

# METABOLIC SYNDROME TRAITS IN UROLITHIASIS PATIENTS

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## ABSTRACT

**Objective:** To explore the relation of MetS and urolithiasis in our center. **Material & Methods:** This is a prospective study of all patients diagnosed with urolithiasis in Kardinah Hospital, Tegal, from April to June 2018, who were screened for metabolic syndrome criteria. The data was collected from the medical record and analyzed with SPSS ver. 23. **Results:** We included 71 cases of urinary tract stone in our center. 8.4% of the patients didn't undergo definitive therapy for stones caused by patients' preferences or the surgery being postponed with various reasons. The patient's mean age is  $54.7 \pm 11.24$ , with a male to female ratio 2.4:1. The average BMI is  $20.9 \pm 2.3 \text{ kg/m}^2$ . Most of the stones are found in kidney (38.0%) and bladder (26.8%). The average blood pressure is  $127.2 \pm 7.96 \text{ mmHg}$  for systolic pressure and  $81.6 \pm 5.77 \text{ mmHg}$  for diastolic pressure. The average values of lipid profile include total cholesterol, high- and low-density lipoprotein, and triglyceride were  $177.0 \pm 35.92$ ,  $52.0 (27-96)$ ,  $107.3 \pm 37.58$  and  $131 (50-406)$ , respectively. The mean of patient's blood glucose level is  $122 \text{ mg/dL}$ , and the highest level is  $203 \text{ mg/dL}$ . **Conclusion:** Not all of the MetS traits found in our patients in Kardinah Hospital. The HDL level is the only variable that shown abnormal level and it could be included into one of the MetS criteria of diagnosis. Thus, this observational study needs further research to confirm the correlation between urolithiasis and MetS, and also the underlying mechanism.

**Keywords:** Urolithiasis, urinary tract stone, metabolic syndrome.

## ABSTRAK

**Tujuan:** Menggambarkan hubungan antara sindrom metabolik dan urolitiasis di RSUD Kardinah Tegal. **Bahan & Cara :** Studi ini merupakan studi prospektif dari semua pasien yang didiagnosis dengan urolitiasis di RSUD Kardinah, Tegal dari bulan April hingga Juni 2018, kemudian dinilai untuk kriteria sindrom metabolik. Data dikumpulkan dari rekam medis dan dianalisis dengan SPSS ver. 23. **Hasil:** Jumlah sampel pada studi ini adalah 71 kasus batu saluran kemih. 8.4% kasus tidak menjalani terapi definitif batu dikarenakan pilihan pasien atau ditundanya operasi dengan berbagai sebab. Rerata usia pasien adalah  $54.7 \pm 11.24$  dengan perbandingan jumlah pasien laki-laki dan perempuan sebesar 2.4:1. Rerata IMT pada studi ini sebesar  $20.9 \pm 2.3 \text{ kg/m}^2$ . Sebagian besar batu ditemukan di ginjal (38.0%) dan buli-buli (26.8%). Rerata tekanan darah sistolik sebesar  $127.2 \pm 7.96 \text{ mmHg}$  dan  $81.6 \pm 5.77 \text{ mmHg}$  untuk tekanan darah diastolik. Nilai rerata profil lemak termasuk kadar kolesterol total, high-density lipoprotein, low-density lipoprotein, dan trigliserida adalah  $177.0 \pm 35.92$ ,  $52.0 (27-96)$ ,  $107.3 \pm 37.58$  and  $131 (50-406)$ , secara berurutan. Rerata kadar glukosa darah pasien menunjukkan kadar  $122 \text{ mg/dL}$ , dengan nilai tertinggi sebesar  $203 \text{ mg/dL}$ . **Simpulan:** Tidak semua kriteria sindrom metabolik dapat ditemukan pada pasien-pasien di RSUD Kardinah. Satu-satunya kriteria yang menunjukkan abnormalitas adalah kadar HDL yang dapat juga dimasukkan ke dalam kriteria diagnosis sindrom metabolik. Oleh karena itu, studi observasional ini memerlukan studi lanjut untuk menkonfirmasi hubungan antara urolitiasis dan sindrom metabolik, dan juga untuk menilai mekanisme yang mendasari.

