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INCIDENCE AND RISK PROFILE OF HYPERURICEMIA AMONG PATIENTS WITH HEART FAILURE

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Keywords:

Hyperuricemia, Heart failure, Diuretics, Serum uric acid, Cardiovascular risk

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ABSTRACT: Background: Hyperuricemia is a frequently observed metabolic abnormality in patients with heart failure, particularly among those receiving long-term diuretic therapy. Elevated serum uric acid levels have been associated with adverse cardiovascular outcomes, highlighting the need for systematic evaluation in this patient population. **Aim:** To determine the incidence of hyperuricemia in patients with heart failure receiving diuretic therapy and to assess its association with demographic factors, diuretic classes, treatment duration, and selected clinical parameters. **Materials and Methods:** This was a prospective observational study conducted over a period of six months in the Department of Cardiology at a tertiary care hospital. A total of 130 patients with heart failure on diuretic therapy were enrolled based on predefined inclusion and exclusion criteria. Data on demographics, clinical characteristics, medication history, laboratory parameters, and echocardiographic findings were collected. Statistical analysis was performed using SPSS software, with results expressed as frequencies, percentages, means, and Pearson correlation coefficients. **Results:** The incidence of hyperuricemia among the study population was 53.1% (69/130). A higher proportion of cases was observed in males (63%) compared to females (37%). The age group of 61-70 years showed the highest incidence. Among diuretics, torsemide alone and torsemide combined with spironolactone were associated with a higher incidence of hyperuricemia, particularly with usage exceeding three months. A weak negative correlation was observed between serum uric acid levels and ejection fraction ($r = -0.102$), which was not statistically significant. **Conclusion:** Hyperuricemia was common among patients with heart failure receiving diuretic therapy, particularly in older adults, males, and those on prolonged treatment. Routine monitoring of serum uric acid levels may be considered in this population to support optimal clinical management.

INTRODUCTION: Heart failure (HF) remains a major global public health concern, characterized by high morbidity, mortality, and healthcare utilization.

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Despite advances in pharmacological and device-based therapies, patients with heart failure continue to experience significant disease burden, largely due to disease progression and the presence of metabolic and biochemical abnormalities that worsen clinical outcomes. Among these abnormalities, elevated serum uric acid levels, commonly referred to as hyperuricemia, have gained increasing attention as a potential marker of disease severity and cardiovascular risk in heart failure patients. Uric acid is the final product of purine metabolism, and its concentration in the

blood is influenced by both production and renal excretion. In patients with heart failure, multiple pathophysiological mechanisms contribute to increased serum uric acid levels, including reduced renal perfusion, impaired uric acid clearance, tissue hypoxia, oxidative stress, and enhanced xanthine oxidase activity. Hyperuricemia has been associated with endothelial dysfunction, inflammation, oxidative stress, and neurohormonal activation, all of which play a central role in the progression of heart failure and adverse cardiovascular events.

Diuretics form the cornerstone of symptomatic management in heart failure, particularly for the control of volume overload and congestion. Loop diuretics such as furosemide and torsemide, as well as potassium-sparing diuretics like spironolactone, are commonly prescribed either alone or in combination. However, diuretic therapy is a well-recognized cause of secondary hyperuricemia due to reduced renal urate excretion and volume depletion. Prolonged diuretic use has been shown to further elevate serum uric acid levels, thereby potentially increasing cardiovascular risk in an already vulnerable population.

Several clinical studies have reported an association between elevated serum uric acid levels and poor prognosis in patients with heart failure, including reduced ejection fraction, increased hospitalization rates, and higher mortality. Hyperuricemia has also been explored as a surrogate marker for oxidative stress and impaired myocardial energetics. Despite these observations, the reported incidence of hyperuricemia in heart failure patients varies widely across studies, influenced by differences in study populations, diuretic regimens, duration of therapy, and comorbid conditions such as hypertension, diabetes mellitus, and renal dysfunction.

In the Indian clinical setting, data on the incidence and risk profile of hyperuricemia among heart failure patients receiving diuretic therapy remain limited. Moreover, routine monitoring of serum uric acid is not consistently incorporated into standard heart failure management protocols, despite emerging evidence suggesting its potential clinical relevance. Understanding the burden of hyperuricemia and its association with commonly prescribed diuretics, demographic factors, and treatment duration is essential for optimizing patient management and preventing avoidable complications. Therefore, the present study was undertaken to evaluate the incidence of hyperuricemia in patients with heart failure receiving diuretic therapy in a tertiary care hospital setting. The study also aimed to examine the association between serum uric acid levels and demographic variables, diuretic classes, duration of therapy, and selected clinical and laboratory parameters, thereby providing clinically relevant evidence to support improved monitoring and therapeutic decision-making.

