



SERIAL MONITORING OF SODIUM A HELPFUL INDICATOR TO PREDICT ANASTOMOTIC LEAKAGE.

General Surgery

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ABSTRACT

Hyponatremia, linked to systemic inflammation, may predict anastomotic leakage (AL) following colorectal surgery. This study evaluates the role of postoperative serum sodium levels in identifying AL. A retrospective analysis of 125 patients undergoing colorectal surgery at Mahatma Gandhi Hospital (January–December 2023) was performed. Postoperative serum sodium levels were monitored, and patients were grouped into AL and no anastomotic leakage (NAL) groups. Hyponatremia was defined as serum sodium <135 mmol/L. AL was observed in 27 patients (21.6%), mostly between postoperative days 5 and 7. Sodium levels were significantly lower in the AL group (135.63 ± 4.29 mmol/L) than in the NAL group (139.81 ± 3.41 mmol/L, $p = 0.002$). Hyponatremia was present in 70.4% of AL cases. A sodium cutoff of 137 mmol/L demonstrated a negative predictive value of 97.2%. Postoperative hyponatremia is a valuable marker to exclude AL and may reduce reliance on imaging.

KEYWORDS

hyponatremia, anastomotic leakage, colorectal surgery, serum sodium.

INTRODUCTION

Hyponatremia, the most common electrolyte disturbance in clinical practice, is frequently linked to systemic inflammation. Conditions such as pneumonia, urinary tract infections, peritonitis from intestinal perforation, and spontaneous bacterial peritonitis in liver cirrhosis have all been associated with hyponatremia. Recent studies suggest that systemic inflammation may induce hyponatremia through immune-neuroendocrine pathways involving interleukin-6 and non-osmotic vasopressin release. Despite its low sensitivity, hyponatremia has been shown to be a relevant marker for detecting perforations in infectious colonic diseases.

Given the established relationship between systemic inflammation and hyponatremia, as well as the role of inflammatory processes in AL, investigating their correlation is crucial. This study aims to explore the significance of hyponatremia as predictor of AL following colorectal surgery. Additionally, it reviews existing literature on electrolyte disturbances as markers for intra-abdominal sepsis and AL, while examining the underlying pathophysiology and its potential impact on patient outcomes. Despite advancements in surgical techniques and perioperative care, AL remains a significant cause of morbidity, mortality, prolonged hospital stays, and increased healthcare costs.

Aim

To correlate post operative hyponatremia as an indicator of bowel anastomotic leakage

METHODS

Ethics

The study was approved by the Institutional Review Board and Research Ethics Committee of Mahatma Gandhi Hospital, Jaipur. As this was a retrospective analysis utilising anonymised data routinely collected during clinical care, the requirement for informed consent from patients was waived.

Patient Data

This retrospective study analysed patients who underwent colorectal surgery at Mahatma Gandhi Hospital, Jaipur, between January 2023 and December 2023. The inclusion criteria included patients with histologically confirmed colorectal cancer, incarcerated hernias, obstructions due to bands and adhesions, malrotation, internal hernia and stoma closure. The exclusion criteria included contaminated cases, cases posted for emergency surgery, and patients with an impending risk of perforation.

Clinical and demographic data collected included age, sex, type of surgery, status of a preventive stoma, nutritional status assessed using the Nutrition Risk Score (NRS) 2002, anastomotic technique, and cancer stage based on the 7th edition of the American Joint Committee

on Cancer (AJCC) staging system. Preoperative and postoperative serum sodium levels were recorded for all patients. For patients with anastomotic leakage (AL), the time of diagnosis was documented.

Among patients diagnosed with AL, leakage was observed predominantly between postoperative days 5 to 7. To identify potential complications, serial monitoring of serum sodium levels was initiated on day 1 and continued until day 14. Laboratory assessments were conducted every second day during this period to ensure timely detection and intervention.

Diagnostic Criteria for Postoperative Anastomotic Leakage

Anastomotic leakage was diagnosed based on the following criteria

1. Fecal material detected in the drainage tube,
2. Confirmation of an anastomotic fistula through reoperation, or
3. Identification of a pelvic abscess near the anastomotic site via computed tomography (CT).

Patients were classified into two groups based on the occurrence of AL: the AL group and the no anastomotic leakage (NAL) group.

Definition of Hyponatremia

Hyponatremia was defined as a serum sodium level below 135 mmol/L, based on the reference range used by the hospital's laboratory.

RESULTS

A total of 125 patients were included in the study. Among these, 25 patients (20%) had colorectal cancer, 19 patients (15%) had incarcerated hernia, and 38 patients (30%) presented with perforation. Anastomotic leakage (AL) was identified in 27 patients, representing an overall incidence of 21.6% as shown in figure 1.

AL occurred, on average, on postoperative day 6 ± 3 . Most cases (74.1%) were observed between postoperative days 5 and 7, with the highest incidence on day 6.

