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Calculating the level of Uric acid in order to determine the impact of diseases with clinically diagnosed Sepsis

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A B S T R A C T

Background and Aim: The definition of acute organ dysfunction and infection, as well as the data sources used, influence the rates of sepsis and septic shock. This investigation was therefore carried out to highlight the relationship between morbidity and mortality and hyperuricemia in patients with clinically confirmed sepsis.
Materials and Methods: The study included 150 patients in total. Blood samples were obtained from the patients in order to estimate their uric acid levels. The department of the biochemistry and medicine in RKDF Medical College Hospital & Research Center, Jatkhedi, Bhopal, Madhya Pradesh collaborated on the biochemical estimation of the uric acid level.
Results: Of the 150 participants in the study, 64 patients (42.7%) had increased uric acid levels, whereas 86 patients (57.3%) had normal uric acid levels. It can be deduced that patients with type 2 diabetes mellitus were among the study population. 40% is the most prevalent comorbidity. Type 1 and type 2 diabetes, decompensated liver disease, and cerebrovascular accidents were the most common comorbidities among individuals with hyperuricemia. About 36% of research participants who had no comorbidities also experienced sepsis.
Conclusion: This study shows that in patients with clinically confirmed sepsis in the intensive care unit, serum uric acid may be utilized as a predictor of death and morbidity as well as a measure of the severity of the illness. This report suggests more research on a wide foundation for verifying the observations.

Keywords: Uric acid; Sepsis; Serum level; Population; Morbidity and Mortality; Hyperuricemia.

INTRODUCTION

The way acute organ dysfunction and infection are diagnosed, as well as which data are used, determines the occurrences of sepsis and septic shock. Sources are examined. Large databases of electronic health records, prospective cohorts with manual case identification, and administrative data all provide disparate figures.One supportive care is frequently used to reduce organ dysfunction; in these cases, epidemiological studies measure the number of "treated" cases rather than the actual incidence. According to current cohort studies utilizing administrative data, there are up to two million sepsis cases every year.2, 3. Research over the last 20 years has shown that infections can result in numerous organ failure without causing a discernible excess of inflammation. [that is, without SIRS, or systemic inflammatory response syndrome]. In actuality, there are notable alterations in other pathways in addition to pro and anti-inflammatory reactions. Septic shock is a consequence of sepsis that causes disruptions in the body's metabolic and circulatory systems. In animals, purine metabolism produces allantoin, while in humans, it produces uric acid.4,5. Endogenous and exogenous purines are both possible. Purines are nitrogenous substances that are present in food and the body. The uric acid flows through the liver, enters the bloodstream, and is primarily eliminated through urine. After reacting with oxidants, the body breaks down some uric acid.6. In the past decade, a robust correlation has been discovered between uric acid and atherosclerosis, hypertension, hyperinsulinemia, and chronic renal disease.7.

Elevated serum uric acid is an indication of oxidative stress and a poor prognostic indicator for patients with multi-organ sepsis. The cause of dysfunction is elevated oxygen free radicals. Elevated blood uric acid levels are a poor prognostic indicator in cases of severe illness because they trigger rapid activation of several transcription factors.8 Elevated serum uric acid is also linked to chronic diseases. Therefore, the purpose of this study was to determine the relationship between morbidity and mortality and hyperuricemia in patients with sepsis who were clinically diagnosed.

MATERIALS AND METHODS

The current prospective study was conducted at the affiliated hospital and medical college. The study was conducted over a one-year period. There were 150 patients in the research. The following were the inclusion and exclusion criteria that were used:

Criteria for Inclusion:

1. Over the age of eighteen
2. IMCU admission with a working sepsis diagnosis

Criteria for Exclusion:

1. Patients refusing to provide consent.
2. Women who are expecting
3. A known renal disease case
4. Patients who have spent more than twenty-four hours in the intensive care unit at another facility.
5. Individuals with a known gout case 6. Individuals taking medications that cause hyperuricemia.

Blood samples were obtained from the patients in order to estimate their uric acid levels. For the uric acid level's biochemical estimation the biochemistry department of the medical college and hospital was involved in the partnership. Over the course of a year, 150 patients over the age of 18 who were admitted to the intensive care unit (IMCU) at RKDF Medical College Hospital & Research Center, Jatkhedi, Bhopal, Madhya Pradesh, with a clinical diagnosis of sepsis based on the quick SOFA (qSOFA) score participated in the current study. Upon meeting the inclusion criteria, the patient signed and provided written consent. The study participants' clinical proforma, which included demographic information, was carefully gathered, and basic vitals, including heart rate, respiratory rate, blood pressure, and oxygen saturation, were recorded. A comprehensive general and systemic examination was conducted. The Quick SOFA score is determined by three parameters: the Glasgow coma scale, systolic blood pressure, and respiratory rate. Low blood pressure (SBP <= 100 mmHg), high respiratory rate (>=22 breaths per minute), and GCS < 15.

Following that, blood samples were collected for the measurement of serum electrolytes, urea, creatinine, uric acid, complete blood count, and chest x-ray. The baseline value was the patient's creatinine level at IMCU admission. In both males and females, hyperuricemia was defined as a value greater than 7 mg/dl. Death or release from the intensive care unit were the two possible outcomes of the sepsis incident.