MATERIALS AND METHODS:

Study Design: This study was designed as a prospective observational study aimed at evaluating the incidence of hyperuricemia in patients with heart failure receiving diuretic therapy.

Study Duration: The study was conducted over a period of six months.

Study Setting: The study was carried out in the Department of Cardiology, Aster Ramesh Hospitals, located in Guntur district, Andhra Pradesh, India, a tertiary care teaching hospital.

Study Population and Sample Size: A total of 130 patients diagnosed with heart failure and receiving diuretic therapy were enrolled in the study. The sample size was determined based on the study duration and patient availability during the study period.

Recruitment Procedure: Eligible patients admitted to the cardiology wards or attending cardiac health check-ups were approached and informed about the study. Written informed consent was obtained from all participants. In cases where patients were unable to provide consent due to clinical conditions, consent was obtained from their legally authorized caregivers.

Inclusion Criteria:

- Adult patients aged 18 years and above.
- Patients with a confirmed clinical diagnosis of heart failure, including ischemic or non-ischemic cardiomyopathy.

- Patients receiving diuretic therapy (loop diuretics and/or potassium-sparing diuretics) as part of heart failure management.
- Patients of either gender.
- Patients willing to provide written informed consent.

Exclusion Criteria:

- Patients with chronic kidney disease (estimated glomerular filtration rate <60 mL/min/1.73 m²), as impaired renal function independently affects serum uric acid levels.
- Patients with a history of gout or known disorders of uric acid metabolism
- Patients receiving uric acid-modifying agents (e.g., allopurinol, febuxostat, probenecid), which could confound serum uric acid measurements.
- Patients with acute infections, inflammatory conditions, or malignancy, which may alter metabolic parameters.
- Patients unwilling or unable to provide informed consent.

Data Collection: Data were collected using a structured data collection form. The following information was obtained either directly from patients or from medical records:

- Demographic details (age, gender, body weight, body mass index).
- Clinical data (diagnosis, comorbidities such as hypertension and diabetes mellitus).
- Medication history, with specific emphasis on type, class, and duration of diuretic therapy.
- Vital parameters including blood pressure.
- Laboratory parameters including serum uric acid and serum electrolytes (sodium and potassium).
- Echocardiographic findings, particularly ejection fraction.

Outcome Measures: The primary outcome measure was the incidence of hyperuricemia among patients with heart failure receiving diuretic therapy. Secondary outcomes included the association of hyperuricemia with demographic variables, diuretic classes, duration of diuretic use, ejection fraction, comorbid conditions, and selected laboratory parameters.

Statistical Analysis: All collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics were used to summarize demographic and clinical characteristics. Results were expressed as frequencies, percentages, and means. Pearson's correlation coefficient was applied to assess the relationship between serum uric acid levels and selected clinical variables. A p-value of <0.05 was considered statistically significant.

RESULTS:

Study Population: A total of 130 patients with heart failure receiving diuretic therapy were included in the study. Among them, 79 (60.8%) were males and 51 (39.2%) were females. The majority of patients belonged to the age group of 61-70 years, followed by 51-60 years.

Incidence of Hyperuricemia: Hyperuricemia was observed in 69 out of 130 patients, corresponding to an overall incidence of 53.1%, while 61 patients (46.9%) had normal serum uric acid levels.

TABLE 1: INCIDENCE OF HYPERURICEMIA AMONG THE STUDY POPULATION

Parameter	Hyperuricemia Present	Hyperuricemia Absent	Total
Number of cases	69	61	130
Percentage (%)	53.1	46.9	100

Hyperuricemia and Demographic Characteristics: The incidence of hyperuricemia was higher among male patients (63%) compared to female patients (37%); however, this difference was not statistically significant (p = 0.700).

Age-wise analysis showed that the 61-70 years age group had the highest proportion of hyperuricemia cases, although the association between age and hyperuricemia did not reach statistical significance (p = 0.414).

Diuretic Therapy and Hyperuricemia: Among the different diuretic regimens, torsemide alone and torsemide in combination with spironolactone were associated with a higher proportion of hyperuricemia cases. Patients receiving spironolactone alone showed the lowest proportion. However, correlation analysis between diuretic class and hyperuricemia demonstrated a very weak and non-significant association (r = −0.025, p = 0.783).

