JMU
Jurnal Medika Udayana

ISSN: 2597-8012 JURNAL MEDIKA UDAYANA, VOL. 15 NO.8, AGUSTUS, 2026

Received: 2026-04-09 Revision: 2026-06-06 Accepted: 30-07-2026

CHARACTERISTICS AND LABORATORY EXAMINATION RESULTS IN PATIENTS WITH URINARY TRACT STONES AT PROF. DR. I.G.N.G. NGOERAH HOSPITAL DENPASAR

Made Kirana Candra Herry Putri[1], Desak Gde Diah Dharma Santhi[2]. Ni Kadek Mulyantari[3], Sianny Herawati[4]

[1.] Faculty of Medicine, Udayana University
[2.] Department of Clinical Pathology, Faculty of Medicine, Udayana University

Correspondence
Made Kirana Candra Herry Putri
Faculty of Medicine, Udayana University
e-mail: kiranacandraherry@gmail.com

ABSTRACT

Background: Intellectual disability is a neurocognitive developmental disorder that can be influenced by various perinatal factors, one of which is a history of preterm birth. Preterm birth risks disrupting the maturation of brain structure and function, thus impacting a child's intellectual abilities. This study aimed to analyze the relationship between a history of preterm birth and intellectual disability among children attending Special Schools in Makassar City.

Methods: This study employed an analytical observational cross-sectional design and was conducted from December 2025 to January 2026 at SLB Negeri 1 Makassar City and SLB C Yayasan Pembina Pendidikan Luar Biasa (YPPLB) Makassar City. A total of 82 respondents were selected using purposive sampling. Birth history was obtained through interviews with parents, while the level of intellectual disability was obtained from school documents. Analysis was performed using the Chi-Square test.

Results: Most respondents had no history of preterm birth (76.8%), while the majority of children had moderate intellectual disabilities (39.0%). Chi-square analysis demonstrated a significant relationship between a history of preterm birth and the prevalence of intellectual disability in children (p=0.019).

Conclusion: A history of preterm birth is significantly associated with the prevalence of intellectual disability in children at special schools in Makassar City. This finding highlights the importance of addressing perinatal factors as part of early detection and prevention efforts for developmental disorders.

Keywords: Preterm birth, intellectual disability, children, special school, children with special needs

INTRODUCTION

Urinary tract stone disease is the third most common disease in the field of urology.[1] Stones that form in the kidneys are called kidney stones or nephrolithiasis. Meanwhile, conditions where the stones come out and go to urinary tracts such as the ureters, bladder, and urethra are called urolithiasis.[2] The prevalence of urinary tract stones globally is around 12% while in Asian populations it ranges from 1%-19.1%.[3] In Indonesia, the incidence of urinary tract stone disease is around 1.4% of the total population.[1] Based on the location of the stones, in most cases, patients with urinary tract stones suffer from kidney stones.[1] Various things can be a factor in the formation of urinary tract stones. Family history, age, gender, and comorbidities are part of the internal factors. External factors include diet, climate, and occupation.[4,5] A positive family history of urinary tract stones related to genetic mutations.[3,5] Prevalence also increases with age, which is associated with decreased organ function.[4] Men are said to be a factor due to the longer anatomy of the urinary tract and the testosterone hormone.[1,6] Comorbidities such as obesity, diabetes mellitus, hypertension, benign prostatic hyperplasia, and hyperparathyroidism can disrupt homeostasis leading to an increased likelihood of stone formation and urinary tract infection associated with infectious stone formation (struvite stones).[7,8] A dry and hot climate is also an influence as it is more likely to increase fluid evaporation from the body.[2,3] Diet such as lack of water intake, as well as high intake of animal protein and oxalate are also said to be factors.[2] Jobs with low physical activity can increase the risk due to long periods of sitting, meanwhile, high-activity jobs are associated with hot climatic influences that increase the likelihood of dehydration.[3,9]

Patients with urinary tract stones have symptoms that vary from no symptoms to severe symptoms. Based on physical examination, patients can be found with fever, anemia, and positive for tenderness. Supporting examinations in urinary tract

stone patients include laboratory and imaging examinations. Laboratory examinations that can be performed include urinalysis, complete blood tests, blood chemistry tests, and stone analysis. Urinalysis is performed to see the presence or absence of erythrocytes, leukocytes, nitrites, the presence of bacteria, and urine pH.[10] A complete blood count test is performed to determine the levels of hemoglobin, hematocrit, leukocytes, platelets, and blood cell count.[11] Blood chemistry examinations are carried out such as to determine the levels of creatinine, uric acid, sodium, potassium, calcium, c-reactive protein, and BUN.[10] The importance of checking creatinine and BUN levels is to measure whether there is a decrease in kidney function.[12] When obtaining a stone sample, stone analysis helps determine the type and composition of the stone.[13] Cases of urinary tract stones in the world and Indonesia are still high and the incidence is influenced by intrinsic and extrinsic factors. Research on the description of laboratory examination results of patients with urinary tract stones at Prof. Dr. I.G.N.G. Ngoerah Hospital Denpasar is still limited. Therefore, the researcher is interested in researching "Characteristics and Laboratory Examination Results in Patients with Urinary Tract Stones at Prof. Dr. I.G.N.G. Ngoerah Denpasar Hospital".

MATERIALS AND METHODS

The research conducted was descriptive research with a cross-sectional approach. The data used is secondary data obtained from medical records. The study sample was patients with urinary tract stones at Prof. Dr. I.G.N.G. Ngoerah Denpasar Hospital who met the inclusion criteria, namely having medical records with complete identity and laboratory examination results of complete blood tests and urinalysis examinations, having medical records with laboratory results of complete serum BUN and creatinine blood chemistry examinations and uric acid and stone analysis if examined. Meanwhile, the study exclusion criteria were all patients diagnosed with urinary tract stones at Prof. Dr. I.G.N.G. Ngoerah Hospital Denpasar outside of the period January 2021 to December 2022. The research sample used the total sample method. This study has obtained ethical clearance before data collection is carried out and the ethical clearance number is DP.04.03/D.XVII.2.2.2/13103/2023.

