

Prevalence of Calcium Oxalate Crystals in Khumulwng: A Rural Tribal Area in Tripura

Dr. Partha Pratim Pal, MD (Hom – Practice of medicine)

Research Officer / Scientist -I Regional Research Institute for Homoeopathy, Tripura
under Central Council for Research in Homoeopathy.

ARTICLE INFO

Published Online:
14 August 2018

Corresponding Author:

Dr. Partha Pratim Pal

37C, Hemchandra Street,
Kolkata – 700023 (West Bengal)

ABSTRACT

Clinical significance of identifying the crystals of calcium oxalate in urine has been demonstrated in many previous studies. The presence of such crystals is markedly regulated by lifestyle and habitat of an individual also. The present article is an effort to compare this aspect of health parameter (i.e. measurement of calcium oxalate crystals in routine examination of urine) between two different population groups and correlate the indicator with their customary food habit.

KEYWORDS: Calcium oxalate crystals, Kidney stone, Tribal population, Araceae

Introduction

Crystals are formed when a crystalline compound becomes supersaturated. In urine inorganic salts such as oxalate and phosphate and oxalate salts such as uric acid and cystine may precipitate and appear in urine as true crystals or as amorphous material. Crystal formation is enhanced when urine flow through renal tubules decrease along with pH changes in the ultra filtrate ¹. Crystals normally found in urine are urates, uric acid or calcium oxalates ². The presence of these crystals is not related to pathology but they must be properly identified and reported because occasionally they may have clinical significance. For example, calcium oxalate has been considered to be one of the normal crystals as oxalates are natural end products of metabolism in the body and it is excreted out in urine. Now, if oxalate levels are too high, the extra oxalate can combine with calcium to form kidney stones and hence on several occasions it has been linked to lithiasis.

Calcium oxalate crystals (COC) are the most common cause of Kidney stones and calcium oxalate (CaOx) is the most prevalent type of kidney stone which accounts for 70-80 % of the kidney stones in the population ³. The amount of oxalate excreted in urine is a major risk factor for CaOx stones formation. Another risk factor for CaOx stone is hyperoxaluria which occurs due to bowel disease (enteric hyperoxaluria) and genetic disorders of oxalate metabolism (primary hyperoxaluria) ⁴. Hence in cases of dietary excess of oxalate one possible approach to prevent renal stone formation and recurrence is to decrease the consumption of oxalate rich foods (ideal daily intake

should be 50 mg or less) such as tomatoes, spinach, rhubarb, garlic, oranges and asparagus ⁵.

Material and Method

A retrospective comparative study of COC in reports of urinalysis was made between two different population groups in Tripura from the laboratory records available in the Regional Research Institute for Homoeopathy - peripheral wing of Central Council for Research in Homeopathy, New Delhi.

Urinalysis comprises of physical examination, bio-chemical examination and microscopic examination. In microscopic examination the major concern are the cells (pus cells, epithelial cells and red blood cells), casts, crystals and microorganisms ².

Initially, the unit was located somewhere in the midst of the capital city, Agartala. The majority of the patients who were coming to our OPD were non-tribals. Later on, in February 2017 when the centre was upgraded to Regional research unit, it was shifted to a rural tribal area named Khumulwng. Now, the patients coming in the new OPD were primarily tribal peoples. Hence, the exposure to these two different population groups was not an experimental intervention but purely a matter of coincidence. Utilizing this opportunity for having coverage to a new and fresh population group a retrospective analysis of the reports for urine analysis was made. Reports from February 2016 to January 2018 were taken into account. Out of which the reports of 2016-17 was belonging to the urban

“Prevalence of Calcium Oxalate Crystals in Khumulwng: A Rural Tribal Area in Tripura”

population group in Agartala and reports of 2017-18 was belonging to the rural population group in Khumulwng.

The COC was quantified by simple identification done under light microscopy. It is identified by its special octahedral or envelope form. When viewed from the sides, it appears as dumb-bell. Calcium carbonate crystals appear as colorless spheres and triple phosphate appears as colorless three to six sided prisms. COC are mainly found in acidic

urine ². The crystals were identified and counted under high power field (hpf) and grouped as per the following range: Scanty – 1 to 3/ Few – 4 to 10 / Moderate – 10 to 20 / Many – 20 to 40 / Plenty – over 40. Out of 148 urine samples in the urban population, 12 were found to have COC (i.e. 8.1 % - table 1). This is 2.4 times less when compared to 38 positive samples out of 194 routine examination of urine in the rural tribal population group (i.e. 19.58 % - table 2).

