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CALCIUM;
SERUM AND URINARY IN STONE FORMERS AND NON-STONE FORMERS

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ABSTRACT... Aims & Objectives: To evaluate the effects of Serum Calcium and Urinary Calcium excretion on upper urinary tract stone diseases in the Peshawar (a high stone incidence belt). **Subjects & Methods:** One hundred patients (age 20-60years) who were suffering severely from upper urinary tract stone disease were selected from LRH and Hayatabad Medical Complex Hospitals of Peshawar, same numbers of healthy controls from the same region were also selected for the study. **Results:** When results were summed up and test Parameters were compared, it was seen that mean Serum Calcium in stone formers was greater than that of non-stone formers (P<0.001). Same pattern was also observed (P< 0.001) in both groups regarding mean urinary calcium excretion. **Conclusions:** We concluded that calcium is a definitive risk factor in upper urinary tract stone disease. However we suggest further work and research on wide scale population in order to evaluate this relation.

Key words: Kidney stones, Serum Calcium, Urinary Calcium.

INTRODUCTION

Urolithiasis has a worldwide distribution ranging from upper urinary tract stone diseases to the lower urinary tract stone diseases. Bladder stone was a common disease about one hundred years ago, but now-a-days upper urinary tract stone diseases are common[1,2]. Pakistan is situated in 'Stone belt' extending from Turkey, Israel, Iran, India, Thailand and Indonesia, having high incidence of urinary calculi. Calculus disease is endemic in Pakistan[3,4] perhaps the stone disease incidence in Pakistan is highest in the world[5,6].

In Pakistan no efforts have been made so far to localize the geographical high and low stone forming areas nor detailed studies are available on the clinical and aetiological aspect of the disease. Rizvi et al studied calculus disease in 400 patients at the Civil Hospital, Karachi which included both children and adults. He found all types of stone both upper and lower urinary tract and men were affected more than women. He also observed that vesical stone was more common in children below ten year of age[8]. The Upper urinary tract stone disease is more common in northern Punjab. This may also be linked with high protein diet [9]. The incidence of bladder stone in adult is dependent upon the changing demographic pattern of Pakistan. More people are surviving into the prostatic age and secondary stone have shown a rise[7]. Peshawar is lying in high stone incidence belt, but also far no study evaluating aetiology and risk factors of stone disease in these areas have been done.

The thrust of present study is in terms of presentation rather than leaving the disease in study area. Our effort is to enhance the knowledge regarding the aetiological factors and ultimately preventing the disease. By considering above facts in mind present study was planned, to evaluate biochemical risk factors (calcium) of stone formation in Peshawar.

SUBJECTS & METHODS

One hundred subjects (age: 20-60 years) who were suffering from upper tract stone disease were included in the study Subjects were selected from Lady Reading Hospital (Urology and General Surgical Units) Khyber Teaching Hospital (all surgical units) and Hayatabad Medical Complex, Peshawar. The total period of study was six months (i.e. from March to September 2009). The detailed clinical history and physical examination were made to exclude any disease which might affect our results. The diagnosis of urinary stone in upper tract was based on the following criteria:-

a. X-ray evidence of stone in the renal ureteric area.

b. History of spontaneous passage of stone in the urine.

Microscopic examination of the urine was carried out and those patients with pyuria i.e. white blood cells more than eight per high power field, were not included in the study. Those patients having serum creatinine of more than 1.3 mg/dl were also not included in the study. Those patients with any other disease besides urolithiasis, which might effect our results were also excluded from the study. A Proforma giving details of patients history (history of intake dairy products, meat and water) and family history of stone disease in immediate family (parents and off springs) were filled.

One hundred normal volunteers age matched with the patients and living in the same environment of the patients were also studied. Those giving history of urolithiasis or any disease which might effect our results were excluded from the study. Blood was collected from the patients and controls during morning time between 9.00- 11.00a.m 10 ml blood sample was collected from each subject in a disposable syringe without applying tourniquet and immediately put in the centrifuge tube. The centrifuge tubes were left undisturbed till a firm clot settled down. Twenty four hours urinary sample was collected from each individual in three liter capacity plastic jars. Previously washed with hydrochloric acid and them distilled water and finally three times with deionised water. The jars were dried by inverting them. To dried jars toluene (5 ml) was added as preservative.

The serum calcium estimations were performed on the collected samples by cresophthalein complexone method. The urinary calcium estimations performed on the collected samples by standard laboratory methods. Statistical analysis was done by student's "t" test to observe any significant difference between various parameters.

RESULTS

1. Serum and Urinary Calcium in stone Formers (S.F) and Non-stone Formers (N.S.F)

Table reflects the mean concentration of calcium in serum samples obtained from 100 stone formers and 100 controls receptively. The 10.6 + 1.07 mg/dl and 9.16 + 0.51 mg/dl in non-stone formers. The mean concentration of serum calcium in S.F is greater than that of N.S.F and statistically it is highly significant (P<0.001).