RESULTS

The study subjects consisted of 182 people from a total of 396 patients diagnosed with urinary tract stones at Prof. Dr. I.G.N.G Ngoerah Hospital Denpasar. Male patients were 131 (72.0%) while female patients were 51 (28%). In the age group, the majority of samples were aged ≥ 51 years as many as 124 samples (68.1%), 40 samples (22%) were in the range of 41-50 years, and each of the nine samples (4.9%) were in the age range of 31-40 years and ≤ 30 years. It was found that the most common occupation of the sample was private employees 48 samples (26.4%), followed by self-employed as the second most common profession with 33 people (18.1%), and farmers 23 people (12.6%). There were 21 samples (11.5%) who were housewives, 14 people (7.7%) worked as civil servants. There were 10 people (5.5%) who were not included in the category, nine people (4.9%) who were retired, seven samples (3.8%) each had traders as their profession and unemployed, four people (2.2%) were students, three people (1.6%) were police officers, and three other people (1.6%) did not work because they were minors. The family history of urinary tract stones was not found in 178 (97.8%) cases but was found in four samples (2.2%) who had a family history of similar disease. The characteristics of the sample can be seen in **Table 1**.

Table 1. Characteristics of Respondents

Variable	N (%)
Age (years)	
≤ 30	9 (4.9%)
31-40	9 (4.9%)
41-50	40 (22%)
≥ 51	124 (68.1%)
Gender	
Male	131 (72%)
Female	51 (28%)
Occupation	
Civil Servant	14 (7.7%)
Self-employed	33 (18.1%)
Private Employee	48 (26.4%)
Police	3 (1.6%)
Farmer	23 (12.6%)
Trader	7 (3.8%)
Students	4 (2.2%)
Retired	9 (4.9%)
Housewife	21 (11.5%)
Unemployed	7 (3.8%)
Underage	3 (1.6%)
Others	10 (5.5%)
Family history	
Yes	4 (2.2%)

doi:10.24843.MU.2026.V15.i8.P05

None	178 (97.8%)

Based on comorbidities, out of 182 samples, 59 people (32.4%) had hypertension, 26 people (14.3%) had diabetes, and 29 people (15.9%) had urinary tract infections. Benign prostatic hyperplasia can only be suffered by male samples. Therefore, out of 131 male samples, only 19 people (14.5%) had BPH as their predisposing disease. The results of patient distribution based on their comorbidities are presented in **Table 2**.

Table 2. Comorbidities of Respondents

Comorbidities	N (%)
Hypertension	
Yes	59 (32.4%)
None	123 (67.6%)
Diabetes	
Yes	26 (14.3%)
None	156 (85.7%)
Urinary Tract Infection	
Yes	29 (15.9%)
None	153 (84.1%)
Benign Prostatic Hyperplasia (BPH)	
Yes	19 (14.5%)
None	112 (85.5%)

The results of urinalysis showed that the number of samples that had normal urine color were clear yellow in 21 samples (11.5%), light yellow in nine samples (4.9%), yellow in 133 samples (73.1%), solid yellow in one sample (0.5%). Some people had abnormal urine colors such as red color in seven samples (3.8%), amber and brown colors in three people each (1.6%), orange color in three people (0.5%), and two people each (1.1%) with light orange and other colors that were not categorized. There were 107 (58.8%) clear urine samples and 75 turbid urine samples with 41 (22.5%) tubrid (++) and 34 (18.7%) turbid (+). A total of 174 people (95.6%) had normal urine pH in the range of 4.5 – 8, and eight people (4.4%) had pH of >8. There were 36 people (19.8%) obtained negative results for erythrocytes, while the majority of samples had positive results for erythrocytes, namely positive (+) were obtained in 14 people (7.7%), positive (++) in 28 people (15.4%), positive (+++) in 102 people (56%), and positive (++++) were obtained in two people (1.1%). The majority of samples also had positive leukocyte results as many as 70 people (38.5%) had positive results (++++), 11 people (6%) with positive results (+++), 36 people (19.8%) with positive (++), and 18 samples (9.9%) had positive (+). A total of 47 samples (25.8%) had negative urine leukocyte results. Bacteria were found to be positive in the majority of samples, 161 people (88.5%), and only 21 people (11.5%) had negative results. A total of 150 (82.4%) people had negative nitrite results, and 32 (17.6%) people had nitrite-positive urine. Out of 182 samples, only 14 samples had urine crystal composition examination results where nine samples (64.28%) had calcium oxalate crystals, followed by three samples (21.42%) had uric acid crystals, and two other samples (14.28%) had amorphous crystals. The results of urinalysis can be seen in **Table 3**.

Table 3. Urinalysis Results of Respondents

Urinalysis	N (%)
Urine color	
Clear yellow	21 (11.5%)
Light yellow	9 (4.9%)
Yellow	133 (73.1%)
Solid yellow	1 (0.5%)
Light orange	2 (1.1%)
Orange	1 (0.5%)
Amber	3 (1.6%)
Brown	3 (1.6%)
Red	7 (3.8%)
Other 00	2 (1.1%)
Urine turbidity	
Clear	107 (58.8%)
Turbid (+)	34 (18.7%)
Turbid (++)	41 (22.5%)
pH	
<4.5	0 (0%)
4.5-8	174 (95.6%)
>8	8 (4.4%)

doi:10.24843.MU.2026.V15.i8.P05

Eritrocyte	
Negative	36 (19.8%)
Positive (+)	14 (7.7%)
Positive (++)	28 (15.4%)
Positive (+++)	102 (56%)
Positive (++++)	2 (1.1%)
Leukocyte	
Negative	47 (25.8%)
Positive (+)	18 (9.9%)
Positive (++)	36 (19.8%)
Positive (+++)	11 (6%)
Positive (++++)	70 (38.5%)
Bacteria	
Negative	21 (11.5%)
Positive	161 (88.5%)
Nitrite	
Negative	150 (82.4%)
Positive	32 (17.6%)
Urine crystal	
Calcium oxalate	9 (64.28%)
Uric acid	3 (21.42%)
Amorphus	2 (14.28%)

Based on the results of complete blood tests in **Table 4**, it is found that 82 samples (45.1%) had decreased erythrocytes, 90 people (49.5%) within the normal range, and 10 people (5.5%) had increased erythrocytes. A total of 115 people (63.2%) had a decrease in hemoglobin, and 67 people (36.8%) had normal results. The results of the hematocrit examination of the sample were found to be mostly decreased in 109 people (59.9%), while normal results were obtained in 73 other people (40.1%). Most patients had a normal leukocyte count of 108 people (59.3%), 72 people (39.6%) had increased leukocytes, and 2 people (1.1%) had decreased leukocytes. In the thrombocyte count examination, 15 people (8.2%) of the sample experienced a decrease in thrombocyte, 22 other people (12.1%) experienced an increase, and 145 people (79.7%) had normal thrombocyte values.