Table 1

From analysis of urine examination reports –February 2016 to January 2017 (non-tribal population group)				
Serial No	Gender	Age	Crystal form	Interpretation
1	M	41	Calcium Oxalate	moderate
2	F	65	Calcium Oxalate	moderate
3	F	49	Calcium Oxalate	many
4	M	23	Calcium Oxalate	many
5	F	20	Calcium Oxalate	scanty
6	M	39	Calcium Oxalate	moderate
7	F	66	Calcium Oxalate	few
8	M	57	Calcium Oxalate	scanty
9	F	38	Calcium Oxalate	many
10	M	35	Calcium Oxalate	moderate
11	F	23	Calcium Oxalate	moderate
12	M	47	Calcium Oxalate	moderate

Table 2

From analysis of urine examination reports –February 2017 to January 2018 (tribal population group)				
Serial No	Gender	Age	Crystal form	Interpretation
1	F	48	Calcium Oxalate	scanty
2	M	17	Calcium Oxalate	moderate
3	M	35	Calcium Oxalate & Calcium Carbonate	few
4	M	65	Calcium Carbonate	moderate
5	M	65	Calcium Oxalate	many
6	F	42	Calcium Oxalate	moderate
7	F	22	Calcium Oxalate	many
8	M	31	Calcium Oxalate	scanty
9	M	36	Calcium Oxalate	few
10	M	95	Triple phosphate & Calcium Carbonate	scanty
11	M	40	Calcium Oxalate & Calcium Phosphate	moderate
12	M	13	Calcium Oxalate	plenty
13	F	20	Calcium Oxalate	many
14	F	30	Calcium Oxalate	few
15	F	35	Calcium Carbonate	few
16	M	19	Calcium Oxalate	moderate
17	M	41	Calcium Oxalate	scanty
18	M	27	Calcium Oxalate	many
19	M	37	Calcium Oxalate	moderate
20	M	43	Calcium Oxalate & Calcium Carbonate	moderate

“Prevalence of Calcium Oxalate Crystals in Khumulwng: A Rural Tribal Area in Tripura”

21	M	28	Calcium Oxalate & Calcium Carbonate	many
22	F	48	Calcium Oxalate	scanty
23	F	31	Calcium Oxalate	few
24	F	48	Calcium Oxalate	moderate
25	M	26	Calcium Oxalate	few
26	F	33	Triple phosphate	few
27	F	9	Calcium Oxalate	many
28	M	45	Calcium Oxalate	moderate
29	M	9	Calcium Oxalate	many
30	F	30	Calcium Oxalate	few
31	F	39	Calcium Oxalate	plenty
32	M	29	Calcium Oxalate	few
33	F	60	Calcium Oxalate	moderate
34	F	29	Calcium Oxalate	moderate
35	M	39	Calcium Oxalate	moderate
36	M	65	Calcium Oxalate	many
37	F	48	Calcium Oxalate	few
38	M	48	Calcium Oxalate	moderate

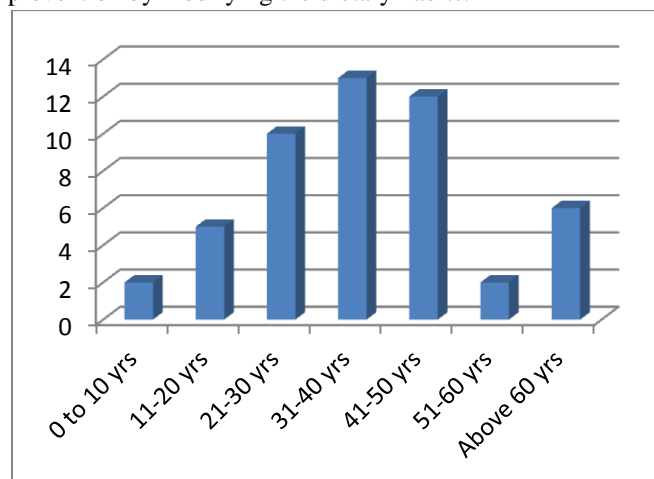
Total 342 reports of urine analysis were obtained from the records. A total of 50 cases were found to have crystals positive in the urine. Among the type of crystals obtained in the laboratory records for the above mentioned period are calcium oxalate, calcium carbonate, calcium phosphate and triple phosphate. Most abundantly found was COC ($n_1=48/50$) either occurring singly ($n_2=44/50$) or in combination with other crystals ($n_3=4/50$). Only in two occasions crystals were positive in urine sample but it was not COC and instead it was triple phosphate and calcium carbonate in combination and triple phosphate only respectively. All age group was considered out of which 28 were male and 22 were female. Advice was given to patient collect the early morning midstream urine. Collection phial was provided from the unit.