Postoperative serum sodium levels were significantly lower in the AL group compared to the no anastomotic leakage (NAL) group (135.63 ± 4.29 mmol/L vs. 139.81 ± 3.41 mmol/L, $p = 0.002$). The optimum cut-off value for postoperative serum sodium levels was determined to be 137 mmol/L as shown in Figure 2. Patients with postoperative serum sodium levels below this cut-off were classified as having redefined hyponatremia.

According to this redefined criterion, 19 patients in the AL group (70.4%) and 8 patients in the NAL group (29.6%) were identified as having hyponatremia ($p < 0.001$). Postoperative serum sodium levels decreased by an average of 3.63 ± 4.97 mmol/L in the AL group, compared to 0.84 ± 3.80 mmol/L in the NAL group. This reduction in

sodium levels was significantly associated with the development of AL ($p < 0.001$).

Multiple logistic regression analysis revealed that postoperative serum sodium level (odds ratio: 1.176, $p = 0.006$) was an independent predictive factor for AL.

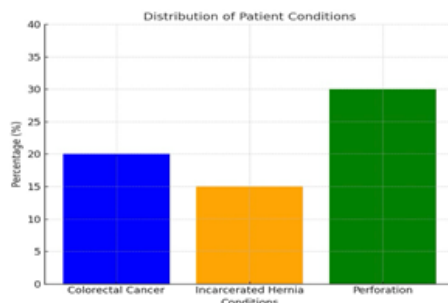


Figure.1: Percentage wise distribution of anastomotic leakage

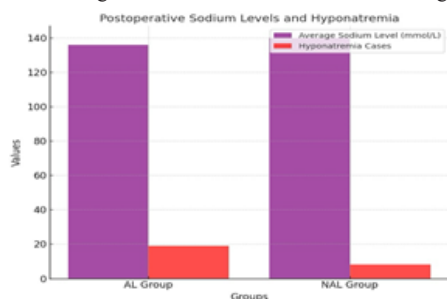


Figure 2 : postoperative serum sodium levels in AL and NAL

CONCLUSIONS

This study identified postoperative serum sodium level as a potential marker for predicting and excluding anastomotic leakage (AL) in gastrointestinal conditions, including colorectal cancer, incarcerated hernia, and perforation. Patients who developed AL were significantly more likely to have hyponatremia compared to those without AL. Earlier research, such as Clowes et al. (1966), linked secondary peritonitis to hyponatremia [1]. Similarly, Käser et al. (2014) demonstrated that hyponatremia might indicate AL after colorectal surgery, but their study was limited by a lack of focus on a broader spectrum of gastrointestinal cases [2]. By including a heterogeneous group of conditions—colorectal cancer (20%), incarcerated hernia (15%), and perforation (30%)—our study provides more generalisable findings.

Diagnosing AL remains challenging due to its non-specific clinical presentation, reliance on subjective signs, and the high cost of objective tests like CT imaging. Although biomarkers like CRP and procalcitonin are promising, their infrequent use in routine postoperative monitoring and higher costs limit their applicability. In contrast, serum sodium levels are routinely monitored, making them a cost-effective and readily available diagnostic tool.

In this study, a postoperative serum sodium cutoff of 127 mmol/L was identified. Hyponatremia was significantly associated with AL, but its sensitivity (70.4%) and positive predictive value (12.8%) were too low to support its use as a standalone diagnostic tool. However, the absence of hyponatremia had a high negative predictive value (97.2%), allowing it to effectively rule out AL in most cases. When combined with the absence of leukocytosis, the negative predictive value further increased to 99.1%, suggesting that routine CT scans may not be necessary for these patients.

The mechanisms linking hyponatremia and AL remain speculative but are likely multifactorial. Inflammation may disrupt the regulation of antidiuretic hormone (ADH), leading to increased release and fluid retention, causing hyponatremia. Additionally, peritonitis associated with AL can result in significant intraperitoneal fluid loss, further stimulating ADH secretion and sodium dilution. Interestingly, no significant association was observed between hyponatremia and surgical site infections, likely because most infections remain localised and do not cause systemic fluid and electrolyte imbalances.

This study has limitations. As a retrospective analysis, there were variations in the timing and frequency of postoperative laboratory testing, which could have introduced bias. Sodium supplementation was not standardised and was adjusted based on individual needs or the presence of hyponatremia. However, preoperative sodium levels were normal across all patients, strengthening the validity of the findings.

In conclusion, postoperative serum sodium measurement is a valuable tool for excluding AL in a wide range of gastrointestinal conditions. Its high negative predictive value, especially when combined with the absence of leukocytosis, suggests that patients without hyponatremia or leukocytosis are unlikely to develop AL. This could reduce the need for routine CT imaging in such cases. Further prospective studies are warranted to confirm these findings and establish serum sodium as a reliable marker in postoperative care.

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