**Kata Kunci:** Batu saluran kemih, sindrom metabolik, urolitiasis.

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## INTRODUCTION

Metabolic syndrome (MetS) is a cluster of commonly co-occurring metabolic risk factors

associated with cardiovascular disease and type 2 diabetes mellitus, including elevated blood pressure, atherogenic dyslipidemia, insulin resistance, and central obesity.<sup>1</sup> The prevalence of metabolic

syndrome varies by definition used, ethnic background, age, sex, and socioeconomic status.<sup>2</sup> This appears to increase worldwide, likely due to increasing obesity and sedentary lifestyles.<sup>1</sup> In Europe, the prevalence of the metabolic syndrome is 41% in men and 38% in women.<sup>3</sup>

In Indonesia, the prevalence of MetS is 28.4%.<sup>4</sup> MetS influences the acidity in urine, which the orethically influence the formation of uric acid, calcium and oxalate stone.<sup>5</sup> The previous study showed that metabolic syndrome was associated with other chronic diseases, such as renal failure, prostatic disorder, and stone formation, especially kidney stone.<sup>6</sup> Another study also recommends patients with urolithiasis should be screened for metabolic syndrome. However, this recommendation remains controversial in the case of different demographic data of the patients.<sup>7</sup> In our center, there is no previous study that examined the profile of MetS with urolithiasis.

**OBJECTIVE**

This study aims to explore the relation of MetS and urolithiasis in our center.

**MATERIAL & METHODS**

This study was conducted using prospective study. All patients diagnosed with urolithiasis in Kardinah Hospital, Tegal, from April to June 2018, were screened for metabolic syndrome criteria. We will determine demographic data as well. Then, data was analyzed descriptively with SPSS ver. 23.0.

**RESULTS**

We included 71 cases of urinary tract stone in our center. Not all of the patients underwent definitive therapy for stones caused by patients' preferences or the surgery being postponed with various reasons (n = 6, 8.4%). The results are were presented in the following tables.

**Table 1.** Characteristic of Patients (N= =71).

Characteristics	N (%)
Age, years (mean ± SD)	54.7 ± 11.24
Gender (n= 71)	
Male	70.4% (50)
Female	29.6% (21)
BMI, kg/m <sup>2</sup> (mean ± SD)	20.9 ± 2.3

**Table 2.** Stone characteristics.

Characteristics	N (%)
Stone Location	
Kidney	38.0% (27)
Proximal Ureter	22.5% (16)
Distal Ureter	11.3% (8)
Bladder	26.8% (19)
Urethra	1.4% (1)
Stone Size , mm	
Length , median (min -max)	20 (5 -120)
Width , median (min -max)	13 (2 -90)

**Table 3.** Traits of metabolic syndrome.

Parameters	N (%)
Blood Pressure, mm/Hg	
Systolic (mean ± SD)	127.2 ± 7.96
Diastolic (mean ± SD)	81.6 ± 5.77
Lipid Profile	
Total Cholesterol (mean ± SD)	177.0 ± 35.92
HDL , median (min -max)	52.0 (27 -96)
LDL (mean ± SD)	107.3 ± 37.58
Triglyceride , median (min-max)	131 (50 -406)
Blood Glucose median (min-max)	122 (91 -203)

**DISCUSSION**

The average age of patients come with urolithiasis was 54.7 ± 11.24 years old which slightly higher compared to other studies.<sup>8-9</sup> According to Denstedt et al, stone prevalence increased in all age groups, but the composition of the stone was influenced by the region and age.<sup>10</sup> For example, Taiwanese patients tend to have higher prevalence of calcium stone in young people but tend to have higher prevalence of struvite and uric acid stone in older patients.<sup>11</sup> While in France, the prevalence of uric acid stone increased with age.<sup>12</sup>

In this study, we could also assess the gender profile of urolithiasis patients. Commonly, we use male/female ratios to describe the distribution of gender among urolithiasis patients. The male/female ratio was 2.4, which has no differences with other literature.<sup>12-13</sup> The differences of urolithiasis cases between male and female might be caused by lifestyle and dietary habits.<sup>14</sup>

The average BMI is 20.9 ± 2.3 kg/m<sup>2</sup>, which is within the normal range. This result is different

compared to other studies in which the mean BMI of patients with urolithiasis was  $24.5 \pm 7.5 \text{ kg/m}^2$ .<sup>15</sup> BMI is one of many parameters assessed as a risk factor for stone formation.<sup>9</sup> Not only act as a risk factor of stone formation, obesity was also associated with the types of stone formed.<sup>16</sup> Obese patients might have greater risk of stone formation due to increased urinary phosphate excretion.<sup>8</sup> Other mechanism, overweight or obesity was correlated with low urine pH and an increase in uric acid level in urine, thus uric acid stone formation could have happened in acidic urine.<sup>17</sup> However, we referred the stone formation as a multifactorial and complex process, involving metabolic, genetic, and environmental factors. The acidity of urine was not the only factor influencing the stone formation.<sup>18-19</sup>

This study also describes the characteristics of the stone in urolithiasis patients. Most of the stones are found in kidney and bladder. The size of the stones is varied, but the smallest stone found is  $5 \times 2 \text{ mm}$  and the largest is  $120 \times 90 \text{ mm}$ . With various sizes of the stone, the author should decide different approach for the therapy or stone removal procedures. The therapies conducted for these stone cases are extracorporeal shockwave lithotripsy, lithotripsy, open pyelolithotomy, open ureterolithotomy, percutaneous nephrolithotomy, sectio alta, and other therapies to aid releasing the obstruction caused by stone such as nephrostomy or insertion of the double-J stent.

