Interpretation of Preoperative Albumin and Hematocrit Levels in Patients Operated for Cleft Palate: A Single-Center, Retrospective and Controlled Analysis

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Abstract

Aim: Infants with cleft palate often experience feeding difficulties, leading to subtle nutritional deficiencies that may impact surgical outcomes. Serum albumin is commonly used to assess nutritional status. This study evaluates preoperative albumin and hematocrit levels and their association with postoperative complications in cleft palate patients.

Methods: We retrospectively analyzed consecutive patients operated on for secondary cleft palate between January 2017 and January 2023. Patients with primary cleft lip/palate or syndromic conditions were excluded. Preoperative hematocrit and albumin levels were compared with a control group of pediatric patients undergoing superficial excisional biopsy. Postoperative fistula development was recorded.

Results: A total of 224 cleft palate patients and 44 controls were included. Hematocrit and albumin levels were significantly lower in cleft patients (p=0.05 and p=0.033, respectively) but remained within normal ranges. Although statistically significant, the observed differences were clinically negligible. No significant associations were found between laboratory values and postoperative fistula formation.

Conclusions: Albumin and hematocrit levels, though lower in cleft palate patients, remained within normal limits and did not predict complications. A more holistic nutritional assessment may be warranted preoperatively.

Keywords: *Cleft palate; malnutrition; albumin; hematocrit*

1. Introduction

Cleft palate is among the most common congenital craniofacial anomalies, often resulting in feeding difficulties and compromised nutrient intake during infancy [1,2]. Delays in surgical correction can exacerbate associated complications such as recurrent infections, speech difficulties, and impaired growth. Therefore, thorough nutritional assessment and optimization are critical preoperative steps [3–6].

Micronutrient deficiencies and anemia are common among patients with cleft palate[7]. Serum albumin is a widely used biochemical marker for nutritional status in adults[8,9]. However, its utility in pediatric patients is less definitive, as dynamic growth patterns and hydration states can influence albumin levels. Furthermore, anthropometric measures such as weight-for-age, weight-for-height, and mid-upper arm circumference are considered more sensitive indicators of malnutrition in children.

To our knowledge, few studies have directly compared albumin and hematocrit levels in cleft palate patients and evaluated their predictive value for postoperative complications. This study aims to evaluate preoperative serum albumin and hematocrit levels as potential markers for assessing nutritional status in infants with cleft palate and to determine whether it is predictive of postoperative complications, particularly fistula formation. By identifying reliable nutritional indicators, clinicians can optimize preoperative management and improve surgical outcomes in this vulnerable population.

2. Materials and Methods

This retrospective study was conducted at a single tertiary care center. We analyzed consecutive patients operated on for secondary cleft palate repair between January 2017 and January 2023 by a single surgeon. Patients with isolated clefts involving the secondary palate (hard and/or soft palate) were included. Those with cleft lip involvement (primary palate) or syndromic conditions were excluded. Blood tests were acquired within the week of surgery in

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all cases. Patients with missing laboratory data or inadequate postoperative follow-up were excluded.

Demographic (age, gender), clinical (cleft type), and laboratory (hematocrit, albumin) data were collected. Postoperative fistula development requiring surgical repair was recorded. All patients received nutritional counseling at initial presentation.

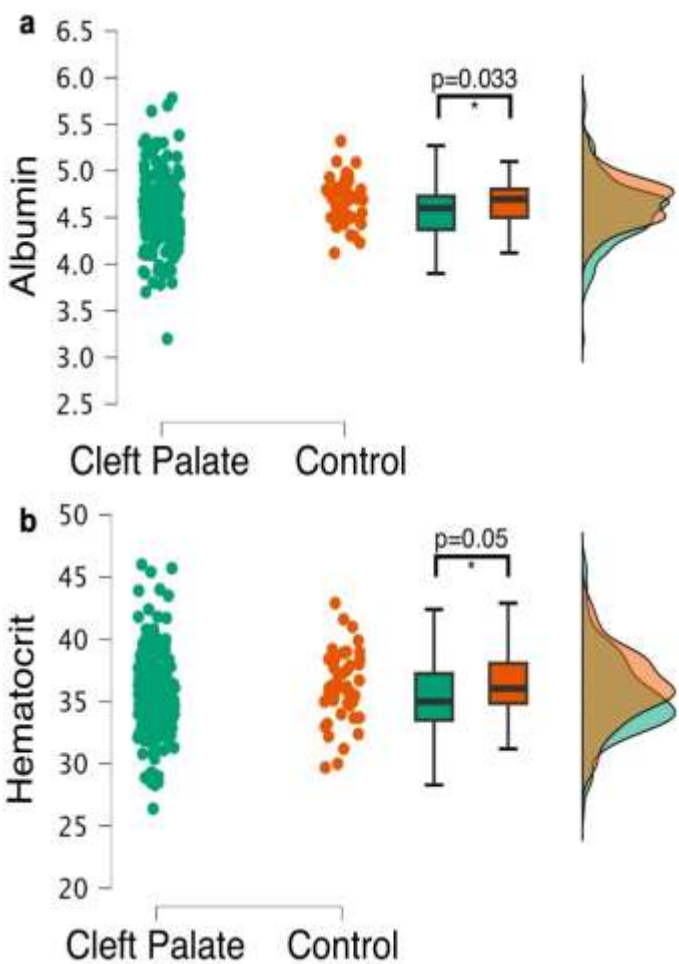
The control group comprised age-matched pediatric patients undergoing superficial excisional biopsy under general anesthesia, without chronic illnesses or known nutritional issues, allowing for unbiased biochemical comparisons.

