

Systematic review

Prevalence and associated risk factors of urolithiasis in India, a systematic reviewLeena Sequira¹, Saraswathi Hebbar¹, Ravishanker N.²¹Manipal College of Nursing, Manipal Academy of Higher Education, Manipal, 576104, Karnataka, India²Department of Biostatistics, Vallabhbhai Patel Chest Institute, University of Delhi, Delhi, India

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Corresponding author: **Leena Sequira**. Email: leena.sequira@manipal.edu**ABSTRACT**

Introduction and Aim: In India approximately two million persons are affected by urolithiasis per year and some areas of India have been named as a stone belt. This article reviews information regarding associated risk factors of urolithiasis from Indian perspectives.

Methods: The studies were retrieved from eight electronic databases. All the cases of an adult above the age of 18 with urolithiasis were included in this review. The studies conducted in different states of India on human subjects and published between 2010 -2017, which are available in electronic media were included. The quality of studies was assessed by the help of Joanna Briggs Institute Checklist for Systematic Reviews and Research Syntheses. A narrative approach was adopted to analyze the data.

Results: The risk factors identified were, less frequency of urination /day, consumption of red meat once a month or more, higher consumption of calcium, sodium, magnesium and phosphorus, high intake of coffee, tea, and sugar, working in high temperatures, lack of physical activity, obesity, and ground water consumption. Habits like smoking and alcohol consumption. Some of the disease conditions like urinary tract infection, renal cyst, horseshoe kidney, atrophic kidney, benign prostatic hyperplasia.

Conclusion: The urolithiasis among adults is a public health problem and calls for appropriate action against this.

Keywords: Prevalence; risk factors; urolithiasis.

INTRODUCTION

Urolithiasis is a common worldwide problem. It leads to a significant economic burden on developing and developed countries. The main signs of Urolithiasis are pain and hematuria or sometimes it remains asymptomatic (1). Rural as well as urban areas of the stone belt region consume a high amount of protein in comparison to other regions. These food habits are one of the main reasons behind the prevalence of renal stones in India (2). High resolution imaging studies done more frequently in aged patients leads to kidney stone (3). Dietary habits may be an important factor, as could global warming. The intake of animal protein has increased in many countries, this may also give rise to urolithiasis (4). In India approximately two million persons are affected by urolithiasis per year and some areas of India have been named as a stone belt also e.g., Gujarat, Punjab, Delhi etc., Genetic, and environmental and lifestyle factors also contribute significantly. The conditions commonly associated with kidney stones are obesity, hypertension, and hyperlipidemia (5). There is association between uric acid stones, type 2 diabetes mellitus, obesity, metabolic syndrome and low urine pH values (6). Obesity is significantly associated with uric acid stone formation also been linked to reduction in urinary pH and associated nephrolithiasis (7). A Meta-analysis on prevalence of renal stones among adults in mainland China, the pooled overall prevalence 7.54% (95% CI, 9.15). Age and gender were associated with increased prevalence (8). The

incidence of urolithiasis is associated with central obesity because of metabolic alterations (9).

There is much review literature available on the trends of prevalence of urolithiasis globally. This article reviews information regarding associated risk factors of urolithiasis from Indian perspectives.

METHODS

This systematic review was performed using the checklist based on PRISMA guidelines. The detailed methodology is explained in the following sections.

Search strategy

The studies were retrieved from eight electronic databases: Scopus, PubMed-Medline, IndMed, CINAHL, ProQuest, Web of Science, Ovid-Medline, and Google-Scholar. The following search strategies were developed according to the databases. The terms used were urolithiasis, nephrolithiasis, urinary stone, renal stone, renal calculi, prevalence, risk factors, India, clients, cases, case-control studies, cohort studies, cross-sectional studies, observational studies, regions in India. The search was expanded by using the Boolean operators AND & OR.

Selection criteria

All the cases of an adult above the age of 18 with urolithiasis will be included in this review. The studies conducted in different states of India on human subjects and published between the years 2010-2017,

which are available in electronic media were included in the review.

The patients admitted in hospitals, nursing homes or clinics, community and diagnosed cases of renal stone through clinical and ultrasound were included. The studies done in India, published in English language were included for the review.

Definition

The term urolithiasis refers to the formation of stones in the urinary system, may be in the kidney, ureter, bladder, or urethra.

Quality assessment

The quality of studies was assessed by the help of Joanna Briggs Institute Checklist for Systematic Reviews and Research Syntheses. The checklist had a total of nine areas. Two reviewers independently assessed each of the characteristics mentioned in the checklist with 'yes' or 'no'. Each 'yes' answer was given one score and 'no' was zero with the total possible maximum score of nine. The study method and result section were considered for quality assessment. The studies with the score of six or more than six were considered for review.

Data extraction

Two reviewers independently read the title and abstract of identified studies to decide whether the study was following the review criteria (LS and SH).

The controversies between two reviewers were resolved with the help of the third reviewer (RS). The data were extracted using the 'data extraction form' prepared based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)' guidelines (10).

