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OBJECTIVES

Asthma is one of the representative diseases that can cause a systemic inflammatory response. Anemia of chronic disease (ACD), also called anemia of inflammation, is known to be caused by diseases with a chronic inflammatory state. Whether the incidence of anemia is higher in asthmatic patients than in healthy control remains unclear. Thus, the objective of this study was to determine incidence of anemia in asthmatic patients and healthy adults.

METHODS

Data Sources and Study Subjects

The study included two groups of participants: adults with asthma and healthy adults. The asthma group included patients diagnosed with asthma at the Department of Internal Medicine at Seoul National University Hospital between 2010 and 2017 and had medical records available for at least three years after their diagnosis. The healthy adult group included individuals who had health checkups between 2010 and 2017 at Seoul National University Hospital Healthcare System Gangnam Center, with no asthma diagnosis and had medical examination records available for two years before the checkup.

Definition of disease and study outcome

Asthma was defined as the presence of respiratory symptoms along with certain

RESULTS

Subject Characteristics

The study involved 1,354 adult patients who were diagnosed with asthma at Seoul National University Hospital and 1,731 healthy adults who underwent health checkups at Seoul National University Hospital Healthcare System Gangnam Center. 448 patients were excluded from the asthma group and 12,705 individuals were excluded from the healthy adult group due to anemia or potential confounding factors. Males accounted for 68.4% of asthma patients and females accounted for 63.4% of healthy adults. The majority of adults in both groups were under 65 years old. The asthma group had a higher percentage of obese subjects compared to the healthy adults group.

Table 1. Characteristics of study subjects

Characteristics	Healthy adults (n = 1,731)	Asthma patients (n = 1,354)
Age group		
Adult (≥ 18 and < 65 y)	1,657 (95.7)	1,009 (74.52)
Elderly (≥ 65 y)	74 (4.3)	345 (25.48)
Sex		
Man	634 (36.6)	926 (68.39)
Women	1,097 (63.4)	428 (31.61)
Obesity		
Non-obese (BMI < 25.0 kg/m ²)	1,246 (72.0)	855 (63.15)
Obese (BMI ≥ 25.0 kg/m ²)	485 (28.0)	499 (36.85)

Risk of anemia in asthma patients compared to healthy adults

The study found that among all patients, 15% of asthma patients had anemia compared to 4.6% of healthy adults. After adjusting for age, sex, and obesity, the asthma patients group had a significantly higher HR of 4.06 for anemia than healthy adults.

Age was found to be a significant risk factor for anemia, but sex and obesity were not. In patients aged 18 to 65, the adjusted HR for anemia in the asthma patients group was 3.27. In patients over 65, the adjusted HR was 5.56, and the rate ratio was 4.68 compared to healthy adults.

The incidence of anemia in older asthma patients was more than double that in younger patients,

while the risk of anemia in healthy adults did not vary with age.

Table 2. The risk of anemia according to asthma

Subject groups	HR [†]	95% CI
Healthy adults		Reference
Asthma patients	4.056	2.703–6.087

[†]Adjusted for age, sex, and obesity. CI, confidence interval; HR, hazard ratio.

Sensitivity analysis

After restricting the analysis to only patients diagnosed with anemia on two consecutive occasions, the risk of anemia remained higher in individuals with asthma compared to healthy adults.

The asthma group had an adjusted HR for anemia of 9.32 (95% CI: 4.16–20.89) after controlling for age, gender, and obesity, and this association was statistically significant.

Table 3. Sensitivity analysis for the risk of anemia according to the asthma

Group	HR [†] (95% CI)
Healthy adults	Reference
Asthma patients	9.32 (4.16–20.89)

[†]Adjusted for age, sex, and obesity. CI, confidence interval; HR, hazard ratio.

METHODS (continued)

criteria, such as increased FEV1 after bronchodilator use or a positive bronchial provocation test. The study outcome was anemia, which was defined as low levels of hemoglobin, hematocrit, or red blood cell count below the normal range. Other diseases were defined based on physician diagnosis or self-reported diagnosis by the patient.

Follow-up

The study followed up with patients until they were diagnosed with confounding diseases, or for a maximum of 60 months or until December 31, 2021, whichever occurred earlier.

Sensitivity analysis

A sensitivity analysis was conducted to evaluate the effect of potential outcome misclassification by restricting the analysis to individuals with persistent anemia, which was defined as two consecutive anemia diagnoses at least 3 months apart.

CONCLUSION

The risk of anemia is increased in asthma patients after adjusting for patient's gender, age, and obesity and excluding effects of other risk diseases on anemia. Results of this study might provide evidence that asthma patients need regular anemia-related tests.