age-wise distribution of stone formers

Age Group	N	Types of stone			
		CaOx +CaP +UA	CaOx +CaP	CaP +UA	CaOx +UA
10-19	11	9.1%	54.5%	9.1%	27.7%
20-29	8	0.0%	87.5%	0.0%	12.5%
30-39	9	11.1%	88.8%	0.0%	0.0%
40-49	11	27.7%	63.3%	9.1%	0.0%
50-59	6	66.6%	33.3%	0.0%	0.0%
>60	2	50.0%	50.0%	0.0%	0.0%

CaOx= Calcium Oxalate, CaP= Calcium Phosphate, UA=Uric Acid