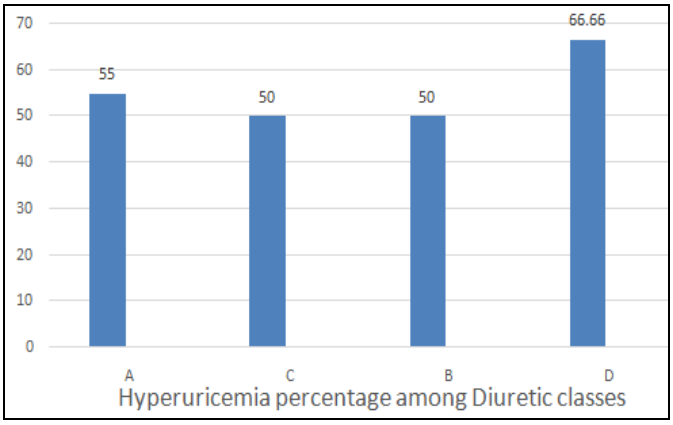

FIG. 1: BAR GRAPH REPRESENTATION OF RISK OF HYPERURICEMIA AMONG DIURETIC CLASS

TABLE 2: INCIDENCE OF HYPERURICEMIA ACROSS DIFFERENT DIURETIC CLASSES

Category of Diuretic	Hyperuricemia (Yes)	Hyperuricemia (No)	Total	Risk (%)
Torsemide (Dytor)	38	30	68	55.0
Furosemide (Fruselac)	4	4	8	50.0
Torsemide + Spironolactone (Dytor Plus)	25	25	50	50.0
Spironolactone (Aldactone)	4	2	6	66.7

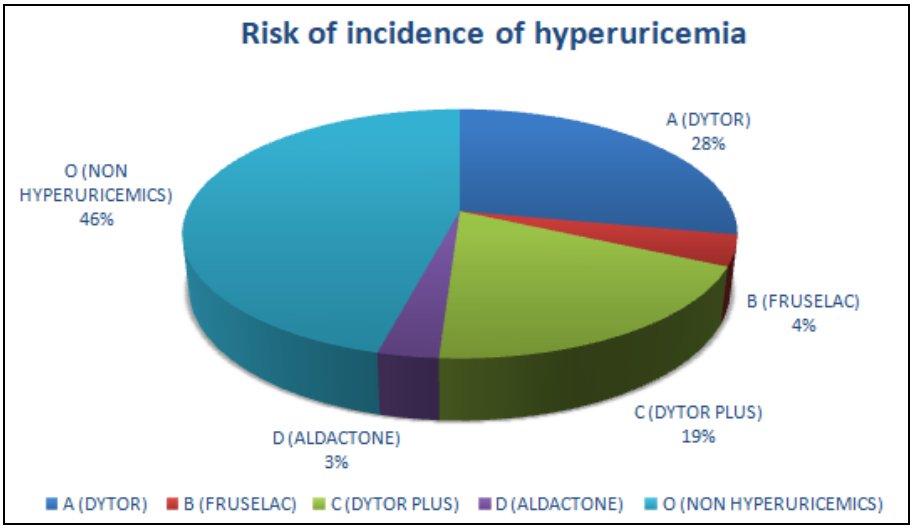

FIG. 2: PIE GRAPH REPRESENTATION OF RISK OF HYPERURICEMIA AMONG DIURETIC CLASS

Duration of Diuretic Use: An increasing proportion of hyperuricemia was observed with longer duration of diuretic therapy, particularly beyond three months. Nevertheless, statistical analysis showed no significant association between duration of therapy and hyperuricemia (p = 0.163).

TABLE 3: ASSOCIATION BETWEEN DURATION OF DIURETIC THERAPY AND HYPERURICEMIA

Duration of diuretic use (months)	Hyperuricemia Present (n)	Hyperuricemia Absent (n)	Total (n)
3	14	16	30
4	6	13	19
5	14	10	24
6	8	1	9
7	7	9	16
8	4	4	8
9	5	1	6
10	1	0	1

12	8	4	12
14	1	0	1
16	0	1	1
24	1	1	2
28	0	1	1
Total	69	61	130

Hyperuricemia and Cardiac Function: Correlation analysis between serum uric acid levels and left ventricular ejection fraction showed a weak negative correlation (r = −0.102), which was not statistically significant (p = 0.247), indicating no meaningful association between hyperuricemia and cardiac systolic function.