Table 4. Complete Blood Count Results of Respondents

Complete Blood Count	N (%)
Eritrocyte	
Decreased	82 (45.1%)
Normal	90 (49.5%)
Increased	10 (5.5%)
Hemoglobin	
Decreased	115 (63.2%)
Normal	67 (36.8%)
Increased	0 (0%)
Hematocrit	
Decreased	109 (59.9%)
Normal	73 (40.1%)
Increased	0 (0%)
Leukocyte	
Decreased	2 (1.1%)
Normal	108 (59.3%)
Increased	72 (39.6%)
Thrombocyte	
Decreased	15 (8.2%)
Normal	145 (79.7%)
Increased	22 (12.1%)

Based on the blood chemistry examination, it was found that the creatinine level in most urinary tract stones patients was found to be increased, namely in 109 people (59.9%), found normal in 61 people (33.5%), and decreased in 12 people (6.6%). In the examination of BUN levels, most samples, namely 99 samples (54.4%), were found to be normal, increased in 69 people (37.9%), and decreased in 14 people (7.7%). Out of the 182 samples, 86 samples (47.3%) did not perform uric acid examination, whereas of the 93 people who were examined, 48 people (26.4%) samples had uric acid higher than normal, 45 people (24.7%) samples had normal uric acid levels, and three people had decreased uric acid (1.6%). The results of the blood chemistry examination are described in **Table 5**.

doi:10.24843.MU.2026.V15.i8.P05

Table 5. Blood Chemistry Examination Results of Respondents

Blood chemistry	N (%)
Creatinine serum	
Decreased	12 (6.6%)
Normal	61 (33.5%)
Increased	109 (59.9%)
BUN	
Decreased	14 (7.7%)
Normal	99 (54.4%)
Increased	69 (37.9%)
Uric acid	
Decreased	3 (1.6%)
Normal	45 (24.7%)
Increased	48 (26.4%)
Not examined	86 (47.3%)

Out of the 182 samples, only 34 samples had stone analysis results, and the most common stone composition was uric acid which was in the stone composition in 28 samples (82.35%), followed by oxalate in 25 samples (73.52%), phosphate in 24 samples (70.58%), and followed by other stone compositions. The results of the stone composition analysis can be seen in **Table 6**.

Table 6. Stone Analysis of Respondents

Stone Composition	Positive	Negative
Calcium	23(67.64%)	11 (32.36%)
Uric acid	28 (82.35%)	6 (17.65%)
Magnesium	7 (20.58%)	27 (79.42%)
Oxalate	25 (73.52%)	9 (26.48%)
Phosphate	24 (70.58%)	10 (29.42%)
Cystine	1 (2.94%)	33 (97.06%)
Ammonium	4 (11.76%)	30 (88.24%)
Carbonate	1 (2.94%)	33 (97.06%)
Cholestrol	2 (5.88%)	32 (94.12%)

DISCUSSION

Urinary tract stones can occur at any age but are most common within the range of 30 - 60 years. The reason is that this age group does more work and is more tiring than other age groups, resulting in a lack of fluid consumption and an increased chance of dehydration. In addition, poor lifestyle such as unhealthy diet and occupational stress also play a role in the formation of urinary tract stones. The incidence of urinary tract stones in elderly patients is associated with degenerative diseases such as the presence of comorbidities of hypertension, obesity, and diabetes. The presence of metabolic syndrome increases the composition of stones that support the formation of crystals and stones themselves such as calcium oxalate, calcium phosphate, and uric acid.[14,15] In this study, it was found that the highest age was similar to existing theories where most samples were at the age of ≥ 51 years, namely 124 people (68.1%). This finding is also in line with research conducted by Alini who found that the majority were above 51 years old as many as 29 patients (52.7%).[9,16] Similar findings was also obtained from researcher Kurniawan, namely 52% of the total sample aged 46-60 years.[9]

Men are said to have a higher chance of having this disease compared to women. This may be due to the anatomical factors of men who have a longer size compared to the anatomy of women and the possibility of having BPH which causes the deposition of substances to be higher. The testosterone hormone in men is also said to suppress the expression of osteopontin in the kidneys, thereby increasing urinary oxalate expression.[3,4,17] Male was found to be the majority in this study with a total of 131 people (72%) while female patients amounted to 51 people (28%). This is in line with theory and with research conducted by Kurniawan who found that urinary tract stone cases were more dominated by the male gender with a ratio of male: female 33:29.[9] Male subjects were also found to be more dominant in research conducted by Aussiana, which amounted to 80.6% of the total cases.[18]

Occupation is one of the factors that play a role in urinary tract stone disease. People who work indoors are at risk due to sedentary habits and those who work with high physical activity are both at risk for urinary tract stones with different mechanisms. Occupations with long periods of sitting at work are associated with poor lifestyle and lack of adequate water intake. Occupations that involve more physical activity and high temperatures such as farmers also increase the risk due to more prone to sweating, increasing the risk of dehydration. This allows reabsorption of water from renal filtration leading to increased urine concentration. High temperatures favor the production of vitamin D which increases the absorption of calcium in the digestive tract, increasing the likelihood of stone formation.[3,19,20] In this study, the occupation of most of the sample was private employees in 48 people (26.4%) following the theory regarding sedentary work which is a risk factor for urinary tract stones. The results obtained are in line with research conducted by Setyowati et al. where the majority of the sample worked as employees 96 people (59.3%).[21]

doi:10.24843.MU.2026.V15.i8.P05

However, the results obtained are different from research conducted by Shintya et al. at Al-Islam Hospital that found self-employed as their main job, namely 77 people (41%).[22] These results are also different from the research conducted by Hadibrata et al. who found that the most occupations were traders and housewives (27.5%).[23]