All patients with cleft palate were referred to the nutrition specialist after diagnoses and they were followed-up until the date of surgery and afterwards. All patients and guardians were educated specifically about the feeding positions and dietary intake.

Statistical analyses were performed using JASP version 0.19.2. Normality was assessed with the Shapiro-Wilk test. Normally distributed variables were compared using t-tests; non-normal variables were compared using the Mann-Whitney U test. Categorical variables were analyzed with the $\chi 2$-test. Ethical approval was obtained, and all procedures complied with the Declaration of Helsinki.

Figure 1

Raincloud plots and bar charts illustrating mean hematocrit and albumin levels in cleft palate (n=224) and control groups (n=44).



3. Results

The study included 224 patients who underwent surgery for secondary cleft palate (48.7% female) and 44 control patients (47.7% female). Among the cleft palate patients, 136 (60.7%) had incomplete clefts, while 88 (39.3%) had complete clefts. The median age of cleft palate patients was 1.00 year, while the control group had a median age of 2.00 years. There was no statistically significant difference in age between the groups.

Preoperative hematocrit and albumin levels were significantly lower in cleft palate patients compared to controls, with no values falling under the reference range (**Fig. 1**). The mean hematocrit was 35.40 ± 3.20% in cleft palate patients and 36.16 ± 2.86% in controls (p=0.05). Mean albumin levels were 4.58 ± 0.36 g/dL in cleft palate patients and 4.67 ± 0.25 g/dL in controls (p=0.033).

When comparing incomplete and complete clefts, no significant differences were found in hematocrit (35.65 ± 3.21% vs. 35.01 ± 3.15%, p=0.387) or albumin levels (4.60 ± 0.34 g/dL vs. 4.53 ± 0.38 g/dL, p=0.163) (**Fig. 2**).

Postoperative fistula formation occurred in 12 patients (5.3%). Patients with and without fistula did not show significant differences in hematocrit (35.82 ± 3.57% vs. 35.37 ± 3.18%, p=0.564) or albumin levels (4.64 ± 0.25 g/dL vs. 4.57 ± 0.36 g/dL, p=0.885) (**Fig. 3**). Additionally, fistula development was not significantly associated with gender (p=0.618) or cleft type (p=0.435).

Figure 2

Comparison of hematocrit and albumin levels between incomplete (n=136) and complete (n=88) cleft palate cases.

