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Research Article

Characteristics of Urinary Tract Stone Patients in Central Sulawesi, 2020–2024

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Abstract: Urolithiasis is a common urologic disorder characterized by stone formation along the urinary tract, predominantly affecting adult males and showing a high recurrence rate. Despite numerous global studies, data on the Central Sulawesi population remain limited, hindering the development of local management strategies. This study aims to describe the epidemiological and clinical characteristics of patients with urinary tract stones in Central Sulawesi from 2020 to 2024. A retrospective cross-sectional study was conducted using secondary data from electronic medical records and surgical archives of referral hospitals. A total of 4,078 patients diagnosed with urinary tract stones were analyzed descriptively based on age, sex, diagnosis, and treatment modalities. The mean age was 47.77 ± 14.80 years, and males accounted for 53.4% of cases. Ureteral stones were the most frequent diagnosis (48.4%), followed by renal stones (40.4%) and bladder stones (11.0%). In terms of management, ureterorenoscopy (URS) with DJ stent insertion was most common (20.15%), followed by extracorporeal shock wave lithotripsy (ESWL) (10.15%), while 47.29% were managed with medical expulsive therapy (MET). These findings indicate that urolithiasis in Central Sulawesi mainly affects males in productive age, with ureteral stones as the leading type. Minimally invasive procedures, especially URS and ESWL, dominate clinical practice, highlighting the need for strengthened prevention, early detection, and urological service infrastructure.

Keywords: Epidemiology; Patient Characteristics; Retrospective Study; Urolithiasis; URS

1. Introduction

Urolithiasis, or urinary tract stones, is one of the most common urological diseases worldwide and tends to recur frequently (Razi et al., 2024). In recent years, the increasing trend of urolithiasis cases has become an important public health issue, which is believed to be closely related to changes in dietary habits and modern lifestyles, such as high consumption of salty and animal-protein foods, low water intake, and a sedentary lifestyle (Allam, 2024). This disorder is characterized by the formation of stones along the urinary tract—including the kidneys, ureters, bladder, and urethra—caused by the deposition of mineral crystals in supersaturated urine (Cheng & Tseng, 2024). Clinically, urinary stones may cause severe acute pain (renal colic), hematuria, urinary obstruction, and urinary tract infections, and if left untreated, can lead to renal function decline (Mao et al., 2025).

Beyond its health impact, urolithiasis also imposes a significant economic burden on both patients and healthcare systems. Medical costs include diagnostic examinations, conservative treatments, surgical procedures (such as lithotripsy or kidney stone surgery), and follow-up care for possible complications (GBD 2021 Urolithiasis Collaborators, 2024). About half of patients experience recurrence, and approximately 10% have multiple episodes of stone formation (Mutomba et al., 2025).

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The global prevalence of urolithiasis varies widely depending on geographic and ethnic factors. In the United States, the prevalence of kidney stones reaches 8.8%, while in Asia it ranges from 5% to 19.1% (Razi et al., 2024). In Indonesia, although national epidemiological data are still limited, reports from several tertiary healthcare centers indicate that urolithiasis is one of the leading causes of hospitalization and both elective and emergency urological procedures (Atmoko et al., 2023).

A study at Undata General Hospital in Central Sulawesi found that kidney and ureteral stones were the second and third most common diagnoses in the urology clinic from 2021 to 2023, accounting for 16.7% and 6.8% of all urology patients, respectively (Sukarni, 2024). Most patients were elderly males, indicating differences in risk based on age and sex. This finding is consistent with studies from China and Taiwan showing male predominance (ratio >2:1) and a peak incidence among individuals aged 40–60 years (Wang et al., 2024; Cheng & Tseng, 2024).

Multiple factors contribute to stone formation, including sex, age, body mass index (BMI), dietary habits high in protein or sodium, low fluid intake, and metabolic diseases such as diabetes mellitus and hypertension (Wang et al., 2024; Mao et al., 2025; Atmoko et al., 2023)). Histochemically, urinary stones are mainly composed of calcium oxalate, uric acid, and struvite, each with distinct epidemiological and clinical features (Wang et al., 2024; Razi et al., 2024)). Recurrent urinary tract infections may also lead to the formation of struvite stones, particularly among women (Yang et al., 2024).

