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Original Article

Prevelance of Kidney Stones to the Human Populaton of District Buner and Nonpharmacologic Treatment of Kidney Stone

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ABSTRACT

Background: Kidney stones are a common urological condition with significant geographical variation in prevalence and composition. The Buner district of Khyber Pakhtunkhwa, Pakistan, represents a diverse population with distinct environmental and dietary factors that may influence the epidemiology of nephrolithiasis.

Objective: This study aimed to determine the prevalence and types of kidney stones in the Buner district, to analyze the demographic distribution of affected individuals, and to evaluate the nonpharmacologic treatment approaches used locally.

Methods: A cross-sectional survey was conducted from January to September, encompassing 965 cases from various hospitals, laboratories, and localities in the Buner district. Data collection involved gender, age, and locality-specific questionnaires, clinical examinations, and diagnostic imaging, including X-rays, ultrasounds, and CT scans. Statistical analysis was performed using Microsoft Excel 2016 and SPSS version 25.

Results: The prevalence of kidney stones was found to be higher in males (60.62%, n=585) than females (39.37%, n=380), with the highest incidence reported in individuals aged 35 to 55 years (47.97%, n=463). Rural areas showed a greater prevalence than urban areas. The majority of stones were calcium-based (70%), with calcium oxalate being the most common (65%). Uric acid stones accounted for 17%, while struvite stones were observed in 10% of cases. Seasonal variation was noted, with the highest occurrence in January.

Conclusion: Kidney stones in the Buner district are predominantly calcium oxalate and are more prevalent in males and rural residents. The age group of 35 to 55 years is most affected. Nonpharmacologic treatments, such as dietary adjustments and herbal remedies, are commonly recommended by local health practitioners. Further research into environmental and dietary influences is essential for developing targeted prevention strategies.

Keywords: Nephrolithiasis, Prevalence, Calcium Oxalate, Uric Acid, Struvite Stones, Nonpharmacologic Treatment, Buner District, Epidemiology.

INTRODUCTION

Kidney stone disease, medically termed as nephrolithiasis or urolithiasis, is an ancient medical condition, its nomenclature stemming from the Greek words 'nephros' (kidney), 'uro' (urinary), and 'lithos' (stone) (1). This multifactorial disorder arises from a confluence of epidemiological, biochemical, and genetic factors. It involves the aggregation of minerals, salts, and other substances in the urinary system, which crystallize and solidify to form stones. Common among individuals aged 30 to 60, kidney stones predominantly affect men more than women. The pain associated with kidney stones, known as renal colic, is estimated to impact 10-20% of men and 3-5% of women at some point in their lives (2, 3).

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The prevalence of urolithiasis has been escalating globally, with current estimates suggesting that 1-15% of the population will experience kidney stone formation in their lifetime. The recurrence of this condition is notable, with a 50% likelihood of recurrence within 5-10 years, escalating to 75% over 20 years (4, 5). The increasing incidence and prevalence of nephrolithiasis worldwide, coupled with the limited efficacy of available pharmacological interventions, underscore the seriousness of this health issue. In the United States alone, the self-reported prevalence of kidney stones has nearly tripled from 3.2% in the late 1970s to 8.8% in 2007-2010, as per the National Health and Nutrition Examination Survey (NHANES) data (6, 7).

The rising incidence of kidney stones is attributed to various factors including global warming, lifestyle changes, and dietary habits. The disease's prevalence is not limited by gender, race, or age and varies significantly across geographical locations. Risk factors contributing to kidney stone formation include climatic conditions, particularly warmer climates and insufficient fluid intake, dietary patterns such as high salt and animal protein intake and low fiber diets, and certain medical conditions (8, 9). These conditions include those that lead to increased serum calcium levels, like primary hyperparathyroidism, and metabolic disorders such as diabetes, stomach diseases, cardiovascular and liver diseases, obesity, high creatinine and uric acid levels, and hypertension. The consumption of high sodium diets can exacerbate the risk by increasing urinary calcium levels due to reduced calcium reabsorption in the kidney tubules (10-12).