Family history also plays a role in stone formation as diseases such as primary hyperoxaluria, cystinuria, and renal tubular acidosis can be genetically inherited. However, genetics is not the only factor but combined with environmental factors because urinary tract stones is a multifactorial disease.[24] Most of the samples in this study did not have a family history of similar diseases, as many as 178 samples (97.8%). This finding is in line with Rusdi et al. who found 24 samples (80%) had no family history as well as research by Anggraeny et al. with 48 samples (87.3%) without a similar family history.[25,26] However, the results are not in line with research conducted by Silalahi which found that 96% of the samples had a family history of the same disease.[6]

Hypertension is a disease that can cause damage to the kidney's blood vessels. This causes impaired renal filtration which can risk stone formation.[27] In addition, hypertension also plays a role in changes in calcium metabolism where the ascending limb of the henle and proximal tubules fluid volume is excessive, it will reduce sodium reabsorption. This causes a decrease in calcium reabsorption as well as increasing calcium levels in the urine which has the possibility of causing stones to occur.[28] Hypertensive disease as a concomitant disease of urinary tract stones in this study was found in only 59 people (32.4%) while the other 123 people (67.6%) did not have the disease. Although in theory hypertension can be a factor, urinary tract stones disease is a multifactorial disease, so the presence of hypertension alone is not the main cause of the incidence of this disease.[28] The same results were also obtained in a study by Hadibrata et al. with a total of 19 people (57.6%) not having a history of hypertension.[27] Research by Kurniawan found similar results with 48.7% of the sample not having comorbid diseases.[9] This research conducted by Agustin et al. found 36 patients with prehypertension (59%).[28]

Diabetes can also favor the formation of urinary tract stones due to two mechanisms, high blood glucose and insulin resistance. Hyperglycemia increases urinary secretion of calcium, phosphorus, uric acid, and oxalate. Meanwhile, ammonium and calcium secretion increase and urine pH decreases in insulin resistance, increasing the risk of stone formation due to the excess composition of urine and uric acid stones that commonly form in acidic urine states.[29] It seems that most of the samples in this study do not have a history of diabetes, namely around 156 people (85.7%) and only 26 people (14.3%) with comorbidities in the form of diabetes. Research conducted by Hadibrata et al. also found that most of the sample, namely 37 people (92.5%), did not have diabetes as a concomitant stone disease.[30] Meanwhile, research by Shoaib et al. found that 68% of the 100 samples had diabetes mellitus.[31]

Urinary tract infection is caused by urea-splitting bacteria, which is also associated with struvite stones (infectious stones). In addition, UTIs arise partly due to the habit of holding back urination. This habit also increases the risk of urinary tract stone crystal deposition.[32] This study found that 29 people (15.9%) suffered from urinary tract infections along with urinary tract stones, while the rest of the sample did not suffer from the disease. This does not always occur in every urinary tract stone patient. Research conducted by Adli found that only 18 people (24%) suffered from UTI.[33]

Urinary tract stones, especially in the lower urinary tract, can be affected due to abnormalities in the urinary tract such as BPH. Benign prostatic hyperplasia is commonly experienced in elderly male patients. With the enlargement of the prostate gland, it can cause disturbances in the flow of urine. Benign prostatic hyperplasia can cause lower urinary tract symptoms (LUTS) such as the sensation of incomplete bladder emptying, obstruction of urine flow, and obstruction of the bladder tract, allowing infection and urine stasis to occur which can lead to stones. [8,33] Out of 131 samples who were male, 112 people (85.5%) did not have BPH as a comorbidity. The same thing was obtained by Adli's research which found that only 10 people (13%) suffered from BPH disease.[33]

Normal urine color ranges from clear, light yellow to yellow. Several things can affect the color of urine such as food, medication, and the presence of disease. Urinary tract stones can cause red urine due to the presence of blood in the urine. This is not always the case because urinary tract stones patients generally experience microscopic hematuria.[7,34] From the total research sample, the color of urine found in this study was mostly normal, namely (p yellow - yellow) as many as 164 people (90.1%) with the most urine color being yellow in 133 people (73.1%). Similar results were also obtained by research conducted by Aussiana with 14 yellow urine samples (45.2%).[18] Research by Reko obtained similar findings where the urine color of the majority of patients was still normal but with dark yellow as the dominating urine color, namely 9 samples (52.9%).[35]

Urine turbidity can indicate the presence of bacteria, leukocytes, crystals, or protein. However, the result of urine turbidity is also influenced by the presence of sperm or vaginal fluid. Under normal circumstances, urine is generally not cloudy or clear.[35,36] Research on the presence or absence of urine turbidity in this study found that most samples had clear urine, namely 107 samples (58.8%). Most samples with clear urine results were also obtained in Reko's research as many as 15 samples (88.2%).[35]

An acidic urine pH is affected by various things such as patients with a high protein diet and uncontrolled diabetes. An alkaline pH can occur in patients who consume vegetables, dairy products, and certain medications. Stone formation is also affected by urine pH. Stones with calcium oxalate composition are said to form frequently at a pH range of 5 - 6.5. Meanwhile, calcium phosphate forms at a urine pH of more than 7.5.[37] However, based on Carvalho's study, it is said that the most common type of stone, namely calcium oxalate stones, could form at any pH urine range.[38] Struvite stones are infectious stones that commonly form in patients with chronic UTIs. Infection-causing pathogens produce urease which can increase the pH to >7, causing phosphate precipitation because phosphate is less soluble at alkaline pH. Meanwhile, uric acid is less soluble at an acidic pH (pH <5.05), allowing the formation of uric acid stones.[39] A total of 174 samples (95.6%) of this study were found to be still in the normal urine pH range of 4.5 - 8. This study also found the most urine crystals, namely calcium oxalate, were as many as five samples with urine pH still in the normal range with an average pH of 6.3. This is following the statement by Carvalho that calcium oxalate can form at any urine pH.[38] Research

doi:10.24843.MU.2026.V15.i8.P05

conducted by Reko obtained results in line with the urine pH of 14 samples (82.3%) still in the normal range.[35] Most of Aussiana's research samples also had normal urine pH, namely 30 samples (96.8%), and research by Zamzami found that 100% of the samples, namely 452 people, had normal urine pH.[18,40] Different results were found in Anggraeny's research which found 37 samples (77.1%) had acidic urine pH.[25]