Statistical analysis

A narrative approach was adopted to analyze the data given its heterogeneous nature.

Quality appraisal of studies

Good quality of evidence of included studies, as the study objectives were clearly mentioned. Selection criteria for cases and controls were defined. The average appraisal score (The Joanna Briggs Institute, 2014), was seven. Overall, there was a good quality of evidence of included studies.

RESULTS

Among 54 identified studies, 14 studies eligible for systematic review (Fig. 1). The Characteristics of the included studies were given in table 1. Among the 14 studies, 11 studies mentioned risk factors for renal stone. In three studies only, prevalence was mentioned. Of these seven were case control studies (11,12,14,17,21-23), five surveys (13, 16,18-20) and two retrospective studies (1,15).

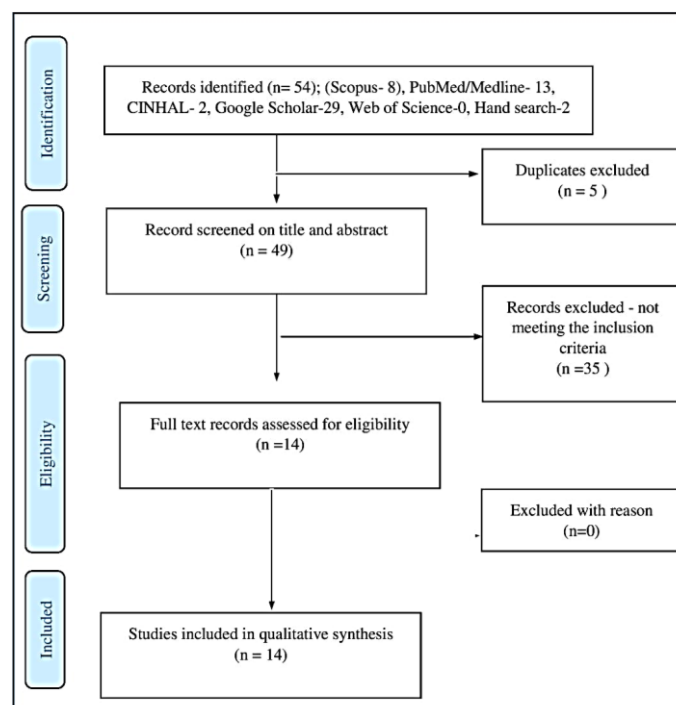


Figure 1: PRISMA flow chart

The risk factors identified were, less frequency of urination /day, consumption of red meat once a month or more, higher consumption of calcium, sodium, magnesium and phosphorus, high intake of coffee and tea, sugar, and ground water consumption. Habits like

smoking and alcohol consumption. Some of the disease conditions like urinary tract infection, renal cyst, horseshoe kidney, atrophic kidney, benign prostatic hyperplasia. Non-modifiable factors like middle age 30 – 50 years, male gender, genetics.

Occupational risk like agriculturist working in high temperature. Personal factors like lack of physical activity and obesity. Lab values like Increased MDA (malondialdehyde), Decreased Vitamin E and β -

carotene, increased C reactive protein and interleukin – 6 in diabetics, hypercalciuria, Acidic urine pH, hyperuricemia, low urinary volume were seen in patients with kidney stones.

Table 1: Study characteristics

S. No.	Author, Year, and Location	Aim and variables	Study design	Sample size	Population	Results
1	Bharathi <i>et al.</i> , 2013, Karnataka, India	Assess the levels of serum, malondialdehyde, Vitamin E and β -carotene and to investigate their possible bearings in pathogenesis of urolithiasis.	Case control.	100 (50 cases and 50 control)	50 healthy controls and 50 urolithiasis cases aged 15- 80 years	Increased, MDA (malondialdehyde) Decreased Vitamin E & β -carotene was seen in patients with renal stones.
2	Dongre <i>et al.</i> , 2017, Pondicherry, India	To identify the social and dietary risk factors of kidney stone	Case control	70 cases and 140 controls.	Reported with renal stone and acute onset of symptoms were included as cases. First two patients waiting in OPDs of Medicine, were controls.	Genetic disposition, less frequency of urination/day consumption of red meat once a month or more is identified in people with renal stones.
3	Avasti <i>et al.</i> , 2015, Himachal Pradesh, India	To find the association between family history of renal stones and mineral intake with demographic variables.	Explorative survey	130 (M- 78, F 52)	Kidney stone patients selected randomly from different medical institutions.	Higher intake of minerals like calcium, magnesium, sodium, and phosphorus, particularly by males compared to females.
4	Hasna <i>et al.</i> , 2015, Puducherry, India	To measure IL-6 and CRP in Diabetic patients with kidney stones.	Case control study	60 (30+30)	Diabetic patients with and without renal stone.	In patients with renal stone CRP and IL 6 levels were significantly increased in diabetic patients compared to the control group.
5	Neil <i>et al.</i> , 2017, Kerala, India	To find the prevalence of metabolic and structural changes of the genitourinary system in patients with renal stone	Retrospective study	30 (20 M, 10-F)	Age groups ranging from 20- 70 years (mean age: 38.6) with recurrent renal calculi	80% of recurrent renal stone patients had certain metabolic problems. Metabolic alteration hypercalciuria, low urinary volume, Urinary Tract Infection, Renal cyst, pelvic, horseshoe kidney and atrophic kidney are the risk factors.
6	Madhusudan <i>et al.</i> , 2015, Karnataka, India	Evaluate the patient with upper urinary tract stones in terms of incidence, clinical presentation, age, and sex distribution and to study various predisposing factors and chemical composition of renal stones.	Descriptive survey	29	11/10,000 hospital admissions	The maximum incidence was observed in the third and fourth decades. The incidence of upper urinary tract stone is more in the rural population. Consumption of groundwater, Agriculturalists working in high temperatures were at risk.
7	Guha <i>et al.</i> , 2015, West Bengal, India	To find the relationship between	Case control study	400	200 patients with renal stone and 200 controls.	Association is found between kidney stones and genetic defects.