Given the rising prevalence and recurrence of kidney stones, a comprehensive understanding of the disease, its risk factors, and effective non-pharmacological management strategies is crucial. This includes the exploration of dietary modifications, fluid intake adjustments, and lifestyle changes to mitigate the risk and manage the condition effectively (13, 14). The increasing global burden of nephrolithiasis necessitates an integrated approach to prevention and management, combining medical insights with lifestyle and dietary interventions to reduce the incidence and recurrence of this painful and prevalent condition (15, 16).

MATERIAL AND METHODS

In the study conducted in District Buner, located in the province of Khyber Pakhtunkhwa, Pakistan, a comprehensive approach was adopted to investigate the prevalence of kidney stone disease, or nephrolithiasis. Buner, with its diverse population of 506,048 across an area of 1865 km², is bordered by Swat to the north, Malakand to the west, Mardan to the south, and Hazara division to the east. The region's coordinates lie between latitudes 34° 11' N and 34° 43' N, and longitudes 72° 13' E and 72° 45' E (17, 18).

The study spanned from January to September 2022 and involved visits to various hospitals and localities within the district to collect relevant data. The methodology employed consisted of distributing 965 questionnaires across different hospitals and institutions, targeting both male and female participants. These questionnaires contained queries pertaining to nephrolithiasis and its risk factors, encompassing a range of demographic and medical information including age, gender, marital status, profession, education, and locality. Furthermore, the questionnaire delved into physical and medical aspects such as signs and symptoms, risk factors, water and food intake, exercise habits, diagnosis, results, and treatment options (19, 20).

Clinical tools such as microscopes, centrifuges, test tubes, X-ray machines, ultrasound machines, and CT scanners were utilized for diagnosis and investigation. Additionally, data recording was facilitated through the use of computers, mobile phones, pens, and notebooks. The diagnostic approach typically commenced with a symptom inquiry and physical examination, followed by various tests to ascertain the presence, size, type, and location of the kidney stones. These tests included blood tests, urine analysis (urinalysis), X-rays, ultrasounds, and CT scans (21).

The urinalysis, comprising visual, microscopic, and dipstick tests, was conducted on 358 samples to detect abnormalities and early signs of diseases such as kidney disease, diabetes, and liver disease. The blood tests, totaling 330, involved serum analysis to detect levels of calcium, glucose, sodium, potassium bicarbonate, chloride, blood urea nitrogen (BUN), creatinine, hemoglobin, cholesterol, and albumin. The process entailed a 15-minute gel-tube placement, a 10-minute water bath, followed by a 5-minute centrifugation. X-ray examinations, particularly Kidney-Ureter-Bladder (KUB) X-rays, were performed on 450 patients to identify stones larger than 2.5mm. Ultrasound tests, amounting to 250, helped in assessing kidney size, injury signs, ureter blockages, cysts, tumors, and urinary tract infections (UTIs). Additionally, 85 CT scans were conducted, providing detailed information on the size and location of kidney stones (22-24).

The data collected from these diverse sources was meticulously analyzed using statistical tools. Initially, Microsoft Excel 2016 was employed for preliminary data organization and analysis. Subsequently, for more in-depth statistical evaluation, SPSS (Statistical Package for the Social Sciences) version 25 was utilized. This comprehensive approach, encompassing data collection, clinical investigation, and statistical analysis, aimed to provide a thorough understanding of the prevalence and risk factors of nephrolithiasis in District Buner. The study was conducted in accordance with ethical standards, ensuring the confidentiality and privacy of the participants' information (25, 26).

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RESULTS

In the comprehensive study carried out in Buner district, a total of 965 cases of kidney stones were investigated, spanning across various demographics, ages ranging from 15 to 65 years, and including both male and female patients from diverse localities within the district.

Gender-wise, the clinical investigation reported that out of the 965 cases, 585 were males, constituting 60.62%, and 380 were females, making up 39.37%. This gender distribution is graphically illustrated in the relevant figure. Age-wise, the distribution was as follows: individuals aged 15 to 35 years accounted for 285 cases or 29.53%, those between 35 to 55 years made up the majority with 463 cases or 47.97%, and the 55 to 65 years age group comprised 217 cases or 22.48%, as depicted in the corresponding figure.