TABLE 4: CORRELATION BETWEEN SERUM URIC ACID LEVELS AND EJECTION FRACTION

Parameter	Uric Acid	Ejection Fraction
Uric Acid	1	−0.102
p-value	-	0.247
Ejection Fraction	−0.102	1
p-value	0.247	-

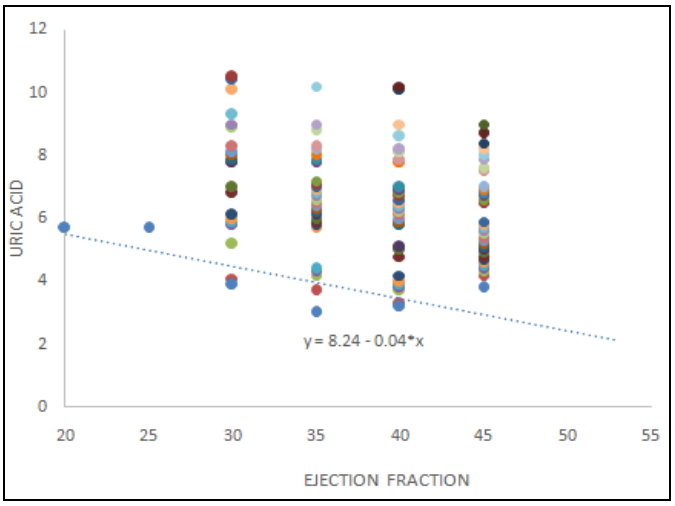

FIG. 3: SCATTER PLOT SHOWING THE RELATIONSHIP BETWEEN SERUM URIC ACID LEVELS AND LEFT VENTRICULAR EJECTION FRACTION

Etiology of Heart Failure: No statistically significant correlation was observed between hyperuricemia and heart failure etiology, including ischemic cardiomyopathy and dilated cardiomyopathy.

Body Weight, BMI, and Hyperuricemia: Body weight showed a weak positive correlation with serum uric acid levels (r = 0.133, p = 0.131), which was not statistically significant.

However, body mass index (BMI) showed a statistically significant association with serum uric acid levels (mean BMI: 26.82 kg/m²; p = 0.023).

Comorbidities and Laboratory Parameters: No statistically significant correlations were observed between serum uric acid levels and:

- Blood pressure (systolic or diastolic)
- Diabetes mellitus
- Serum sodium or potassium levels

Categorization of Hyperuricemia: Based on serum uric acid levels:

- Low normal: 55.39%
- High normal: 13.84%
- Abnormal: 30.77%

TABLE 5: CATEGORIZATION OF SERUM URIC ACID LEVELS AMONG STUDY PARTICIPANTS

Category of serum uric acid	Frequency (n)	Percentage (%)
Low normal	72	55.39
High normal	18	13.84
Abnormal	40	30.77
Total	130	100.00

DISCUSSION: This prospective observational study evaluated the incidence of hyperuricemia among patients with heart failure receiving diuretic therapy and explored its association with demographic, clinical, and treatment-related factors.

The overall incidence of hyperuricemia in the present study was 53.1%, indicating that more than half of the heart failure patients on diuretics exhibited elevated serum uric acid levels. This finding is consistent with earlier reports suggesting a high prevalence of hyperuricemia in heart failure populations, particularly among those receiving long-term diuretic therapy. Previous studies have identified elevated uric acid as a common metabolic abnormality in heart failure, attributed to impaired renal excretion, tissue hypoxia, and increased oxidative stress.

Male patients demonstrated a higher proportion of hyperuricemia compared to females, although the difference was not statistically significant. Similar gender-related trends have been reported in earlier studies, possibly reflecting differences in purine metabolism and renal urate handling, but the lack of statistical significance in the present study suggests that gender alone may not be a strong determinant. The highest incidence of hyperuricemia was observed in the 61-70 years age group. Advancing age is known to be associated with reduced renal function and increased comorbidities, which may contribute to elevated uric acid levels. However, the absence of statistical significance indicates that age-related changes should be interpreted cautiously. Diuretic therapy, particularly torsemide-based regimens, showed a higher proportion of hyperuricemia cases. This observation aligns with earlier literature describing diuretic-induced hyperuricemia due to reduced renal urate excretion. Nevertheless, correlation analysis in the present study did not demonstrate a statistically significant association, suggesting that factors such as duration of therapy and patient-specific characteristics may play a more prominent role than the choice of diuretic alone.

