

## A Contemplation of Renal Calculi and it's Metabolic Evaluation in Bundelkhand Region

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### Abstract

**Introduction:** Kidney stones develop as a result of various metabolic disorders which affect various elements in the body especially calcium. Study was done to record the metabolic evaluation of kidney stone patients and to identify metabolic abnormality, and treating the same. Nephrolithiasis is a major public health problem worldwide. In recent years, growing evidence suggest that this disease may originate from underlying metabolic disorders. This is the first study that reports the frequency of different metabolic abnormalities among patients with nephrolithiasis in Bundelkhand Region.

**Material and Methods:** A prospective observational study, of hundred patients with the history of pain in flanks radiating to front and analyzing them for any metabolic abnormality. We analyzed urine samples for volume, creatinine, calcium, citrate, oxalate, uric acid, sodium, and cystine. Fasting blood samples were assessed for serum calcium, phosphorus, sodium, potassium, uric acid, albumin, creatinine and blood urea nitrogen.

**Results:** Out of the 200 patients, 140 were males and 60 were females. Patients underwent metabolic evaluation, in which 110 male, 30 female patients had a metabolic abnormality remaining male and female patients had no abnormality. The common abnormality found was hypoxaluria, followed by hypercalciuria -hypocitraturia and hypernatriuria of the cases.

**Conclusion:** Metabolic evaluation is a must which greatly help to diagnose kidney stone and reduce the risk of stone recurrence, Although, high calcium excretion was the most frequent metabolic derangement in several similar studies, it is not frequent among nephrolithiasis patients. Instead, other metabolic risk factors were in higher frequencies.

**Keywords:** Kidney Stones, Metabolic evaluation, Hyperuricosuria, Hypercalciuria

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## Introduction

Kidney stone formation is a major public health problem resulting in high morbidity and economic burden. The incidence and prevalence of nephrolithiasis is globally increasing in both sexes. [1,2] Nearly 10% of the world's population are expected to develop kidney stones in their lifetime, and this lifetime risk is suggested to be even higher in certain regions of the world including the Bundelkhand. Although nephrolithiasis was previously considered as a mere kidney disorder, there is now growing evidence suggesting that kidney stone formation

may originate from a wide range of underlying metabolic abnormalities; among which hypercalciuria is the most frequent. Kidney stones are made up of mainly uric acid, calcium oxalate, triple phosphate or cystine. They are solid in structures, based on their composition four kinds of stones mainly- 1. calcium oxalate stones 2. uric acid stones 3. cystine stones and 4. struvite stones[1]. Renal calculi are more common in males than in females. Mostly in 30-60yrs age group are affected. A genetic defect in urinary acidification associated with a high frequency of stone formation[2]. family history of stone disease, individuals who drink less water than the recommended, recurrent urinary tract infections (UTIs), renal tubular acidosis (RTA) and hyperparathyroidism, People with certain medical conditions, such as hypertension, diabetes, gout, and those who take certain medications, are the major risk factors. Symptoms include pain in the back radiating to front, blood in urine, vomiting and nausea, burning urination, urgency, fever and chills.3 Among kidney stones Calcium oxalate and calcium phosphate are the most common types accounting for >70-80% of stones, followed by uric acid (8-10%) and cysteine, struvite. Renal calculi both medical and surgical treatment. In 98% of cases stones passes spontaneously of diameter 5mm, while

those stones measuring 6 to 10 mm in diameter pass spontaneously in less than 53% of cases[4]. Large size stones require surgical intervention. Metabolic evaluation (ME) of renal stones, have become an important part as it helps to identify the major metabolic abnormalities. Metabolic Abnormality when treated properly can reduce the formation and recurrence of stones. Metabolic screening is based on diet related and helps in stone identification, points out stone risk factors, and identifies patient's comorbidity. ME includes tests for serum calcium, phosphorus, uric acid, creatinine, blood urea nitrogen (BUN), electrolytes, CUE and urine pH. 24-hrs urine collections on a random diet an essential part of metabolic evaluation[5]. It includes various components of urine such as urine volume, calcium, sodium, creatinine, citrate, uric acid, and oxalate. Study was done to record the metabolic evaluation of kidney stone patients and to identify metabolic abnormality and treating the same.

## Material and Methods:

From Jan 2019 to Dec 2021, a prospective observational study was done, out of 200 patients with the history of pain in flanks radiating to front. 140 patients with metabolic abnormality, were included in our study remaining patients with no abnormality were excluded. The study was conducted over a time of 2 Years, starting from Jan 2019 to Dec 2021 in the Bundelkhand Medical College Sagar, after informed consent was obtained from all individual participants were included in the study. This was a hospital-based prospective observational study, enrolling 140 patients presenting with kidney stones, to the department of General Surgery of the hospital. age, sex, body mass index (BMI), dietary pattern, family history, past history, average water intake, alcohol intake, type of stone, diagnostic tests, 24 hrs urine analysis components, serum calcium, serum uric acid, serum creatinine, random blood

sugar (RBS), and BUN and also other treatment methods used.