Discussion

Dissimilarity in the prevalence of COC in urine in these two population groups can be related to the different dietary habits of the people. The state of Tripura is a hilly state of North-eastern India and also one of the ‘seven sisters’ in which 31 % percent of the population is tribal. Most of the tribal communities are dependent on the wild edible plants of nature for their day to day food. Out of which the popular recipes are Gudak, Chakhwi, Moisdeng and Thok mwi comprises of four Araceae which are known to have COC in abundance ⁶. It occurs in 14 species of Araceae found in North-east India ⁷ out of which *Amorphophallus bulbifer*, *Colocasia esculenta*, *Homalomena aromatica* and *Lasia spinosa* are those edible plants which are used frequently in the above mentioned traditional recipes of the ethnic groups ⁶. In addition to this *Muyabaiwahan* and *Wahan* are popular

dishes of pork meat ⁸ which is an important source of livestock in Tripura as income from pigs accounts for about 50 % of total family income in these remote areas of North-east India ⁹. Moreover, it is known to us that high animal protein intake in diet determine a rise in the urinary oxalate excretion in about 30 % patients with idiopathic calcium nephrolithiasis ¹⁰. Subsequently, high protein diet increases urinary calcium and decreases citrate excretion thus leading to high overall lithogenic risk ¹¹.

On cumulative analysis of all 50 positive cases it was found that the vulnerable age group in both sexes which are having COC in urine is 20-50 yrs (35/50 i.e. 70 % cases). Since, the typical presentation of kidney stones is mainly in the working age group (between 20 and 60 years of age) ^{12, 13}, this clinical correlation provides an evidence to take precautions for primary prevention by modifying the dietary habits.



People who have a high risk of developing CaOx stones in future were 22 out in 194 samples (11.34%) and 9 out of

148 samples (6.08 %) in tribal and non-tribal areas respectively. The high risk factor was considered for samples which were categorized as moderate, many and plenty i.e cases which contained more than 10 COC per high power field (hpf) since in a analytical study about distribution of crystal in urine, deposits containing more than 10 per hpf were collected under liquid paraffin and taken up for scanning under electron microscopy¹⁴.

Conclusion

Consumption of wild edible plants especially belonging to Araceae group and excess eating of pork meat is becoming a high risk factor for the tribal population of Khumulwng, Tripura in the development of kidney stones in future due to abundant amount of COC in the urinary filtrate. Public awareness and health education is essential to bring modifications in their dietary habits and lifestyle.

Acknowledgements

1. Dr RK Manchanda, Director General – CCRH
2. Dr Manas Sarangi, Research officer (H)/ S-II – CCRH, Headquarters
3. Mr. Simson Basumatary, Lab technician – RRI (H), Tripura
4. Mr. Amiya Garai, Lab technician - RRI (H), Tripura

References

1. Broc DA and Hundley JM. Identifying calcium oxalate crystals in Urine. Volume 26, no 11. November 1995. Available from <https://academic.oup.com/labmed/article-abstract> [last cited on 20.07.18]
2. Sood R. Medical Laboratory technology – methods and interpretations. 5th edition. Jaypee brothers medical publishers (P) ltd. 2006: 63
3. Asplin JR. Hyperoxaluric calcium nephrolithiasis. Endocrinology Metabolic Clinical North American 2002; 31: 927-949
4. Bhasin B, Ürekli HM, and Mohamed G Atta. Primary and secondary hyperoxaluria: Understanding the enigma. World Journal of Nephrology. 6.5.2015; 4(2): 235–244
5. Suzanne F and Watson S. What You Need To Know About Calcium Oxalate Crystals. Available from https://www.healthline.com/health/calcium-oxalate-crystals_treatment [last cited on 20.07.18]
6. Deb D, Sarkar A, Debbarma B, Datta BK and Majumdar K. Wild edible plants and their utilization in traditional recipes of Tripura, North-east India. Advances in Biological research 7 (5): 203-211, 2013.
7. Sk. Md. A.I. Saadi and Mondal AK. Studies on the Calcium Oxalate Crystals of Some Selected Aroids (Araceae) in Eastern India. Advances In Bioresearch, Vol. 2 [1] June 2011: 134 - 143
8. Tripura: Food habit. Available from <http://tripuratourism.gov.in/food> [last cited on 20.07.18]
9. Mohana Devi S, Balachandar V, Lee S and Kim H. An Outline of Meat Consumption in the Indian Population - A Pilot Review. Korean Journal for Food Science Animal Resource. 2014; 34(4): 507–515.
10. Curhan GC, Willett WC, Speizer FE et al. twenty-four-hour urine chemistries and the risk of kidney stones among women and men. Kidney International 2001; 59: 2290-2298
11. Antonio Nouvenne, Andrea Ticinesi, Ilaria Morelli, Loredana Guida, Loris Borghi, and Tiziana Meschi. Fad diets and their effect on urinary stone formation. Translation andrology and urology. 2014 Sep; 3(3): 303-312
12. Moe OW. Kidney stones: pathophysiology and medical management. Lancet 2006 ;367: 333–44
13. Stamatelou KK, Francis ME, Jones CA, et al. Time trends in reported prevalence of kidney stones in the United States: 1976–1994. Kidney International 2003; 63: 1817–23
14. Fazil Marickar YM, Lekshmi PR, Varma L and Koshy P. Elemental distribution analysis of urinary crystals. October 2009, Volume 37, Issue 5, pp 277–282. Available from <https://link.springer.com> [last cited on 20.07.18]