Although an increasing trend of hyperuricemia was observed with prolonged diuretic use, the association was not statistically significant. This finding supports the notion that hyperuricemia in heart failure is multifactorial and not solely dependent on treatment duration. The weak and non-significant negative correlation between serum uric acid levels and ejection fraction indicates that hyperuricemia may not directly reflect systolic dysfunction. Similar findings have been reported in previous studies, where uric acid was considered a marker of systemic metabolic stress rather than a direct indicator of myocardial performance.

BMI showed a statistically significant association with serum uric acid levels, consistent with existing evidence linking overweight and obesity with hyperuricemia. Increased adiposity is known to influence purine metabolism and renal urate handling, thereby contributing to elevated serum uric acid levels. No significant associations were observed between hyperuricemia and comorbid conditions such as hypertension and diabetes mellitus or with serum electrolyte levels. These findings further emphasize the complex and multifactorial nature of hyperuricemia in heart failure patients. Overall, the findings of this study suggest that while hyperuricemia is common among heart failure patients receiving diuretic therapy, its associations with clinical and treatment-related parameters are generally weak and often non-significant. Hyperuricemia in this population should therefore be viewed as a frequent metabolic accompaniment rather than a direct surrogate marker of disease severity.

CONCLUSION: In this prospective observational study, hyperuricemia was observed in over half of the patients with heart failure receiving diuretic therapy, indicating that elevated serum uric acid is a common metabolic finding in this population. A higher proportion of cases was noted among male patients and in the 61-70 year age group. Torsemide-based regimens, alone or in combination with spironolactone, were associated with a greater frequency of hyperuricemia, particularly with longer durations of therapy.

Most associations between serum uric acid levels and clinical parameters were weak and not statistically significant, suggesting that hyperuricemia in heart failure is likely multifactorial rather than directly linked to cardiac function alone. Nevertheless, the high prevalence observed highlights the importance of clinical awareness during prolonged diuretic use. Routine monitoring of serum uric acid may be considered as part of comprehensive patient assessment in heart failure, especially in individuals receiving long-term diuretic therapy. However, further large-scale and longitudinal studies are required to clarify the clinical implications of hyperuricemia and to determine whether targeted interventions improve patient outcomes.

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CONFLICTS OF INTEREST: Nil

REFERENCES:

1. Doehner W and Anker SD: Uric acid in chronic heart failure. In Seminars in nephrology. WB Saunders 2005; 25(1): 61-66. https://www.sciencedirect.com/science/article/pii/S0270929504001536
2. Reyes AJ: Cardiovascular drugs and serum uric acid. Cardiovascular Drugs and Therapy 2003; 17(5): 397-