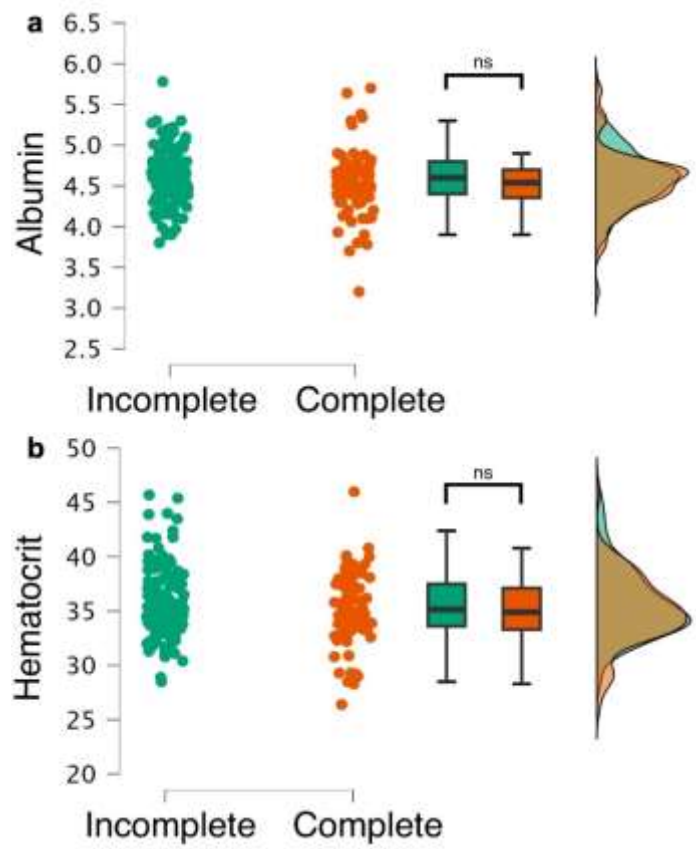
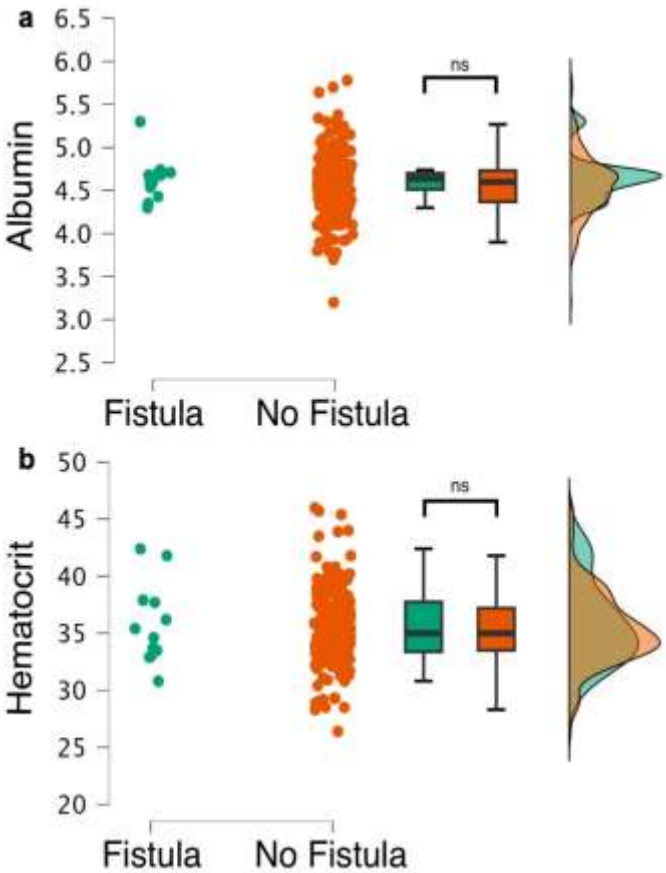


Figure 3

Hematocrit and albumin levels in patients with (n=12) and without postoperative fistula formation.



4. Discussion

It is a known fact that babies with cleft palate and cleft lip have feeding problems [7,10,11]. Feeding problems, together with low weight gain, may delay surgery and create a vicious cycle. Albumin is a parameter widely used in the adult population for the determination of malnutrition. However, although its prognostic role in pediatric patients has been discussed, there is insufficient evidence in the literature [9,12–14]. In pediatric cardiac surgery, lower serum albumin has been associated with prolonged ventilation and adverse in-hospital outcomes, supporting its use as a risk indicator in that population. Similarly, broader pediatric otolaryngology series link poor nutritional status to worse postoperative courses[9-12]. By comparison, our cleft palate cohort—managed with routine preoperative nutrition counseling—demonstrated albumin values largely within the normal range and no association with fistula formation, suggesting that (i) albumin's predictive utility may be procedure- and population-specific, and (ii) early nutritional optimization can attenuate risk signals that albumin might otherwise capture. In our study, similar to what has been reported in the pediatric population undergoing operations other than cleft palate [8], we have shown that albumin may be a reliable parameter in infants with cleft palate in terms of malnutrition, and while albumin may reflect general nutritional status, it does not appear to predict postoperative complications such as fistula formation in adequately nourished infants. Considering that malnutrition is only one factor in wound healing, other factors also have a major effect on cleft palate surgery, including the optimal operative technique choice, postoperative care, and the timing of the surgery.

