

Association Between Seasonality Albumin Levels and Inflammation in Hemodialysis Patients

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Introduction

- Albumin levels are altered by inflammation, with lower albumin levels at higher levels of inflammation. Neutrophil-to-lymphocyte ratio (NLR) is increasingly recognized as a marker of inflammation that can be easily obtained from routine hemodialysis (HD) monthly complete blood count (CBC) tests.
- It has been previously demonstrated that albumin and NLR have a seasonality component, both peaking during winter. Given that inflammation modifies albumin levels, we hypothesized that high levels of NLR may blunt the seasonal trend of albumin.
- Therefore, we aimed to determine the effect of inflammation and other patient variables on the seasonal trend of albumin in a large cohort of hemodialysis patients.

Methods

- All patients receiving HD in Fresenius Medical Care North America (FMCNA) clinics from 1/2010 to 12/2014 were included in the analysis who survived for at least 60 months. NLR was calculated from CBC drawn during routine monthly labs. In order to study the seasonal trend of albumin, we considered the following two-stage approach:
 - Stage 1: Remove long term trend in albumin for each patient and estimate amplitudes of seasonal trend for all patients.
 - Stage 2: Investigate relationships between amplitude and NLR and other covariates.
- In the following analysis we use square root of amplitude and log transformation of NLR such that they approximately follow normal distributions.

Results

- In total there were 1167 patients with 60 months of data. Figure 1, 2, and 3 demonstrates the relationship between seasonal albumin amplitudes (expressed in g/dL), NLR and other covariates.
- We observed no difference in seasonal amplitude of albumin related to race, gender, diabetic mellitus status, and catheter as vascular access. Of note, the seasonal albumin amplitude decreased with increasing age, meaning that with increasing age there was less changes in serum albumin levels throughout the seasons [Figure 1].
- The association between NLR and seasonal trend of serum albumin was evaluated in several ways. First, the NLR was evaluated as a continuous variable. In this analysis, the seasonal albumin amplitude was not associated with minimum, median, mean, and maximum NLR [Figure 2].
- Second, patients were stratified by whether their NLR was consistently $>$ or ≤ 4 , as those with NLR persistently > 4 likely had a chronically inflamed state. However, there was no statistically significant difference between amplitude of albumin between groups [Figure 3].

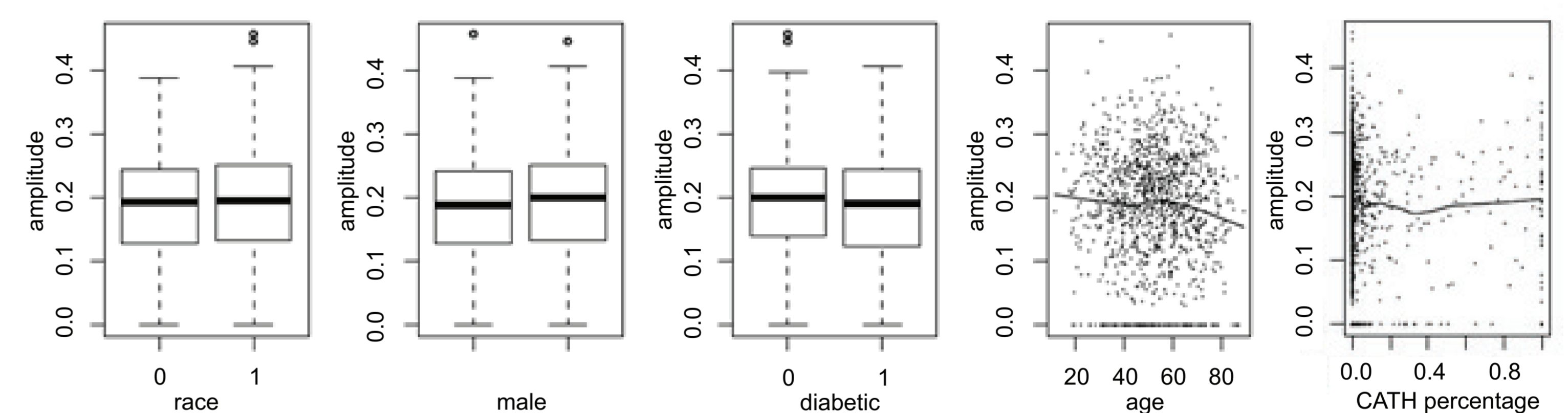


Figure 1. The relationship between amplitude of albumin seasonal trends and race, gender, diabetes status, age, catheter use.