2. Calcium Urinary Excretion

The mean urinary calcium of S.F 167.25 is higher than then of N.S.F 74.92 and statistically it is highly significant. The mean calcium excretion per 24 hour in stone formers (S.F) and non-stone formers (N.S.F) is shown in Table. The values of mean 24 hours urinary calcium execration along with standard deviation is S.F was 167.25 + 4.59 mg/24 hours and 74.92 + 3.41 mg/hours in N.S.F. The mean urinary calcium execration if S.F is greater than that of N.S.F and statically it is highly significant (P<0.001).

	Serum		Urinary Excretion	
	S.F	N.S.F	S.F	N.S.G
	m /dl		mg/24 hours	
Mean ± S.D	10.6 ± 1.07	9.16 ± 0.51*	167.25 ± 4.59	74.92 ± 3.41*
P-value	<0.001		<0.001	

DISCUSSION

The effect of serum calcium and urinary calcium excretion on upper urinary tract stone diseases is widely studied by various authors. The different aspects of calcium which are studied includes and highlights the following:

1. What is the normal serum calcium and normal excretion of calcium in urine.
2. How does it happen to be risk factor in upper urinary tract stone diseases.
3. What is the relation of parathyroid hormone and vitamin D to serum calcium and urinary calcium excretion and its association with stone disease.

These aspects are studied in Pakistan by many authors and similarly by foreign authors. Normal serum calcium in literature ranges from 8.5 to 10.3 mg/dl. Hussain et al demonstrated that serum calcium in stone former (S.F) control, non-stone former (N.S.F) was 9.38, 9.46, 9.84 mg/dl. In our hundred patients, the serum calcium in S.F

ranged from 9.3 mg/dl to 10.5 mg/dl and in N.S.F from 8.6 mg/dl to 10.0 mg/dl. The mean + S.D of serum calcium in S.F (10.6 + 1.07 mg/dl) was higher than in N.S.F (9.16 + 0.51 mg/dl) and the difference was statistically highly significant (P<0.001) Another important aspect was that 52% of our S.F and 19% of N.S.F were in the hypercalciumic range (serum calcium more than 10.5 mg/dl) Shah Jehan and Rehman, estimated a total serum on N.S.F and S.F as 10.6 mg/dl and 10.2 mg/dl respectively[3]. Khanum, in Karachi reported mean total serum calcium of 9.93 and 9.97 mg/dl in N.S.F and S.F respectively[11].

If we compare our study with these studies there seems to be not much difference in the serum calcium of stone former and non-stone former. The slight difference is likely due to laboratory standards and methodology. It is also evident from these studies that in different parts of Pakistan serum calcium in stone former and non-stone former is not different from each other. It may be because that the dietary habits of majority of population of Pakistan and socioeconomic condition of Pakistan is not different. In our study we took 10.5 mg/dl as the normal upper limit of serum calcium and above this value they are regarded as hypercalcaemic. Serum parathormone was not studied at Peshawar. Hyperthyroidism was not established in any case of stone disease. Majority of the patients having only hypercalciuria without hypophosphataemia and normal skeletal radiograph as idiopathic hypercalciuria.

Hypercalciuria is defend as urinary excretion of more than 300 mg/24 hours in men and 250mg/24 hours in female or more than 4 mg calcium excretion/kg body weight per day regardless of age and sex[12]. Robertson et al, has reported a significant risk of upper urinary tract stone diseases with the urinary calcium excretion of more than 400 mg/day[13]. In our study hypercalciuria according to the international[14,15,18,19] studies was observed only in 2% of the cases, However, our results were comparable to the other study in Pakistan. In our study the mean + S.D of urinary calcium excretion/24 hours in S.F was 167.25 + 4.59 mg/24 hours and in N.S.F it was 74.92 + 3.41 mg/24 hours. The difference was statistically significant (P<0.001). Hussain et al from Lahore demonstrated the urinary calcium excretion as 108.8 + 30.4 mg/24 hours. 188 + 63.6 mg/day and 208 + 30.4 mg/24 hours in N.S.F, single episode S.F and recurrent S.F respectively[6]. At Karachi, Khanum demonstrated urinary calcium excretion as 136.91 + 7.20 mg/24 hours and 151.04 + 4.86 mg/24 hours in N.S.F and S.F respectively[11]. Similarly Shah Jehan and Rehman also at Karachi showed mean + S.D of urinary calcium excretion as 148.7 + 13.0 and 157.9 + 24.2 mg/24 hours in N.S.F and S.F respectively[3]. In all these studies the difference in urinary calcium excretion in S.F and N.S.F was statistically significant but were not in the hypercalciuric range.

If we compare our results in Pakistan and abroad it seems that low intake of calcium and milk products might be responsible for the low calcium excretion in this part of world. Though serum calcium is being maintained by high conservation of calcium by the kidneys resulting in decrease urinary calcium excretion and thus none of the patient has demonstrated hypercalciuria according to the international definition. Though hypercalciuria is a definitive risk factor in western part of the world. We have to establish our own standard for the definition of hypercalciuria. Thus this aspect of the study requires further work and research.

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- Baig MA, Baloch L, Khani GMK, Qureshi MA. Low serum calcium associated with tuberculosis. Professional Med J Dec 2006; 13(4):583-586.