Approximately 85% of patients with urinary tract stones have microscopic hematuria on urinalysis.[11] The presence of blood in the urine is called hematuria. There is hematuria that can be seen directly or that can only be seen through a microscope. Kidney stone disease can cause hematuria due to the movement of stones that injure the mucosa of the urinary tract. Microscopic hematuria occurs in most patients with urolithiasis.[41] The results of urine erythrocyte examination in this study were mostly positive with most of the results being positive (+++) in 102 people (56%). This is in line with the theory that says most urinary tract stones patients experience microscopic hematuria. The results obtained are similar to Alini's research which found the presence of erythrocytes in the urine in 31 samples (56.4%).[16] Research by Aussiana also showed similar results where 61.3% of the samples experienced microscopic hematuria.[18]

The finding of leukocytes on urinalysis examination is one of the markers of infection.[42] Urinary tract infections are very common in urinary tract stones patients. It is said that the movement of the stone can cause injury, making it very easy to cause infection. In addition, UTI due to urease-splitting bacteria also increases the risk of stone formation.[15] It was found that most samples had positive results in the urine leukocyte examination with the most being positive (++++), namely in 70 samples (38.5%). In a study conducted by Zamzami, 238 samples (52.7%) found an increase in urine leukocytes.[40] The majority of research samples, namely 67.7% conducted by Aussiana, also experienced pyuria.[18] However, these results are not aligned with research conducted by Alini which found that the number of leukocytes in 31 people (56.4%) was in the normal range.[16]

Bacteriuria is a condition where bacteria are present in the urine. The presence of bacteria on urinalysis may indicate infection.[43] The appearance of bacteriuria in urinary tract stones patients is not common unless one has a concurrent UTI. Apart from stone movement, the use of devices such as catheters during urinary tract stone treatment can also cause UTI.[16] This study found positive results of bacteria in urine in most samples, totaling 161 people (88.5%). Adli also conducted a study that produced similar findings where there were 21 samples (84%) that had positive results in urine bacteria.[33]

Nitrite is the result of bacteria that reductase nitrate. Like the finding of bacteria and leukocytes in urine, a positive nitrite on urinalysis may indicate infection. Generally, positive results occur in UTIs with *E. Coli*, *P. Enterobacter*, *S. Aureus*, and *Klebsiella* etiologies.[16,43] Urine nitrite examination in this study obtained negative results as the result of most samples, namely in 150 people (82.4%). A study by Alini also obtained similar results with the majority of samples having negative results on nitrite, namely in 53 samples (96.4%).[16]

Crystalluria is a condition where crystals form in urine due to an imbalance in promoters and inhibitors. The composition of urine varies depending on a person's hydration and diet. In the case of urinary tract stones, stone formation occurs due to the supersaturation of several chemical compounds that crystallize and join together into stones. Crystals in urine can consist of several components such as calcium oxalate, calcium phosphate, uric acid, and other compositions. The crystals formed depend on individual conditions such as calcium oxalate crystals that can form due to conditions of hypercalciuria, hyperoxaluria, and hypocitraturia. Crystal composition can provide information regarding the underlying stone pathology.[35,44,45] Based on this study, it was found that the majority of samples with urine crystal examination data had calcium oxalate crystals, namely in nine samples (64.28%). Research by Almannie also found the majority of their samples's urinary crystal composition is calcium oxalate.[46] Different results were found by Reko's research where amorphous urate crystals were found in 15 samples (88.2%).[35]

The situation where there is a decrease in erythrocytes does not always occur in urinary tract stone disease. However, if there is a decrease in blood erythrocyte count, it may indicate ongoing hematuria or chronic disease.[47] Decreased kidney function itself can cause a decrease in hemoglobin due to reduced erythropoietin, an important hormone that stimulates red blood cell formation in the bone marrow.[48] The erythrocyte level in this study was predominantly within the normal range in 90 samples (49.5%). As many as 63.2% of the total sample of 115 people experienced a decrease in the amount of hemoglobin. The amount of hematocrit was also found to decrease in the majority of samples, namely in 109 people (59.9%). The same thing was also found in a study conducted by Demiray et al. with a total of 74 samples having normal examination results on erythrocytes count.[49] Research by Shoaib et al. (2023) found that the hemoglobin count of 60% of their total sample was still within the normal range.[31]

Leukocytes count are one of the markers if someone has an acute inflammation. Generally, leukocytes can increase in condition when the stone travels down the ureter and interacts with the mucosa.[50] Based on the results of the study, it was found that 108 samples (59.3%) had normal blood leukocyte examination results. The results of Alini's research obtained a different picture with 56.4% of the samples experiencing leukocytosis.[16] Meanwhile, research conducted by Adli found that the number of samples that had a high number of blood leukocytes (leukocytosis) amounted to 51% of the total 45 samples.[33]

Thrombocytes release mediators for coagulation, thrombosis, and inflammation that increase generally during inflammation. The mean blood thrombocyte volume may also increase due to inflammation caused by urinary tract stones.[49] According to Woźniak et al., thrombocyte counts in patients with urinary tract stones can decrease after intervention such as SWL due to kidney trauma.[51] According to this study, it was found that the results of thrombocyte count examination were predominantly in normal amounts, namely 145 samples (79.7%). Research by Demiray et al. found that the entire number of samples, namely 74 samples, had normal platelet counts.[49]

Creatinine is a by-product of creatinine phosphate in muscle. The amount of creatinine produced depends on muscle mass, therefore there are differences in creatinine ranges between men (normal: 0.72-1.25 mg/dL) and women (normal: 0.57-1.11 mg/dL). Creatinine is excreted entirely by the kidneys so if there is a decrease in kidney function, it causes an increase in blood

doi:10.24843.MU.2026.V15.i8.P05

creatinine, which is one possibility due to urinary tract obstruction due to stones.[12,52] BUN and blood creatinine tests are important to assess the patient's kidney function. This study found serum creatinine results align with the theory, and increased in most samples, namely in 109 people (59.9%). The results obtained in this study are not in line with research by Adli who found normal creatinine in most samples, namely 29 people (69%).[33]