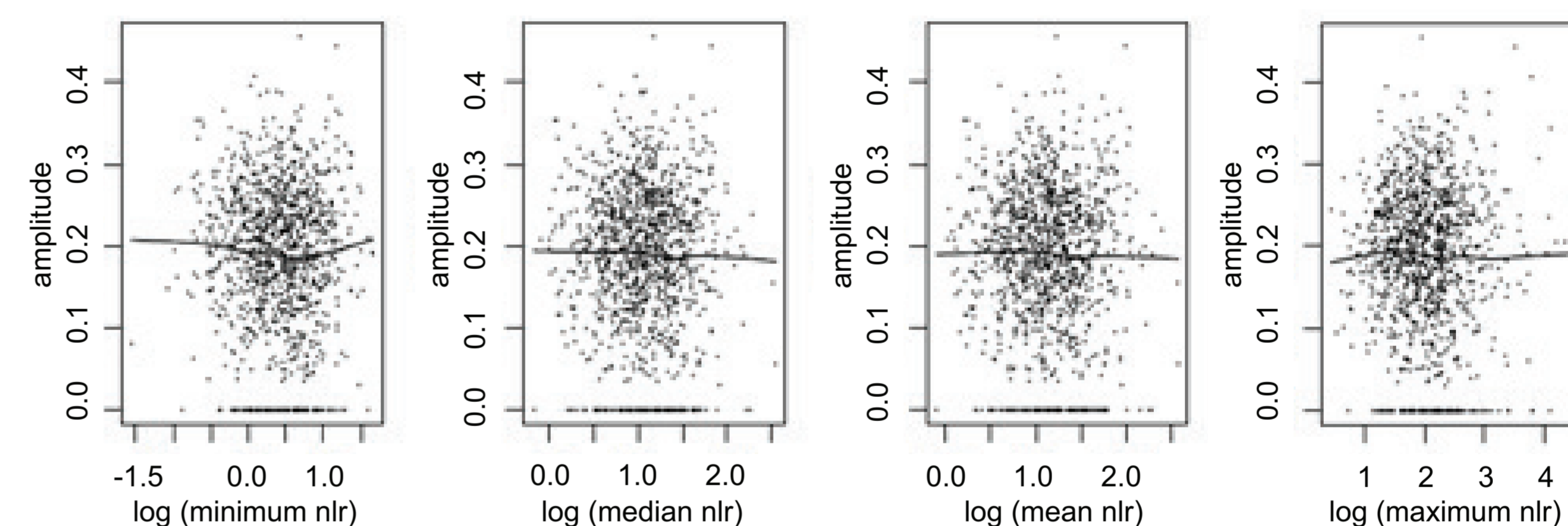


Figure 2. The relationship between amplitude of albumin seasonal trends and minimum, median, mean, and maximum neutrophil-to-lymphocyte ratio.

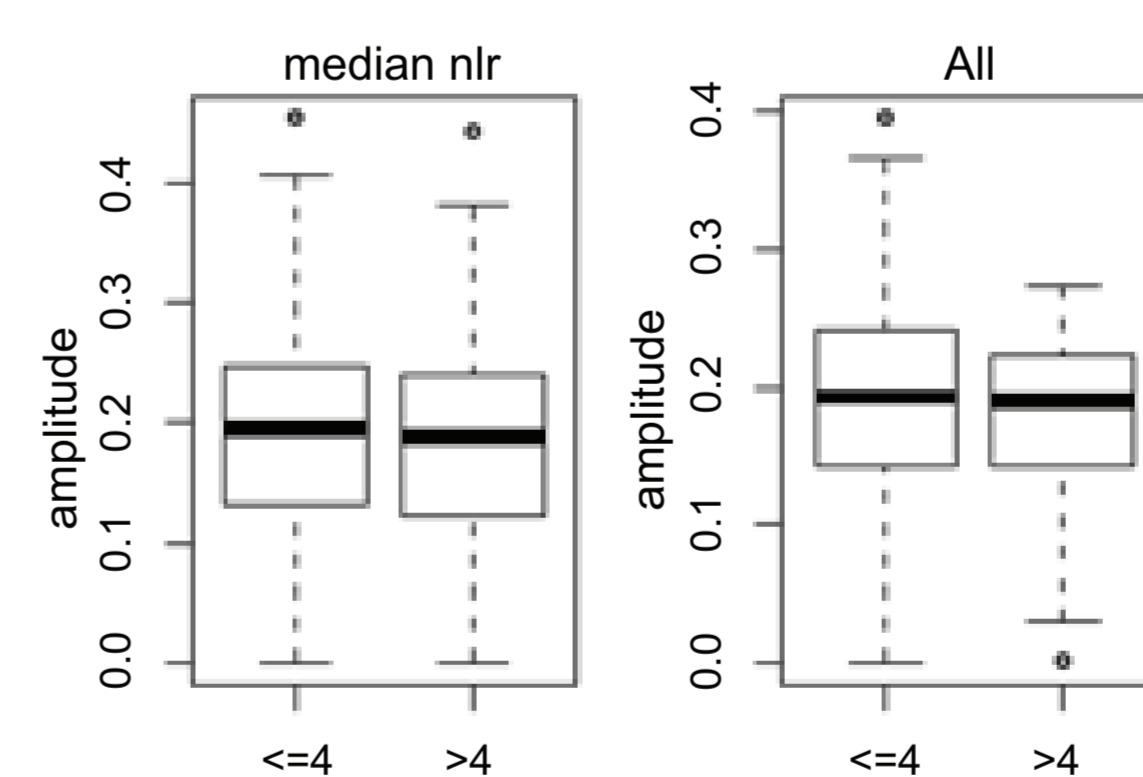


Figure 3. The relationship between amplitude of albumin seasonal trends and neutrophil-to-lymphocyte ratio if stratified by whether their NLR was consistently $>$ or ≤ 4 .

Conclusions

- We demonstrate that there is no association between inflammation (as reported by NLR) and seasonal trends of albumin.
- Although the albumin levels are driven by inflammation, at levels of high inflammation, the effect of seasonality of albumin was still present.
- However, increasing age was associated with a decrease in albumin seasonality amplitude. This finding may be related to a reduced ability to adapt with seasonal changes as HD patients age.

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