The locality-specific analysis of kidney stone abundance revealed varying prevalence across regions such as Gokand, Pirbaba, Jowar, Chamala, Elai, Cheena, Chagarzee, Budal, Nawagii, Chenglay, Totalay, and Malka, with Gokand reporting the highest number of cases and Elai the lowest, as represented in the related figure.

A comparison between rural and urban areas within the Buner district showed a higher prevalence of kidney stones in rural areas compared to urban ones, with a detailed statistical representation provided in the associated figure. Month-wise, the highest number of cases was reported in January, while September had the lowest, as shown in the respective figure.

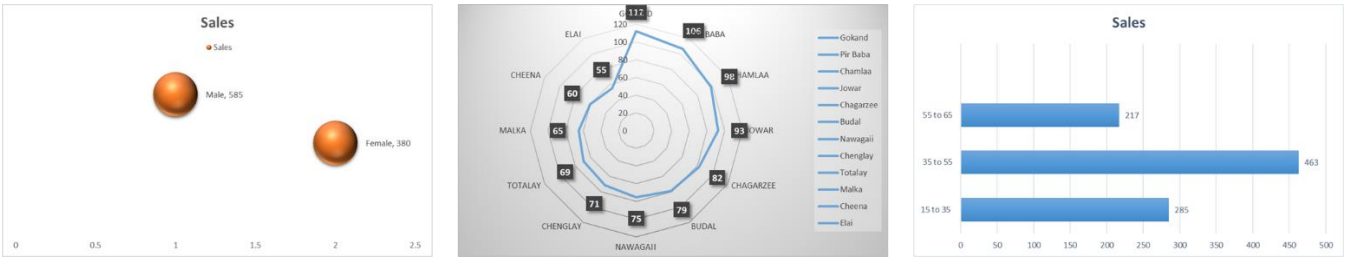
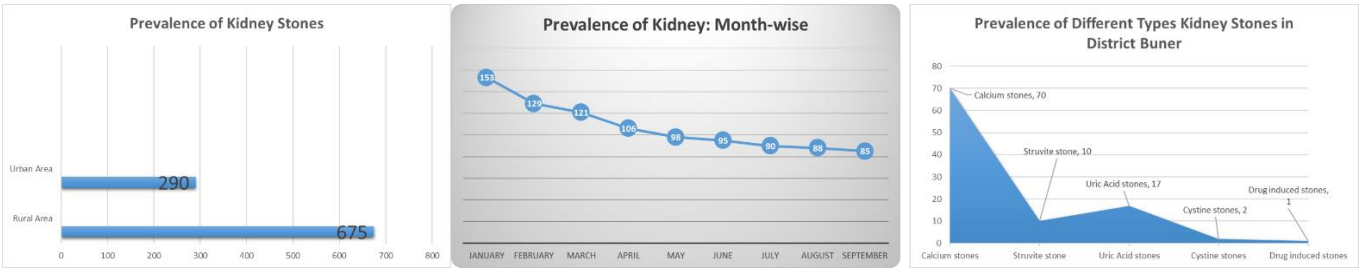


Figure 1 Gender, Age Group, and Location



Different types of kidney stones were identified, classified by their mineral composition. Calcium stones were the most prevalent, constituting 70% of cases, which included calcium phosphate (3%), pure calcium oxalate (65%), and a combination of both (32%). Struvite stones, associated with persistent urinary tract infections, accounted for 10% of the cases. Uric acid stones made up approximately 17%, often linked to a purine-rich diet. Cystine stones, a hereditary condition, and drug-induced stones, attributable to certain medications, represented less than 2% and approximately 1% of cases respectively, as detailed in the designated figure.

In terms of nonpharmacologic treatment, local Hakeem and doctors in the Buner district advocated for dietary and lifestyle modifications as preventive measures. For patients with calcium lithiasis, a normal intake of calcium (1000–1200 mg/day) and a fluid intake sufficient to produce 2 liters of urine daily were recommended. Alternative therapies, including homoeopathy and herbal medicine, were also noted as treatment options for kidney stones.