As a multifactorial disease, the management of urolithiasis should not rely solely on surgical intervention but must be based on a comprehensive understanding of patient characteristics. Analyzing local patient data is essential to identify regional patterns and preferred treatment modalities such as ureterorenoscopy (URS), extracorporeal shock wave lithotripsy (ESWL), or open surgery. This information is crucial for designing effective prevention strategies, public health education, and more efficient and personalized management approaches in the future ((Wang et al., 2024; Alathel et al., 2024).

Previous studies at national and international levels have shown that patient characteristics vary according to geography, ethnicity, and healthcare systems (Razi et al., 2024; Zhang et al., 2024)). Therefore, valid and comprehensive local data are needed to describe the epidemiological pattern of urolithiasis in specific regions. Central Sulawesi, a province with a growing population and limited access to urological facilities, has not been well-documented in terms of the characteristics of its urolithiasis patients.

Based on this background, this study aims to analyze the characteristics of patients with urinary tract stones in Central Sulawesi over the past five years (2020–2024), including demographic profiles and types of treatments provided, to generate baseline data for evidence-based clinical and preventive policy development in the region..

2. Materials and Method

This study employed a quantitative descriptive design with a retrospective cross-sectional approach aimed at evaluating the clinical and demographic characteristics of patients with urinary tract stones. Data were obtained from electronic medical records and procedural archives across several healthcare facilities in Central Sulawesi involved in managing urolithiasis cases from January 2020 to December 2024.

The study population included all patients diagnosed with urinary tract stones (nephrolithiasis, ureterolithiasis, and vesicolithiasis) during the study period. A total sampling technique was applied to include all patients who met the inclusion criteria: (1) diagnosed with urinary tract stones based on ICD-10 codes, (2) having complete demographic data (age and sex), and (3) having recorded urological procedures or interventions. Patients with incomplete data or nonspecific diagnoses were excluded from the analysis.

Secondary data were collected from digital archives, including age, sex, diagnosis, and type of urological intervention. Data processing consisted of four stages: (1) Editing — assessing data quality by identifying duplicates, inconsistencies, and missing entries. Records with incomplete or mismatched diagnosis and procedure information were classified as missing system data and excluded from statistical analysis. (2) Coding — assigning numerical codes to variables for statistical processing (e.g., sex: 1 = male, 2 = female; stone type: 1 = kidney, 2 = ureter, 3 = bladder, 4 = others). (3) Cleaning — removing extreme or illogical outliers (e.g., age >120 years; the raw data contained one case recorded as 225 years old) using double validation to ensure data accuracy. (4) Tabulating — compiling data into frequency and percentage distributions using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

Numerical data (age) were presented using descriptive statistics (mean, median, minimum, maximum, and standard deviation), while categorical data (sex, diagnosis, intervention) were displayed in frequency tables. No inferential analysis was performed since the study aimed to provide descriptive and exploratory findings. The study was conducted with approval from the data-providing institutions and adhered to ethical principles of medical research, ensuring confidentiality and patient data anonymity. As this was a retrospective study using secondary anonymized data, written informed consent was not required..

3. Results and Discussion

This study aimed to evaluate the characteristics of patients with urinary tract stones in Central Sulawesi during the 2020–2024 period. Analysis was conducted on 4,078 patient records retrieved from the main referral hospital system. The results are summarized in the following tables.

Table 1. Age Distribution of Patients with Urolithiasis (n = 4,078)**.**

Statistic Descriptive	Value
Mean	47,77 years
Median	49,00 years
Standar Deviasi	±14,80
Minimum Age	0 years
Maksimum Age	225 years

The majority of patients were within the productive adult age range. This finding is consistent with the study by Wang et al. (2024), which reported that individuals in the working-age group are more susceptible to urolithiasis due to metabolic activity and suboptimal fluid intake patterns (Wang et al., 2024).

Table 2. Gender Distribution of Patients with Urolithiasis (n = 3,812).

Gender	Frequency	Percentage (%)
Male	2.035	53,4%
Female	1.777	46,6%
Total	3.812	100%

The proportion of male patients was higher than female patients. This aligns with the findings of Atmoko et al. (2023), who also reported male predominance in kidney stone cases, likely due to hormonal influences and lifestyle factors related to hydration habits (Atmoko et al., 2023).

Table 3. Distribution of Urolithiasis Diagnosis (n = 3,812).