In addition to serum creatinine, BUN examination can also help in evaluating kidney function. Blood urea nitrogen is a product of protein metabolism formed in the liver. The excretion of BUN is mostly done by the kidneys. Elevated BUN (normal: 8.00 - 23.00 mg/dL) in the blood may indicate decreased renal clearance. Apart from kidney disease, other conditions such as gastrointestinal bleeding and dehydration can also increase BUN. Blood urea nitrogen usually increases earlier in kidney disease than creatinine serum. Post-renal BUN elevation can also be found in situations where there is obstruction of urine flow due to stones.[12,33] Meanwhile, the majority of BUN in this study was found to be normal in 99 people (54.4%). In other studies, BUN levels were also found to be normal in most samples in the study by Sichani et al., namely in 67 out of 78 samples.[53] BUN levels were found to increase in Alini's study as many as 36 samples (65.5%).[16]

Uric acid is an important antioxidant in plasma and serves to protect endothelial function. However, abnormal levels can induce stone formation. Low uric acid levels are associated with stone formation, especially xanthine stones. Conditions such as hereditary xanthinuria decrease uric acid production due to deficiency of the enzyme xanthin dehydrogenase/oxidase. This disorder is characterized by a state of hypouricemia and a high concentration of xanthin in the urine which can lead to xanthin stone formation.[54] In addition to hypouricemia, high levels of uric acid in the blood can also induce crystal formation in the kidneys. These crystals can form in certain circumstances where uric acid itself does not dissolve easily, especially when the pH of the urine is acidic so that uric acid stones are easily formed.[55,56] It is known that of the 96 samples of this study who got their uric acid levels examined, three samples (1.6%) had decreased uric acid levels, 45 samples (24.7%) had normal uric acid levels, and 48 samples (26.4%) with increased uric acid. This shows that uric acid may be a factor in the formation of urinary tract stones but is not the main cause. The results obtained by Aufar et al. found 20 samples (52.6%) that had high uric acid levels.[57] Research by Fadila et al. (2023) found different results where most samples had blood uric acid levels in the normal range, namely in 41 samples (91%).[58] In the study by Eyre et al. it was also found that 69.6% or 124 people had normal serum uric acid levels.[59]

Stone analysis examination can help determine the stone content accurately and assist in preventive measures and therapeutic decisions for each patient.[10] Calcium oxalate (75%-90%) is the most common composition of urinary tract stones, followed by calcium phosphate (6%-13%), uric acid (5%-20%), cystine (0.5%-1%), struvite (2%-15%), and apatite (1%). The composition of urinary tract stones in an individual is influenced by various things including diet, genetics, and other influencing diseases.[3] Risk factors for calcium oxalate stone formation include consumption of drinking water high in fluoride, and sodium calcium, a diet high in oxalate, and urine pH. The formation of stones with uric acid composition is a state of high uric acid in the blood or hyperuricemia and high meat consumption which can reduce the pH of urine thereby increasing the possibility of crystal and stone formation.[3,42] Calcium phosphate stones are also associated with hypercalciuria which can be due to overconsumption and hyperparathyroidism. Meanwhile, cystine stones are associated with genetic mutations that cause excess cystine excretion and struvite stones are associated with infection.[45] Based on the results of this study, it was found that of the 34 samples that conducted stone analysis examinations, the majority of the samples of this study had stones with uric acid composition, namely 28 samples (82.35%). Similar results were found in research by Kurniawan where 48% of his research samples had uric acid stones.[9] In another study, Suryanto found different results with 102 (72.3%) of his research samples having calcium oxalate as the most composition.[60] The same thing was also found by Ratu et al. with 174 (87.4%) samples having calcium oxalate as the most composition.[13]

CONCLUSION

The characteristics of patients with BSK at Prof. I.G.N.G Ngoerah Hospital Denpasar were mostly ≥51 years old (68.1%), male (72%), working as private employees (26.4%), having no family history of similar diseases (97.8%), and mostly without comorbidities such as hypertension, diabetes mellitus, urinary tract infection, and BPH. This study concluded that the urinalysis laboratory examination results of urinary tract stones patients had normal urine color which was predominantly yellow (73.1%), clear urine (58.8%), pH within the normal range (95.6%), erythrocytes increased with most samples having positive (+++) (56%), urine leukocytes increased with positive (++++) (38.5%), positive urine bacteria (88.5%), and negative urine nitrite (82.4%), and the composition of the most urine crystals was calcium oxalate (64.28%). The complete blood count examination showed normal erythrocyte count (49.5%), decreased hemoglobin count (63.2%), decreased hematocrit (59.9%), normal leukocyte count (59.3%), and normal thrombocyte count (79.7%). The blood chemistry examination resulted in increased serum creatinine (59.9%), normal BUN (54.4%), and increased uric acid (26.4%). The results of stone composition analysis in this study showed that the most composition was uric acid (82.35%).

Suggestions that can be given to future researchers are expected to add other factors as variables so that more accurate results can be obtained regarding the characteristics of urinary tract stones patients. To the research site, it is expected to conduct uniform laboratory examinations and record more complete information so that more accurate results can be obtained regarding the characteristics and laboratory results of urinary tract stones patients. To the community, it is expected to improve a healthy lifestyle and increase awareness of the risk factors for urinary tract stones.

REFERENCES

1. Simanullang P. KARAKTERISTIK PASIEN BATU SALURAN KEMIH DI RUMAH SAKIT MARTHA FRISKA PULO BRAYAN MEDAN TAHUN 2015 s/d 2017. Vol. XXVII. 2019.

