Research Article

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Urine analysis of children residing near uranium mines

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ABSTRACT

Background: Animal studies, as well as studies of occupationally exposed persons, have concluded that the major health effect of uranium is chemical kidney toxicity, rather than a radiation hazard.

Methods: Random urine samples of 100 children of age 6 to 12 years was collected and total protein and creatinine values were measured. This was compared with normal levels to evaluate the susceptibility to any kidney disease. **Results:** There was a statistically significant increase level of total protein to creatinine ratio which is a marker of renal diseases among children.

Conclusion: Further study with bigger sample size from different region should be undertaken to draw a more definite conclusion.

Keywords: Uranium, Kidney function, Children, Total protein, Creatinine

INTRODUCTION

The heavy metal uranium is presently world's one of the most powerful sources of energy. It is mostly used to produce electricity and can also be used in manufacturing medical isotopes. Responding to India's aggressive nuclear expansionist policy, and the resulting high demands and needs on the necessary fuel supply of uranium 235, Uranium Corporation India Limited , UCIL, in 2007 initiated a project for mining Uranium in Gogi Village of Yadgir District in Karnataka, India.

One of the sources of exposure to uranium for the population is the intake of water or foods contaminated with uranium which is found in the environment as a result of uranium mining. The toxicity of uranium has been recognized and studied for more than two centuries. Most of the animal experiments and human studies performed, has concluded about the metabolic adverse effects and nephrotoxicity of uranium compounds. Radiation toxicity of uranium and its isotopes has already been recognized since the very beginning of the nuclear

era, with well documented evidence of reproductive and developmental toxicity. Mutagenic and carcinogenic consequences of uranium internal contamination has also been reported. A study done among individuals in Canada have shown that chronic ingestion of water containing uranium can be nephrotoxic and it affects the proximal tubule of kidney. In addition there are few reports on human studies where uranium has caused neurotoxicity, DNA-damage, musculoskeletal toxicity and pulmonary toxicity.2 Most of these effects are due to either radiation or inhaled dust containing uranium. Animal studies, as well as studies of occupationally exposed persons, have concluded that the major health effect of uranium is chemical kidney toxicity, rather than a radiation hazard. Both functional and histologic damage to the proximal tubulus has been reported. Hence the aim of the study was to analyze the urine samples of children in Gogi Village who were born after the uranium mining project began in that area.

METHODS

Source of data was collected from School children residing in Gogi village aged 6-12 who are exposed to uranium was categorised as the subjects of experimental group.

Inclusion criteria

- The child should be born in the Gogi village.
- The child should be aged 6-12 years.

Exclusion criteria

- Children who have recently shifted to gogi village and is not born there.
- Children with systemic disorders or under medication.

100 school children residing near the uranium mines were selected for the study. A detailed medical history was taken to exclude the prevalence of any systemic disease or intake of medications.

Assesment of urine total protein: by biuret method.

The reagent used are sodium potassium tartarate (32mmol/L), potassium iodide (100mmol/L) copper sulphate 18mmol/L and sodium mmol/L.

Method: Let stand reagents and specimens at room temperature. Mixing and incubation was done at room temperature for 1 minute. Then the absorbance value was read at 630(600-650) nm against reagent blank (1000µl).

Assessment of creatinine: by chemical method

The working solution was prepared by mixing equal volumes of picrate reagent and diluents reagent.

Method: The required amount of working solution was pre-warmed at 30°C/37°C before use. Then to 50 μl of creatinine, 1000 μl of working solution was added and mixed. Absorbance of assay mixture was recorded at 30 seconds and 90 seconds at 492nm. Hence absorption of standard was obtained. Now 50 μl of sample was taken and its absorption was calculated in a similar manner. From these two values, creatinine value of sample was obtained.

Statistical analysis

The results were statistically analyzed using one sample test.

RESULTS

The mean value of total protein derived from the study sample was 0.103 gm/dl and that of creatinine was 0.507 by biuret method and chemical method seperatively.

Table1: mean and standard deviation of total protein and creatinine

	Total prot	ein Creatinine in mg/dl	Ratio
Mean	0.103	0.507	0.216
Std. Deviation	0.024	0.151	0.072

Table 2: Mean and SD of the ratio of total protein and creatinine

	N	Mean	SD	Mean difference	t	df	p-value
Ratio of total protein:	100	0.216	0.07	0.016 (0.001-0.03)	2.247	99	0.02*
creatinine							

Reference value = 0.2; One-Sample Test; P<0.05 statistically significant.

The mean of the ratio between total protein and creatinine in urine was 0.216 gm per mg of creatinine and it was statistically significant when compared to the normal range.

DISCUSSION

According to the guidelines for the management of proteinuria, untimed urine samples, often called 'spot' samples, should be used to detect and monitor protein in children and adults. In children, total protein to creatinine ratio can be used to check for kidney diseases.³ Total protein to creatinine ratio in urine in urine is often

considered normal if ≤ 0.2 and has been taken as a reference range for this study.⁴

Environmental uranium exposure from drinking water has been associated with glucosuria, microalbuminuria, beta 2 microglobulinuria, phosphaturia, and hypercalciuria. Studies in occupationally exposed populations have also reported aminoaciduria and low molecular weight proteinuria. An epidemiologic survey also reported statistically, but not clinically significant, higher serum creatinine levels in individuals residing in close proximity to a uranium processing plant in Ohio, compared with the general US population. In our study also there is a statistically significant increase level of

total protein to creatinine ratio which is a marker of renal diseases among children.

Fluoride is often found in sites of uranium as uranium hexafluoride which is usually added to increase the efficacy of uranium. Hence, the fluoride levels in water was also checked. The fluoride level of the drinking water in the Gogi village was measured to be 1.7 ppm. Chronic toxicity with fluoride can also cause kidney diseases but standard levels are not known. A study done among 210 children drinking different fluoride levels in water suggested that drinking water fluoride levels over 2.0 mg/L can cause damage to liver and kidney functions in children. §

Since the uranium levels in water couldn't be measured, a definitive conclusion couldn't be drawn regarding the causative factor of the increased risk of renal diseases among the study sample. More studies with a larger sample size should be conducted. The study was done not to demote the usefulness of mining but to create awareness about the prevailing effects, so that proper handling of waste materials can be done and people residing near those areas could take as much precautions possible.

CONCLUSION

Children residing near uranium mines are more susceptible to renal diseases. However further studies with bigger sample size in different parts of the world should be carried out to draw more definite conclusion.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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