RESULTS

The median age of the current study population was determined to be 59.13 years. Of those who contributed to the maximum number of individuals, 6.67% were under 30, 56% were between the ages of 30 and 65, and 37.33% were over 65. There was a small male majority in our study population (52%). Uric Acid: Of the 150 research participants, 64 patients (42.7%) had increased uric acid levels, whereas 86 patients (57.3%) had normal uric acid levels. At 40%, type 2 diabetes mellitus was the most prevalent comorbidity among the study population, it can be deduced. Type 1 and type 2 diabetes, decompensated liver disease, and cerebrovascular accidents were the most common comorbidities among individuals with hyperuricemia. About 36% of the research participants who had no comorbidities also experienced sepsis.

The trial participants were found to develop acute renal damage, acute respiratory distress syndrome as the major consequences. Our study aims at identifying the association between hyperuricemia and the secondary end goals like AKI& ARDS. Patient status in respect to sepsis and its relationship to hyperuricemia is one of the study's endpoints. It was discovered in this study that of the 64 patients with hyperuricemia, 18 patients were released, or 28.1%, and 46 patients (81.9%) had expired. But it turned out that this difference was not statistically significant.

Age group	Frequency	Uric acid > 7 mg/dl	Uric acid < 7 mg/dl
< 30	0	4	6
31 - 65	84	36	48
> 65	56	24	32
Total	150	64	86

Table 1: Distribution of hyperuricemia among various age groups.

DISCUSSION

According to this prospective cohort study, patients with sepsis who have higher uric acid levels when they first arrive in the intensive care unit (IMCU) have a worse prognosis; that is, they are more likely to develop AKI or ARDS, which indicates a longer length of stay in the IMCU because sepsis is characterized by elevated pro-inflammatory cytokines and oxidative stress, the body produces more antioxidants to offset these effects. Poor outcomes and immunological dysfunction are caused by this changed degree of antioxidant defense. Both neutrophils and endothelial cells are triggered to emit free radicals formed from oxygen during a systemic inflammatory response.9, 10. Acute oxidative stress causes an increase in uric acid. In the rat heart, uric acid production may even offer a significant antioxidant defense mechanism against peroxynitrite nitration during hypoxia. Uric acid is therefore thought to be a significant indicator of oxidative stress. The causes of elevated uric acid are not fully known.11.

When AKI develops during sepsis, it significantly affects several organ functions, increases patient morbidity, predicts higher mortality, is linked to a longer stay in the critical care unit, and uses a significant amount of healthcare resources. Our study's primary finding is that in patients with early sepsis, hyperuricemia is linked to AKI. The development of AKI results in a bad prognosis. After CVS surgery, for example, the immediate operating and postoperative death rate is between 1 and 2%; if AKI develops, this increases to 10 to 38%, and if dialysis is required, it reaches >50%.12. Sepsis patients are typically very unwell individuals with a complex portion of the population that has MODS and a poor prognosis. AKI develops in these patients as a result of hemodynamic alterations, modifications to the heart's and liver's functional capacity, exposure to several drugs, and a host of other variables. Uric acid is one of these variables that may also have a role in the development of AKI.

Uric acid can cause AKI by a variety of mechanisms, including direct tubular toxicity brought on by crystals or indirect damage brought on by the production of vasoactive mediators and oxidative stress. AKI is caused by uric acid-induced renal vasoconstriction brought on by catecholamine release, renin-angiotensin system activation, pro-inflammatory marker production, oxidative stress, and decreased nitric oxide levels. According to Khosla et al., allopurinol causes rats with hyperuricemia to have lower levels of plasma nitrites, which are metabolites of NO. Zoccali et al.12 have shown a link between endothelial dysfunction and elevated uric acid levels. When uric acid causes inflammation, a number of pro-inflammatory markers, including MCP and CRP, rise.
By raising several pro-inflammatory markers as MCP and CRP, uric acid triggers an inflammatory response.13, 14 Uric acid may therefore be a predictor of AKI risk in septic patients and an early indicator of imminent AKI in sepsis patients.
The possibility that treating hyperuricemia in early sepsis could lower the risk for AKI is further raised by this. Elevated uric acid levels contribute to the development of CKD as well as the incidence of AKI. When GFR and renal urate excretion are reduced in patients with renal disease, uric acid levels rise. Despite the high frequency of ARDS observed in this group of septic patients, our research revealed no statistically significant correlation between hyperuricemia and ARDS.

Therefore, uric acid levels were not significant enough to predict the incidence of ARDS, even if they could be used to predict the severity of sickness, length of stay in the intensive care unit, and risk for AKI. Given that rising uric acid levels have been shown by Nagaya et al. to correlate with the clinical severity of primary pulmonary hypertension and have an independent association with the long-term mortality of patients with primary pulmonary hypertension, this may be the result of the small patient population we had for our study. The tiny sample size was probably the cause of this. Although there was a little higher death rate among hyperuricemic sepsis patients compared to those with normal uric acid levels, the difference was statistically significant to support the claim. The association between mechanical ventilation and ARDS and AKI was one end point that was statistically significant. Increased mechanical ventilation among ARDS patients was statistically significant.

CONCLUSION

This study shows that in patients with clinically confirmed sepsis in the intensive care unit, serum uric acid may be utilized as a predictor of death and morbidity as well as a measure of the severity of the illness. This study suggests further additional research to validate the findings.

Ethical Approval
The ethics committees at the RKDF Medical College Hospital & Research Center, Jatkhedi, Bhopal, Madhya Pradesh accepted the anonymous data collection and processing. Local laws state that past evaluation does not require further consent.

Competing interests
The authors declare no competing interests.

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