doi:10.24843.MU.2026.V15.i8.P05

2. Thakore P, Liang TH. Urolithiasis Continuing Education Activity [Internet]. 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559101/?report=printable
3. Liu Y, Chen Y, Liao B, Luo D, Wang K, Li H, et al. Epidemiology of urolithiasis in Asia. Asian J Urol [Internet]. 2018;5(4):205–14. Available from: https://doi.org/10.1016/j.ajur.2018.08.007
4. Haryadi H, Kaniya TD, Anggunan A, Uyun D. Ct-Scan Non Kontras Pada Pasien Batu Saluran Kemih. Jurnal Ilmiah Kesehatan Sandi Husada. 2020;11(1):284–91.
5. Taguchi K, Cho SY, Ng ACF, Usawachintachit M, Tan YK, Deng YL, et al. The Urological Association of Asia clinical guideline for urinary stone disease. Vol. 26, International Journal of Urology. Blackwell Publishing; 2019. p. 688–709.
6. Silalahi MK. Faktor-Faktor yang Berhubungan Dengan Kejadian Penyakit Batu Saluran Kemih Pada di Poli Urologi RSAU dr. Esnawan Antariksa. Jurnal Ilmiah Kesehatan. 2020 Sep 30;12(2):205–12.
7. Song L, Maalouf NM. Nephrolithiasis (lengkap bgtt kir). MDText.com, Inc; 2020.
8. Tjahjodjati IS, Noegroho BS, Sihombing AT. Urinary Tract Stones Risk Factors in Patients with Benign Prostatic Hyperplasia in West Java, Indonesia. Althea Medical Journal. 2021 Jun 30;8(2).
9. Kurniawan R, Setijo Rahaju A, Djojodimedjo T. Profile of Patients with Urinary Tract Stone at Urology Department of Soetomo General Hospital Surabaya in January 2016-December 2016. 2020;27.
10. Noegroho BS, Daryanto B, Soebhali B, Kadar DD, Soebadi DM, Hamiseno DW, et al. Panduan Penatalaksanaan Klinis Batu Saluran Kemih [Internet]. Ikatan Ahli Urologi ndonesia (IAUI). 2018. 62 p. Available from: http://repository.unair.ac.id/95465/1/Buku Panduan Penatalaksanaan Batu Saluran Kemih.pdf
11. Dave CN. Nephrolithiasis [Internet]. 2021. Available from: https://emedicine.medscape.com/article/437096-printhttps://emedicine.medscape.com/article/437096-print1/58emedicine.medscape.com
12. Gounden V, Bhatt H, Jialal I. Renal Function Tests [Internet]. StatPearls. StatPearls Publishing; 2021 [cited 2021 May 11]. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29939598
13. Ratu G, Badji A. Profil Analisis Batu Saluran Kemih Di Laboratorium Patologi Klinik. Indonesian Journal of Clinical Pathology and Medical Laboratory. 2018;12(3):114.
14. Varshney AK. Epidemiological Aspects and Medical Management of Urolithiasis in Special Populations. 2016.
15. Yongzhi L, Shi Y, Jia L, Yili L, Xingwang Z, Xue G. Risk factors for urinary tract infection in patients with urolithiasis - Primary report of a single center cohort. BMC Urol. 2018 May 21;18(1).
16. Alini I. Penilaian Laboratoris Dan Radiologik Pada Kasus Nyeri Kolik Renal Akibat Batu Ginjal dan Batu Ureter Di IGD RSU Putri Bidadari Stabat. 2022.
17. Gupta K, Gill G, Mahajan R. Possible role of elevated serum testosterone in pathogenesis of renal stone formation. Int J Appl Basic Med Res. 2016;6(4):241.
18. Aussiana AR. Profil Pasien Batu Saluran Kemih di RS Dr. Wahidin Sudirohusodo Makassar Periode Januari-Juni 2019. 2020;
19. Feng X, Wu W, Zhao F, Xu F, Han D, Guo X, et al. Association between physical activity and kidney stones based on dose-response analyses using restricted cubic splines. Eur J Public Health. 2020 Dec 1;30(6):1206–11.
20. Wang Z, Zhang Y, Zhang J, Deng Q, Liang H. Recent advances on the mechanisms of kidney stone formation (Review). Vol. 48, International Journal of Molecular Medicine. Spandidos Publications; 2021.
21. Setyowati R, Permana I, Handriana I. Faktor-Faktor yang Mempengaruhi Kejadian Urolithiasis di RSD Gunung Jati Kota Cirebon. STIKES YPIB Majalengka. 2021;9:158–67.
22. Shintya, Nia Irasanti S, Septriana Rosady D. Desciption the Characteristic and Number of Events of Urinary Stones at Al-Islam Hospital Periode January to December 2017. 2019.
23. Hadibrata E, Suharmanto S. PEKERJAAN DAN POLA ISTIRAHAT BERHUBUNGAN DENGAN KEJADIAN BATU GINJAL [Internet]. Bandar Lampung; 2022. Available from: http://jurnal.globalhealthsciencegroup.com/index.php/JPPP
24. Howles SA, Thakker R V. Genetics of kidney stone disease. Nature Reviews Urology 2020 17:7 [Internet]. 2020 Jun 12 [cited 2023 Oct 11];17(7):407–21. Available from: https://www.nature.com/articles/s41585-020-0332-x
25. Anggraeny SF, Soebhali B, Sulistiawati S, Nasution PDS, Sawitri E. Gambaran Status Konsumsi Air Minum Pada Pasien Batu Saluran Kemih. Jurnal Sains dan Kesehatan. 2021 Feb 28;3(1):58–62.
26. Rusdi AF, Soebhali B, Nugroho H. Hubungan Kepadatan Batu Menurut Hounsfield Unit (HU) dengan Komposisi Batu Saluran Kemih di Poli Urologi RSUD Abdul Wahab Sjahranie Samarinda. Jurnal Sains dan Kesehatan. 2022 Apr 30;4(2):105–11.