The average blood pressure found in this study is  $127.2 \pm 7.96 \text{ mmHg}$  for systolic pressure and  $81.6 \pm 5.77 \text{ mmHg}$  for diastolic pressure. These values are considered normal according to the Joint National Committee's 8<sup>th</sup> report (JNC 8). Pharmacologic treatment should be initiated at systolic blood pressure (SBP) more than  $150 \text{ mmHg}$  or diastolic blood pressure (DBP) more than  $90 \text{ mmHg}$  to lower the blood pressure with goal less than  $150 \text{ mmHg}$  and  $90 \text{ mmHg}$  respectively.<sup>20</sup> There are several hypotheses linked urinary tract stone especially nephrolithiasis with abnormal blood pressure, hypertension. A study from Borghi et al. found higher urinary calcium level excretion in hypertensive patients compared to normotensive patients.<sup>21</sup> However, not only urinary calcium linked to hypertension and urolithiasis, but also citrate, oxalate, and uric acid level were connected as well.<sup>22</sup> Stone could also relate to inflammation and oxidative stress which leads to renal vasoconstriction, ischemia, and injury.<sup>23</sup> The prolonged injury would cause a chronic kidney disease with damage at the glomerular and tubulointerstitial site.<sup>24</sup>

Association of stone and hypertension is a reciprocal relationship. Hypertension could be a risk factor for stone formation, as well as urinary tract stone could be a risk factor for hypertension.<sup>25</sup>

The average values of lipid profile include total cholesterol, high- and low-density lipoprotein, and triglyceride were  $177.0 \pm 35.92$ ,  $52.0 (27-96)$ ,  $107.3 \pm 37.58$  and  $131 (50-406)$ , respectively. This study also shows an increase in HDL level with a normal level of triglyceride. As Masterson et al. stated in their study, dyslipidemia increases the risk of nephrolithiasis, with HDL level less than 45 and 60 for males and females respectively.<sup>26</sup> Dyslipidemia could be an independent risk factor of kidney stone regardless other aspects of metabolic syndrome such as diabetes mellitus and obesity.<sup>27</sup> Hypertriglyceridemia was known for not only increasing the risk of stone formation but also increasing the risk of recurrence in patients with urolithiasis.<sup>28</sup> The presence of dyslipidemia in particularly children and adolescent was related with calcium oxalate crystallization with hypocitraturia as a predisposing factor.<sup>29</sup>

Another parameter assessed in this study is blood glucose. This study shows that the mean of patient's blood glucose level is  $122 \text{ mg/dL}$ , and the highest level is  $203 \text{ mg/dL}$ . For metabolic syndrome classification, it uses fasting blood glucose more than  $100 \text{ mg/dL}$  as a threshold. However, a consensus from PERKENI (Indonesian Endocrinologist Association), states that one of the diagnosis criteria of Diabetes Mellitus is incidental blood plasma glucose level more than  $200 \text{ mg/dL}$  with classic complaint.<sup>30</sup> Nonetheless, our study shows that most of the patients have normal blood glucose level. Many studies concluded that the severity of Diabetes Mellitus would correlate with the risk of kidney stones. The more severe the disease, the risk would increase.<sup>31</sup> Blood glucose level could be an independent risk factor of kidney stones.<sup>32</sup> Therefore, tighter glycemic control might reduce stone formation in diabetic patients.<sup>33</sup>

If we discuss all of these parameters as one risk factor, we could discuss the metabolic syndrome. Many studies conducted concerning the metabolic profile of urolithiasis patients and their correlation with urolithiasis itself. The dominant aspect in Metabolic Syndrome (MetS) traits could determine the composition of the stone. Kidney stone might be the renal manifestation of MetS.<sup>7,34</sup> The application of this knowledge would be applicable in treating patients since MetS was a modifiable factor.<sup>35</sup> Adequate lifestyle modification

and proper treatment could be the prevention of urolithiasis.<sup>36</sup> There would be differences in metabolic profile amongst urolithiasis patient since metabolic syndrome should be considered as a multifactorial systemic disorder needing multi-disciplinary approach for the management and prevention.<sup>37</sup>

## CONCLUSION

To sum up, not all of the MetS traits found in our patients in Kardinah General Hospital. The HDL level is the only variable that shown abnormal level and it could be included into one of the MetS criteria of diagnosis. Thus, this observational study needs further research to confirm the correlation between urolithiasis and MetS, and also the underlying mechanism.

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