Diagnosis	Frequency	Percentage (%)
Ureteral Stone	1.844	48,4%
Renal Stone	1.540	40,4%
Bladder Stone	421	11,0%
Others	7	0,2%
Total	3.812	100%

Ureteral stones were the most frequent diagnosis, indicating a tendency for stones to migrate from the kidney. This is consistent with the anatomical characteristics of the urinary tract and global reports identifying the ureter as a common site of clinical manifestation (Yang et al., 2024). Renal stones were also highly prevalent, consistent with findings reported by (Khanam et al., 2024).

Table 4. Types of Procedures Performed for Patients with Urolithiasis (n = 2,010).

Type of Procedure	Frequency	Percentage (%)
URS - Insersi DJ Stent	768	20,5%
ESWL	387	10,15%
Pyelolitotomi	302	7.93%
Litotripsi Batu Buli	293	7.69%
PCNL	111	2.91%
Open Ureterolitotomi	96	2.52%
Open Vesikolitotomi	46	1.21%
Laparoskopi Ureterolitotomi	7	0.18%
Medical expulsive therapy (MET)	1802	47.29%
Total	3812	100%

The URS–DJ stent insertion procedure was the most frequently performed intervention, reflecting the growing adoption of minimally invasive urological techniques in the region. This finding aligns with global evidence indicating that ureterorenoscopy (URS) has become the first-line standard therapy for ureteral stones (Razi et al., 2024). Extracorporeal shock wave lithotripsy (ESWL) remains widely used, particularly for small renal stones, while the proportion of patients receiving medical expulsive therapy (MET) at 47.29% suggests that conservative management is still preferred for stones considered likely to pass spontaneously.

The findings of this study are generally consistent with global epidemiological trends in urolithiasis. The predominance of patients in the productive age group reflects the significant impact of this disease on quality of life and work productivity (Mao et al., 2025). Male dominance in this dataset is also supported by multicenter studies in Taiwan and China, which reported male-to-female ratios ranging from 2:1 to 3.5:1 (Cheng & Tseng, 2024; Wang et al., 2024). Similarly, Zhang et al., (2024) and Shastri et al., (2023) found that urolithiasis occurs more frequently in men, with an approximate ratio of 3:1. This disparity is believed to be associated with higher consumption of alcohol, coffee, and meat among men (Latuconsina et al., 2024).

Regarding stone location, ureteral and renal stones were the most common, supporting previous reports from Central Sulawesi that showed similar distributions (Sukarni, 2024). Geographic and climatic factors—particularly the tropical climate—may influence hydration patterns, indirectly contributing to the incidence of urinary stones (Razi et al., 2024).

The predominance of URS and ESWL procedures reflects the progressive implementation of minimally invasive urology in the region. However, the notable proportion of open surgeries, such as pyelolithotomy and open ureterolithotomy, indicates that large stone size or limited facility availability may still necessitate conventional approaches (Alathel et al., 2024). This study thus provides valuable insights into the regional urological burden and serves as a basis for developing more targeted policies for future urological interventions..

4. Conclusion

This study provides a comprehensive overview of the epidemiological and clinical characteristics of urolithiasis cases in Central Sulawesi from 2020 to 2024. The findings reveal that the majority of patients were within the productive age group, with a mean age of 47.77 years, and that males constituted a slightly higher proportion (53.4%) compared to females (46.6%). Ureteral stones were identified as the most common diagnosis, followed by renal and bladder stones. In terms of management, minimally invasive procedures—particularly ureterorenoscopy (URS) with DJ stent insertion and extracorporeal shock wave lithotripsy (ESWL)—were the predominant treatment modalities, while nearly half of the patients were managed conservatively with medical expulsive therapy (MET).

These findings align with global patterns of urolithiasis epidemiology, reinforcing the hypothesis that lifestyle, hydration habits, and metabolic activity contribute significantly to disease prevalence. The male predominance observed in this study further supports hormonal and behavioral factors as potential risk determinants.

The implications of this research highlight the importance of improving preventive strategies and optimizing urological services in regional healthcare systems. Strengthening public education on adequate hydration, dietary balance, and early screening can potentially reduce the disease burden and recurrence rate. Furthermore, expanding access to minimally invasive technology and improving referral systems are essential for equitable urological care in developing regions.

However, this study has several limitations. It relied on retrospective secondary data, which may contain incomplete or inconsistent records. Additionally, the absence of biochemical analysis and stone composition data limited further exploration of metabolic and etiological factors. Future studies are recommended to incorporate laboratory-based assessments and prospective designs to better understand causal mechanisms and evaluate preventive interventions in the local context.

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