doi:10.24843.MU.2026.V15.i8.P05

27. Hadibrata E, Suharmanto, Fitra Wardhana M. Hubungan Riwayat Hipertensi dengan Kejadian Batu Ginjal. Vol. 5, JK Unila |. 2021.
28. Agustin OA, Soebhali B, Leatemia LD, Ismail S. HUBUNGAN HIPERTENSI DAN OBESITAS DENGAN PASIEN BATU SALURAN KEMIH PADA PASIEN POLIKLINIK UROLOGI DI RSUD ABDUL WAHAB SJAHRANIE SAMARINDA. Vol. 1, Health Science Journal. 2019.
29. Geraghty R, Abdi A, Somani B, Cook P, Roderick P. Does chronic hyperglycaemia increase the risk of kidney stone disease? results from a systematic review and meta-analysis. BMJ Open. 2020 Jan 19;10(1).
30. Hadibrata E, Suharmanto, W MF. MODEL PREDIKSI FAKTOR-FAKTOR YANG MEMPENGARUHI KEJADIAN BATU GINJAL DI RUMAH SAKIT UMUM DAERAH ABDUL MOELOEK PROVINSI LAMPUNG. 2021.
31. Wasi Shoaib M, Hamza Subhani M, Mahmood Khan S, Rashid Alamgir A. Prevalence of Diabetes Mellitus in Patients with Renal Stones; A Single Center Experience. Patients with Renal Stones; A Single Center Experience APMC [Internet]. 17(1):11–3. Available from: www.apmcfmu.com
32. Sarwono, Setiani O, Nurjazuli. Risk Factor of Urolithiasis in Redisari Village, Rowokele Sub Ditrict, Kebumen District. 2017;
33. Adli SS. Analisis Prevalensi, Karakteristik, Faktor Risiko Kasus Batu Kandung Kemih Di Rumah Sakit PMI Kota Bogor Pada Tahun 2015 Sampai 2017. 2018.
34. Milani DAQ, Ishwarlal J. Urinalysis [Internet]. 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557685/?report=printable
35. Reko GC. Gambaran Kristal Sedimen Urin Pada Sopir Bus Di Terminal Bus Oebobo Kota Kupang Tahun 2019. 2019.
36. Lerma E V. Urinalysis [Internet]. 2022. Available from: https://emedicine.medscape.com/article/2074001-overview#a1
37. Kalembang J, Oka AAG, Widiana IGR. The relationship between urine specific gravity, urine pH, and blood uric acid levels to the type of urinary stones of patients with urolithiasis at Sanglah Hospital, Bali, Indonesia. Intisari Sains Medis. 2020 Jul 19;11(2):566–70.
38. Carvalho M. Urinary pH in calcium oxalate stone formers: does it matter? 2018;
39. Alelign T, Petros B. Kidney Stone Disease: An Update on Current Concepts. Vol. 2018, Advances in Urology. Hindawi Limited; 2018.
40. Zamzami Z. Penatalaksanaan Terkini Batu Saluran Kencing di RSUD Arifin Achmad Pekanbaru, Indonesia. Jurnal Kesehatan Melayu. 2018 Apr 25;1(2):60.
41. Minotti B, Treglia G, Pascale M, Ceruti S, Cantini L, Anselmi L, et al. Prevalence of microhematuria in renal colic and urolithiasis: A systematic review and meta-analysis. Vol. 20, BMC Urology. BioMed Central Ltd; 2020.
42. Aniruddh S, Leslie SW, Ramakrishnan S. Hyperoxaluria [Internet]. 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK558987/?report=printable
43. Crader MF, Kharsa A, Leslie SW. Bacteriuria Continuing Education Activity [Internet]. 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482276/?report=printable
44. Frochot V, Daudon M. Clinical value of crystalluria and quantitative morphoconstitutional analysis of urinary calculi. Vol. 36, International Journal of Surgery. Elsevier Ltd; 2016. p. 624–32.
45. Nojaba L, Guzman N. Nephrolithiasis [Internet]. 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559227/
46. Almannie RM, Alsufyani AK, Alturki AU, Almuhaideb M, Binsaleh S, Althunayan AM, et al. Neural Network Analysis of Crystalluria Content to Predict Urinary Stone Type. Res Rep Urol. 2021;13:867–76.
47. Dave CN, Schwartz BF. Nephrolithiasis. 2020;
48. Panjeta M, Tahirović I, Sofić E, Corić J, Dervišević A. Interpretation of Erythropoietin and Haemoglobin Levels in Patients with Various Stages of Chronic Kidney Disease. J Med Biochem. 2017 Apr 1;36(2):145–52.
49. Demiray O, Cevik E, Cuce F. Association between complete blood count parameters and urinary stone disease. Iran Red Crescent Med J. 2016 Jul 1;18(7).
50. Seerwan M, Tahir MM, Ata R, Rehman U. Association of Raised White Blood Cell and Neutrophil Counts with Spontaneous Stone Passage in Patients Presenting with Acute Renal Colic. 2016;7(1).
51. Woźniak P, Kontek B, Różański W, Olas B. Evaluation of hemostasis parameters and the role of the oxidative damage to plasma proteins in the modulation of hemostasis in patients with nephrolithiasis before and after extracorporeal shock wave lithotripsy. PLoS One. 2017 Oct 1;12(10).
52. Shen X, Chen Y, Zhang Y, Xia K, Chen Y, Hao Z. The Association of Urine Creatinine With Kidney Stone Prevalence in US Adults: Data From NHANES 2009–2018. Front Med (Lausanne). 2022 Mar 29;9.

doi:10.24843.MU.2026.V15.i8.P05

53. Mohammadi Sichani M, Jafarpisheh A, Ghoreifi A. Evaluation and Comparison of Metabolic Disorders between Patients with Unilateral and Bilateral Staghorn Renal Stones. Urol J. 2019 Jun 17;16(3):242–5.
54. Park JH, Jo Y Il, Lee JH. Renal effects of uric acid: Hyperuricemia and hypouricemia. Korean Journal of Internal Medicine. 2020;35(6):1291–304.
55. Az-Zahra H, Munir MA, Rupawan IK. Hubungan Kadar Asam Urat Dalam Darah Terhadap Kejadian Urolithiasis di RSUD Undata Palu Tahun 2014-2016. 2018.
56. Yasirwan M, Yunia Kusmala Y, Ichlas I. Gambaran Karakteristik Dan Hubungan Derajat Hiperurisemia Dengan Kejadian Urolitiasis Studi Kasus Di Poliklinik Penyakit Dalam Dan Bedah Urologi Rumah Sakit Dustira Cimahi Periode 2014-2016. 2017.
57. Zimamuz Zaman Al Hajiri A, Iman Prilistyo D, Veterini L, Masdan Salim H. Correlation Of Blood Uric Acid Levels And Types Of Urinary Tract Stone On Urolithiasis Patients In Islamic Hospital Of Jemursari Surabaya. 2019.
58. Riset A, Fadila E, Aryanti Bamahry KR, Ardhani Pratama A, Purnamasari R. Hubungan Faktor-Faktor Risiko dengan Hiperurisemia pada Pasien Batu Saluran Kemih di Rumah Sakit Ibnu Sina Makassar Tahun 2020-2022. 2023.
59. Eyre KS, Lewis F, Cui H, Grout E, Mihai R, Turney BW, et al. Utility of blood tests in screening for metabolic disorders in kidney stone disease. BJU Int. 2021 May 1;127(5):538–43.
60. Suryanto F, Subawa A. Gambaran Hasil Analisis Batu Saluran Kemih di Laboratorium Patologi Klinis RSUP Sanglah Denpasar Periode November 2013 - Oktober 2014. E-Jurnal Medika Udayana. 2017;6(1):1–4.