414.https://link.springer.com/article/10.1023/B:CARD.0000015855.02485.e3

3. Yamamoto HI, Nagatomo Y, Mahara K and Yoshikawa T: In-hospital serum uric acid change predicts adverse outcome in patients with heart failure. Journal of Cardiac Failure 2020; 26(11): 968-76.https://www.sciencedirect.com/science/article/pii/S1071916419318196.
4. Misra D, Zhu Y, Zhang Y and Choi HK: The independent impact of congestive heart failure status and diuretic use on serum uric acid among men with a high cardiovascular risk profile: a prospective longitudinal study. In Seminars in arthritis and rheumatism 2011; 41(3): 471-476). WB Saunders.https://www.sciencedirect.com/science/article/pii/S0049017211000308
5. Reyes AJ: The increase in serum uric acid concentration caused by diuretics might be beneficial in heart failure. European Journal of Heart Failure 2005; 7(4): 461-7.https://onlinelibrary.wiley.com/doi/abs/10.1016/j.ejheart.2004.03.020
6. Kennelly P, Sapkota R, Azhar M, Cheema FH, Conway C and Hameed A: Diuretic therapy in congestive heart failure. Acta Cardiologica 2022; 77(2): 97-104.https://www.tandfonline.com/doi/abs/10.1080/00015385.2021.1878423
7. Raja R, Kavita FN, Amreek FN, Shah A, Sayeed KA, Sehar A and Amreek F: Hyperuricemia associated with thiazide diuretics in hypertensive adults. Cureus 2019; 11(8).https://www.cureus.com/articles/22337-hyperuricemia-associated-with-thiazide-diuretics-in-hypertensive-adults.pdf
8. Conen D, Wietlisbach V, Bovet P, Shamlaye C, Riesen W, Paccaud F and Burnier M: Prevalence of hyperuricemia and relation of serum uric acid with cardiovascular risk factors in a developing country. BMC Public Health 2004; 4(1): 9.https://link.springer.com/article/10.1186/1471-2458-4-9
9. Murai K, Obara T, Ohkubo T, Metoki H, Oikawa T, Inoue R, Komai R, Horikawa T, Asayama K, Kikuya M and Totsune K: Current usage of diuretics among hypertensive patients in Japan: the Japan Home versus Office Blood Pressure Measurement Evaluation (J-HOME) Study. Hypertension Research 2006; 29(11): 857-63.https://www.nature.com/articles/hr2006120
10. Fujimori S, Oka Y, Ogata N and Eto K: Effects of losartan/hydrochlorothiazide on serum uric acid levels and blood pressure in hypertensive patients. Nucleosides, Nucleotides and Nucleic Acids 2011; 30(12): 1030-4.https://www.tandfonline.com/doi/abs/10.1080/15257770.2011.628356.
11. Casiglia E, Tikhonoff V, Virdis A, Masi S, Barbagallo CM, Bombelli M, Bruno B, Cicero AF, Cirillo M, Cirillo P and Desideri G: Serum uric acid and fatal myocardial infarction: detection of prognostic cut-off values: the URRAH (Uric Acid Right for Heart Health) study. Journal of Hypertension 2020; 38(3): 412-9. https://journals.lww.com/jhypertension/FullText/2020/03000/Serum_uric_acid_and_fatal_myocardial_infarction_.9.aspx
12. Qin L, Yang Z, Gu H, Lu S, Shi Q, Xing Y, Li X, Li R, Ning G and Su Q: Association between serum uric acid levels and cardiovascular disease in middle-aged and elderly Chinese individuals. BMC Cardiovascular Disorders 2014; 14(1): 26.https://link.springer.com/article/10.1186/1471-2261-14-26.
13. Wu AH, Gladden JD, Ahmed M, Ahmed A and Filippatos G: Relation of serum uric acid to cardiovascular disease. International Journal of Cardiology 2016; 213: 4-7.https://www.sciencedirect.com/science/article/pii/S0167527315303430
14. Nogi S, Fujita SI, Okamoto Y, Kizawa S, Morita H, Ito T, Sakane K, Sohmiya K, Hoshiga M and Ishizaka N: Serum uric acid is associated with cardiac diastolic dysfunction among women with preserved ejection fraction. American Journal of Physiology-Heart and Circulatory Physiology 2015; 309(5): 986-94.https://journals.physiology.org/doi/abs/10.1152/ajpheart.00402.2015
15. Kuwabara M: Hyperuricemia, cardiovascular disease, and hypertension. Pulse 2016; 3(3-4): 242-52.https://karger.com/pls/article/3/3-4/242/304705
16. Fujita SI, Okamoto Y, Shibata K, Morita H, Ito T, Sohmiya K, Hoshiga M and Ishizaka N: Serum uric acid is associated with left ventricular hypertrophy independent of serum parathyroid hormone in male cardiac patients. PLoS One 2013; 8(12): 82735.https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0082735
17. Franse LV, Pahor M, Di Bari M, Shorr RI, Wan JY, Somes GW and Applegate WB: Serum uric acid, diuretic treatment and risk of cardiovascular events in the Systolic Hypertension in the Elderly Program (SHEP). Journal of Hypertension 2000; 18(8): 1149-54.https://journals.lww.com/jhypertension/fulltext/2000/18080/Serum_uric_acid,_diuretic_treatment_and_risk_of.21.aspx.
18. Walker R: Clinical pharmacy and therapeutics E-Book. Elsevier Health Sciences; 2011 Oct 24.https://books.google.com/books?hl=en&lr=&id=CcDRAQAAQBAJ&oi=fnd&pg=PP1&dq=Walker+R,+Whittlesea+C.+Clinical+Pharmacy+and+Therapeutics.+5th+ed.+Churchill+Livingstone%3B+2012.&ots=9nKFBT6-7C&sig=lbJ95PFkZTRL7urqQAavFJE6sjA
19. Dorj G: Pharmacotherapy: A Pathophysiologic Approach. Central Asian Journal of Medical Sciences 2017; 3(3): 3189.https://mongoliajol.info/index.php/CAJMS/article/view/2732/2916
20. Goodman LS, Gilman A, Gilman AG and Koelle GB: The pharmacological basis of therapeutics. In Bailliere Tindall 1975.https://utsouthwestern.elsevierpure.com/en/publications/the-pharmacological-basis-of-therapeutics-fifth-edition/.

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