		genetic defects and renal stone.				
8	Nerli <i>et al.</i> , 2010, Goa, India	To identify the genitourinary problems in patients attending a medical camp	Descriptive survey	298	General public with complaints of genitourinary problems	Most of the patients had renal stones. About 12% had chronic kidney disease and lower urinary tract symptoms secondary to Prostatic enlargement.
9	Chidambaram <i>et al.</i> , 2016, Tamil Nadu, India	To decrease the recurrence of renal stones by identifying the risk factors in patients with renal stone.	Prospective observational study	100	Patient aged 10-90 years with recurrent renal stones	Renal stones are common among the age group of 51 to 60 years. About 41.8% had a metabolic abnormality. Hyperuricemia, hypercalciuria. Acidic urine pH and decreased urine volume were other risk factors.
10	Sofia <i>et al.</i> , 2016, Tamil Nadu, India	To assess the prevalence and associated factors for kidney stone formation.	Descriptive survey	666	Patients visited medicine OPD. aged 10 – 80 years	The main cause for the renal stone formation is lower intake of fluid, followed by dehydration and mixed diet, increased consumption of coffee and tea, sodium, sugar, alcohol. Other factors like smoking, alcohol consumption, lack of physical activity and obesity.
11	Lohiya <i>et al.</i> , 2017, Haryana, India	To find the burden of urinary stones	Cross sectional	500	All residents 18 years or older.	Lifetime prevalence of urinary stones was 7.9%.
12	Nerli <i>et al.</i> , 2018, Karnataka, Goa, Maharashtra- India	To find the risk factors of kidney stone in patients with renal stone.	Cross sectional	250	Kidney stone patients admitted for the surgical management	High BMI, non-vegetarian, Low urinary pH were the risk factors. Urinary pH was significantly low in patients from Goa compared to patients from Maharashtra and Karnataka.
13	Mitra <i>et al.</i> , 2018, West Bengal, India	To find the association of kidney stone formation with amount and quality of water consumption	Cross sectional	1266	Water sample from cases, (a greater number of kidney stones) and controls (a smaller number of kidney stones).	Water quality is not associated with kidney stones.
14	Sharma <i>et al.</i> , Kerala, India	Analyzing urinary stones and serum biochemical parameters in urolithiasis.	Retrospective	176	Patients aged 18 years or above, with a diagnosis of urolithiasis and underwent surgery for urinary stones.	Most common constituents of kidney stones were Calcium and oxalate. About 32% and 36% of the patients had above normal serum creatinine and uric acid values respectively.

DISCUSSION

This is the first systematic review done in India to find out the risk factors of urolithiasis. The findings of the review suggested that the smoking is associated with renal stones. The similar results are obtained from a systematic review, including studies conducted in different parts of the world. The results propose that smoking is one of the risk factors for the development

of renal stones. People who are involved in physical activity, adequate hydration is the key to preclude renal stones (24). Family history of renal stones, diabetes mellitus, male gender, and middle age are associated with renal stone. There is limited knowledge and awareness about the causation of Urolithiasis. Hence public awareness needs to be increased by educating the people related to the risk factors associated with urolithiasis (25). The

important risk factors for renal stones were obesity, dietary sodium, red meat, calcium supplementation etc. (26). Study supports that middle age and male gender, and family history were the main risk factors (27-28). In women after menopause renal stone formation chances are high. Vitamin C intake increases the risk of renal stone (29). Most of the risk factors are modifiable, wherein the people can modify their lifestyle. Some of the risk factors are non-modifiable, but people can take extra precaution to prevent the stone formation. Hence educating and sensitizing the people about the prevention of renal stone plays an important role in the incidence of renal stone.

CONCLUSION

The prevalence we obtained in this review would be a tip of the iceberg. The urolithiasis among adults is a public health problem and calls for appropriate action against this.

CONFLICT OF INTEREST

None.

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