**Table 1: Distribution of Renal calculi according to sex (n=140)**

Distribution of Renal calculi according to sex (n=140)	
Gender	Frequency (%)
Male	110 (78.0)
Female	030 (22.0)
Total	140 (200.0)

**Table 2: Incidence of Kidney stones, its color and sensitivity**

Kidney stone type	Population	Color	Sensitivity
Calcium oxalate	80%	Black/ dark brown	Radio-opaque
Calcium Phosphate	10-15%	Dirty white	Radio Opaque
Uric acid	10-15%	Yellow/Reddish brown	Radiolucent
Struvite	5-10%	Dirty white	Radio Opaque
Cystine	1-2%	Pink/yellow	Radio-opaque

**Table 3: Distribution of Renal calculi in the study population (n=140)**

Distribution of Renal calculi in the study population (n=140)	
Type of stone former	Frequency (%)
Single	40 (28.0)
Bilateral	80 (58.0)
Multiple	20 (14.0)

### Results:

Total 140 patients diagnosed with either single, bilateral, or multiple, renal stones to the General Surgery Department of Bundelkhand Medical College Sagar were included in this prospective study, Out of these 140 patients, 110 were males and 30 were Females diagnosed with renal calculi. It was observed that the frequency of stone formation was very high in males (78%) when compared to females (22%) (Table 1). The included variables were considered to be significant factors for the formation of stones if  $p < 0.05$ . From 70 kidney stones analyzed (80%) were Calcium oxalate (CaOx) clearly predominated, followed by calcium phosphate (10-15%), uric acid. (10-15%) struvite (5-10%) cysteine (1-2%) described in Table 2. About 28% patients presented with single / unilateral- stones, 58% bilateral stones and 14% with multiple stones (Table 3).

### Discussion:

Nephrolithiasis has become a relatively common disorder, and its prevalence is greatly increasing worldwide. Any metabolic abnormality in an individual can result in single, bilateral or multiple stone. If this is left untreated, it can lead to recurrence of stones. The common metabolic abnormalities occurring in renal calculi patients are hypercalciuria, hyperuricosuria, hyperoxaluria, and hypocitraturia. Thus, evaluation of the metabolic abnormality and treating the patients can mostly reduce the incidence of stones. Metabolic evaluation (ME), is helpful for diagnosis and the risk of further recurrences in the future. This fact is supported by the study conducted by Joshi et al.<sup>6</sup> In this study, 10-20% patients were obese, with increased body mass and can be another causative factor for renal stones. According to Taylor et al, it was concluded that obesity/weight gain can increase the risk of renal stone formation and that the magnitude of increased risk may be greater in women than in men. Weight gain in

adulthood was associated with an increased risk of incident kidney stone formation in both men and women. Another study conducted by Hoppe (2003) et al.[7] also revealed that higher BMI may be a risk factor for nephrolithiasis. Shekarriz and Marshall[8] according to this study laboratory evaluation should include urine analysis and culture; Treatment of renal stones includes Medical expulsive therapy is used for spontaneous stone passage and In cases where medical expulsive therapy fails to pass the stone, other treatment opinions such as URS, ESWL, percutaneous nephrolithotomy (PCNL), and surgery are taken into consideration. Xu et al.[9], in which he explained that low urine volume, abnormally urine pH and hyperuricosuria, leads to formation of uric acid stone. In such condition, the plan of treatment is to increase the solubility of uric acid in urine and to reduce its concentration by urinary alkalization using sodium or potassium alkali. The consumption of animal protein should also be greatly reduced. Goldfarb and Arowojolu[10], it was said that predominant past, medical history mainly (diabetes and hypertension), they may be a contributor to stone formation This is the first large study concerning urinary and serum analysis of nephrolithiasis patients in Bundelkhand Medical College Sagar, a large central province of District Sagar. All recruited patients were adults with ages ranging from 30 to 60 years and about 50% were first-time stone formers. Hypocitraturia was the most common metabolic abnormality in our cases.[11-18] In the literature, the frequency of hypocitraturia varies in patients with nephrolithiasis.[10] It is firmly established that a dietary habit rich in protein and sodium but low in vegetables can reduce the urinary citrate excretion Hypercalciuria was relatively infrequent in our subjects while in similar studies, it was the leading metabolic abnormality among nephrolithiasis patients Dehydration and reduced urinary volume are wellknown risk factors for kidney stone

formation We acknowledge limitations of our study, which may have affected the outcomes of the report. Of most importance, the kidney stone types were not outlined in our study, since we were unable to extract the data of stone analysis in a group of the cases[19-26].

### Conclusion:

Any individual with metabolic abnormality, there is chance to get stones in one or both the kidneys. It was observed that renal stone disease, was more common in the age group of 30-60 and the mean age was observed to be  $45.71 \pm 14.20$ . It occurs in both gender, but the incidence was high in males than in females. The metabolic abnormalities were corrected by administration of suitable medications. Patients should be taught about the role of diet and water intake in the prevention of metabolic abnormalities and thereby prevention of renal stones.

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