DISCUSSION

In the context of renal calculi epidemiology, the current investigation within Buner district of Khyber Pakhtunkhwa, Pakistan, elucidates a significant predominance of calcium-based stones, aligning with regional trends observed in the southern Punjab of Pakistan, where calcium oxalate stones are frequently reported. The study's findings indicate that 70% of urinary calculi are composed of calcium, with calcium oxalate (CaOx) alone accounting for 65% and combined calcium oxalate and phosphate stones comprising 32%. This distribution contrasts with the prevalence patterns in the United States and the East region of Algeria, where urate stones are less prevalent, contributing to 8-10% and 17% of kidney stones respectively, as reported in previous studies. Notably, the current analysis revealed urate stones constituted a significant 17% of cases, underscoring a regional dietary influence potentially rich in purine sources (7, 13).

Furthermore, the study corroborates the infectious etiology of struvite stones, which, in the local setting, accounted for 10% of urinary stones, slightly lower than the 15% reported in other regions. Such discrepancies may be reflective of varying local health conditions, such as the frequency and management of urinary tract infections. The comparative analysis within the study population revealed that kidney stones were more prevalent in rural areas than in urban ones, a pattern that may be attributed to lifestyle factors, access to healthcare, dietary habits, or water consumption behaviors (4, 8, 17, 18).

The temporal distribution of cases displayed a peak in January, with a decline noted towards September. This seasonal variation could be indicative of climatic influences on hydration status and subsequent stone formation. Age-wise, the most affected demographic was between 35 to 55 years, which is consistent with other findings that suggest middle-aged adults bear a higher burden of nephrolithiasis. This is in line with global observations, where the incidence and prevalence of kidney stones are reported to increase with age until a certain point (20, 21).

Symptomatically, the initial asymptomatic nature of kidney stones was noted, with the progression of symptoms such as pain, hematuria, and urinary tract infections becoming more evident as the condition worsened. This progression is in agreement with the broader literature, which suggests that a significant proportion of kidney stones remain undiagnosed until symptomatic episodes occur (12).

The study also highlighted the 'stone belt' phenomenon with Pakistan's inclusion in this high-prevalence geographical zone, further emphasizing the influence of environmental factors, particularly temperature, on the epidemiology of nephrolithiasis. This is consistent with the notion that geographical and climatic conditions play a non-negligible role in the pathogenesis of kidney stones (5, 7, 9).

The current research has its strengths, including the comprehensive sampling from various localities, encompassing both rural and urban areas, and spanning a wide age range. However, the limitations are evident in the scope of nonpharmacologic treatments, which were largely centered around traditional and alternative medicine practices without extensive exploration of modern dietary and lifestyle interventions. Additionally, the study's design may have benefited from a broader temporal scope to fully ascertain the impact of seasonal changes on the prevalence of kidney stones (21, 23).

In light of the findings and the study's constraints, it is recommended that future research should encompass a more extensive geographical area to validate the observed prevalence rates and to explore the efficacy of nonpharmacologic treatments, particularly those that are evidence-based. Further investigations should aim to elucidate the precise dietary and environmental factors contributing to the high prevalence of calcium stones and to assess the impact of modern medical interventions on the management of kidney stones (24).

In conclusion, the study adds valuable data to the existing body of knowledge on the epidemiology of nephrolithiasis in Pakistan and underscores the necessity for continued research in the domain of nonpharmacologic treatments and preventive strategies.

CONCLUSION

The study conducted in the Buner district of Khyber Pakhtunkhwa, Pakistan, concludes with a significant finding that calcium stones, primarily composed of calcium oxalate, are the predominant type of kidney stones in the region, representing 70% of cases. This aligns with global trends but highlights a regional variation in the prevalence of urate stones. The research underscores the influence of local dietary habits and environmental factors, such as the 'stone belt' region's increased temperatures, on the incidence of nephrolithiasis. The age group most affected lies between 35 to 55 years, with rural areas showing a higher prevalence, suggesting that lifestyle and access to healthcare are contributing factors. The study's implications are twofold: first, it calls for a broader investigation into the environmental and dietary causes of kidney stones to inform more effective nonpharmacologic treatments; second, it emphasizes the need for public health strategies to prevent the occurrence of kidney stones, particularly in high-risk populations. These findings and recommendations aim to guide future research and healthcare policies to mitigate the burden of kidney stones in the region.

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