Our study highlights the nutritional challenges faced by infants with cleft palate and the potential role of serum albumin in assessing their preoperative status by using two cohorts. First, we aimed to demonstrate the difference between the patients with cleft palate and the healthy control and then, we proceeded with the in-group analyses among the patients with cleft palate. As expected, albumin and hematocrit levels were significantly lower in cleft palate patients compared to controls, reinforcing the well-documented risk of malnutrition in this group. However, no cases of true hypoalbuminemia (albumin <3.0 g/dL) were observed, suggesting that while albumin levels were slightly reduced, they remained within the normal range. A key factor that may explain this finding is that all cleft palate patients in our study were referred to a nutrition specialist upon their first consultation. Early nutritional intervention likely helped optimize their preoperative status, preventing severe malnutrition and hypoalbuminemia. This underscores the importance of multidisciplinary management, where nutritional support plays a crucial role in preparing cleft patients for surgery. Despite the observed differences in albumin levels between cleft palate patients and controls, our study found no significant association between albumin levels and postoperative complications, including fistula formation. This suggests that while albumin serves as a useful marker of nutritional status, it does not predict surgical outcomes, especially when within normal ranges. Other factors, such as surgical technique, wound healing capacity, and overall health status, may play a more dominant role in determining postoperative complications. Adequate postoperative protein and energy intake help maintain serum albumin levels, support tissue repair, and may reduce the risk of wound complications[10,11]. Although our study did not evaluate postoperative nutrition or its effect on albumin dynamics, this remains an important area for future research. Prospective studies that monitor both pre- and postoperative nutritional support, alongside biochemical markers, may better elucidate how ongoing nutritional optimization influences fistula formation and other complications in cleft palate surgery. Given albumin's long half-life and its behavior as a negative acute-phase reactant, markers with faster kinetics and/or complementary biological domains may improve risk stratification. Candidates include prealbumin (transthyretin) and transferrin, which respond more rapidly to short-term changes in protein–energy intake; retinol-binding protein as another short-half-life transport protein; and C-reactive protein (CRP) to help disentangle malnutrition from inflammation when interpreting visceral proteins. Integrating these with simple anthropometrics (e.g., weight-for-age/height Z-scores, mid-upper arm circumference) and, where feasible, composite indices that pair nutritional markers may yield better prediction of wound healing and postoperative complications than albumin alone. Prospective work in cleft surgery that jointly models these variables could clarify which panel best forecasts fistula, infection, or dehiscence. Biggest limitation of the use of these markers, however, is the limited access and associated costs. What we aimed in this study was to assess the possible role of albumin, since it is a readily available marker that can be included routinely in preoperative blood tests.

This study has several limitations. Its retrospective design may introduce selection bias and limits the ability to establish causation between albumin levels and surgical outcomes. As a single-center study, the findings may not be generalizable to broader populations

with different nutritional practices, healthcare access, or socioeconomic backgrounds. Additionally, the study only assesses preoperative albumin levels and short-term postoperative outcomes, such as fistula formation, without evaluating long-term nutritional status, growth, or speech outcomes. Nutritional assessment was limited to albumin and hematocrit levels, which, while widely used, can be influenced by factors such as inflammation and hydration status. Additionally, more traditional growth parameters such as weight-for-age or Z- scores could not be used due to the retrospective nature of the study. A more comprehensive evaluation, including additional biomarkers and growth parameters, would provide a clearer picture of malnutrition in cleft palate patients. In addition, control group was solely based on pediatric patients undergoing different elective procedures in the same timeline the study was performed. Furthermore, the study focused on postoperative fistula formation as the primary surgical outcome, without assessing other complications such as wound dehiscence, infection, or speech outcomes, which could offer a more complete understanding of albumin's role in surgical success. Lastly, all cleft palate patients in this cohort were referred for early nutritional intervention, which likely optimized their preoperative status and may have minimized the variability in albumin levels, potentially masking its full impact on surgical outcomes. A multicenter or prospective approach is recommended for future studies.

5. Conclusion

Infants with cleft palate exhibit mildly reduced preoperative hematocrit and albumin levels compared to healthy controls; however, these differences do not indicate clinical malnutrition. Albumin alone is insufficient to predict postoperative complications such as fistula formation. While albumin and hematocrit may assist in screening, they should not be used in isolation to guide surgical readiness. A multidisciplinary preoperative assessment remains essential. Comprehensive preoperative nutritional assessments remain essential to optimize surgical outcomes.

Statement of ethics

The study protocol was approved by the Ethics Committee of Istanbul University - Cerrahpasa Faculty of Medicine (IRB Application Code: PJgqw5aR, dated June 16, 2025). All participants were informed in detail about the study's purpose and procedures, and written informed consent was obtained from each participant in accordance with the Declaration of Helsinki.

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No artificial intelligence-based tools or generative AI technologies were used in this study. The entire content of the manuscript was originally prepared, reviewed, and approved by both authors.

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Conflict of interest statement

The authors declare that they have no conflict of interest.

Availability of data and materials

Due to institutional privacy policies, the datasets generated and/or analyzed during the current study are not publicly available, but they are available from the corresponding author upon reasonable request.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Can Ege Yalcin, Serife Kartal Erdost and Emre Savaci. The first draft of the manuscript was written by Can Ege Yalcin and all authors commented on previous versions of the manuscript. Yagmur Aydin supervised the whole process and critically reviewed the drafting process. All authors read and approved the final manuscript.

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