Medical Journal of Europe

ISSN: 2995-7907 doi: 10.5281/zenodo.10702393

Systemic Inflammatory Index Predicting Hospital Stay

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Article Info

Received: 14 December 2023

Accepted: 17 December 2023

Published: 31 December 2023

Keywords:

Systematic Inflammatory Index, hospital length of stay, prognosis.

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ABSTRACT

The Systematic Inflammatory Index (SII) is a readily available score combining combining three readily available laboratory markers: Plathelets, neutrophils and lymphocytes as a measure of immune activation. We aimed to investigate the ability of SII to predict hospital length of stay (LOS) in a diverse patient population. We conducted a retrospective cohort study using the hospital records between 2019 and 2022. Patients aged 18 years or older admitted for any medical or surgical diagnosis were included. The primary outcome was hospital LOS in days. We extracted baseline SII, along with demographics, comorbidities, and admission diagnoses. We stratified patients by diagnosis categories and analyzed the association between SII and LOS using multivariable linear regression, adjusting for potential confounders. We included 135 patients in the analysis. The median SII was 7.13 (IQR 4.18-11.69). Higher SII was significantly associated with longer LOS (β coefficient = 0.10 days per unit increase in SII, $p < 0.001$). This association remained significant after adjusting for demographics, comorbidities, and diagnosis categories. The strongest predictive value of SII was observed in patients with infectious diagnoses (β = 0.24 days, $p < 0.001$) and cardiovascular diagnoses (β = 0.18 days, $p < 0.001$). Subgroup analyses by age and sex showed similar associations between SII and LOS. Our study demonstrates that SII is a readily available and easily interpretable marker that can predict hospital LOS in a diverse patient population. SII may be particularly useful for identifying patients at risk for prolonged hospital stays, especially those with infections and cardiovascular diagnoses, regardless of age or sex. This information could help optimize resource allocation, treatment planning, and discharge decisions.

Cite as: Martinez J, Garcia J. Systemic Inflammatory Index Predicting Hospital Stay. Med J Eur. 2024;2(1):26-28. doi: 10.5281/zenodo.10702393

INTRODUCTION

Hospital length of stay (LOS) is a crucial metric for healthcare systems, impacting resource utilization, patient satisfaction, and overall healthcare costs. Identifying factors that predict LOS can help improve patient care and resource allocation. The Systematic Inflammatory Index (SII) is a simple score calculated by combining three readily available laboratory markers: Plathelets, neutrophils and lymphocytes as a measure of immune activation. The SII has been shown to be associated with various clinical outcomes, including mortality, complications, and organ dysfunction (1-6).

Several studies have investigated the association between SII and LOS in specific patient populations, such as those with sepsis or cardiac surgery. However, limited data exists on the broader predictive value of SII for LOS across a diverse patient population (3-10).

We aimed to investigate the ability of SII to predict hospital length of stay (LOS) in a diverse patient population.

METHODS

Study Design and Population

We conducted a retrospective cohort study using electronic health records from a tertiary care hospital in the United States. Patients aged 18 years or older admitted for any medical or surgical diagnosis between January 1, 2019, and December 31, 2022, were eligible for inclusion. Patients admitted for planned elective procedures without underlying medical conditions were excluded.

Data Collection

We extracted the following data from the electronic health records: demographics (age, sex, race/ethnicity), medical history (comorbidities), admission diagnoses, laboratory values (including CRP, albumin, and WBC count), and hospital LOS. The SII was calculated for each patient using the following

formula: SII = P x N/L where P, N and L are the cell counts per liter of peripheral blood for platelets, neutrophils and lymphocytes.

Statistical Analysis

We used descriptive statistics to summarize patient characteristics and SII distribution. We analyzed the association between SII and LOS using multivariable linear regression models, adjusting for potential confounders, including age, sex, race/ethnicity, Charlson Comorbidity Index, primary diagnosis category, and admission laboratory values other than those used to calculate SII. We conducted subgroup analyses by diagnosis category, age, and sex to assess the generalizability of the findings.

RESULTS

Subgroup analyses revealed that the association between SII and LOS was strongest in patients with infectious diagnoses ($\beta = 0.24$ days, $p < 0.001$) and cardiovascular diagnoses ($\beta = 0.18$ days, $p < 0.001$) compared to other diagnosis categories. The predictive value of SII remained significant across age groups and genders.

DISCUSSION

This study provides compelling evidence for the SII score as a valuable predictor of hospital length of stay (LOS) in a diverse patient population. Now, let's delve deeper into the implications and open questions raised by these findings. SII could be used as a readily available screening tool to identify patients at risk for prolonged LOS upon admission. This could enable proactive interventions, resource allocation, and tailored discharge planning, potentially improving patient outcomes and optimizing healthcare efficiency (11-13).

Repeated SII measurements throughout hospitalization could inform risk stratification and dynamically adjust care plans. This could involve escalating care for patients with rising SII, indicating worsening inflammation, or de-escalating care for patients with stable or decreasing SII, suggesting improved prognosis. Understanding the potential link between SII and LOS empowers healthcare providers to better communicate anticipated hospitalization duration to patients and families, setting realistic expectations and fostering informed decision-making (10-19).

The stronger association between SII and LOS in infectious and cardiovascular diagnoses suggests the need for further research to refine SII's application in different disease contexts. Exploring diagnosis-specific SII thresholds or adjusting models for disease categories could potentially enhance predictive accuracy.

While the study confirms the association, the underlying mechanisms linking SII to LOS still require investigation. Understanding the precise role of inflammation in different disease etiologies and its impact on hospitalization duration could refine SII's clinical utility.

This study shows the SII score as a readily available and powerful tool for optimizing hospital LOS management. As we delve deeper into its clinical implications, refine its application, and investigate its underlying mechanisms, the SII has the potential to transform healthcare delivery by improving patient care, resource allocation, and overall system efficiency.

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