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Correlation of thyroid status with severity and mortality of COVID-19 patients

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Abstract

Introduction: Thyroid status because of the expression of angiotensin-converting enzyme-2 (ACE2), which is a functional receptor for coronavirus disease 2019 (COVID-19) in thyroid glands, maybe affects COVID-19 patients' outcomes.

Objectives: This study aimed to evaluate the correlation of thyroid status with the severity and mortality of COVID-19 patients.

Patients and Methods: In a retrospective cohort study conducted on 521 COVID-19 patients, data were collected by a demographic questionnaire and a checklist of patient outcomes (death/recovery) from the hospital information system (HIS) and analyzed by SPSS version 26 and binary logistic regression. Data about thyroid status were collected from clinical documents and laboratory test data.

Results: Most patients were male (57.2%) with a mean age of 56.12 ± 17.4 years. Seventy-seven patients had a severe stage of disease, and 55 patients died. Twenty-one patients had hyperthyroidism, and 53 patients had hypothyroidism. Results showed that the correlation between hypothyroidism and hyperthyroidism with severity and mortality risk of COVID-19 patients was insignificant ($P > 0.05$).

Conclusion: In this study, we concluded that, thyroid status is not associated with COVID-19 outcomes such as severity or mortality.

Keywords: Thyroid status, COVID-19, Mortality, Severity

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Introduction

Pneumonia caused by the coronavirus family, which first emerged in Wuhan, China, in December 2019, was named by the World Health Organization (WHO) as coronavirus disease 2019 (COVID-19) (1). The international society for classifying of viruses called this new coronavirus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (2). Patients with this disease showed main signs and symptoms, including fever, dry cough, fatigue, body ache, and shortness of breath (2,3). However, clinical findings varied, ranging from asymptomatic pneumonia to severe stages such as respiratory distress, need for mechanical ventilation, and death (4,5). In previous studies, factors such as older age, male gender, underlying disease, and weakness of the immune system were reported as the main affected risk factors for the severity and mortality of patients with COVID-19 (6,7). Thyroid status, including hypothyroidism and hyperthyroidism, is one of the factors that may be affected COVID-19 patients' outcomes because angiotensin-converting enzyme-2 (ACE2), which is a functional receptor for COVID-19, is expressed in thyroid glands (8,9). Previous studies reported inconsistent

results about the impact of hypo and hyperthyroidism on patients with COVID-19 (4,10,11). In this study, we will investigate the effect of hypo and hyperthyroidism on the COVID-19 patient outcomes.

Objectives

Due to the presence of the ACE2 enzyme in the thyroid gland, the function of this gland may affect the results of patients with COVID-19. This study aimed to evaluate the correlation of thyroid status with the severity and mortality of COVID-19 patients.

Patients and Methods

Study design

This retrospective cohort study was conducted on 521 COVID-19 hospitalized patients in Imam Hossein hospital, Tehran, Iran, from February 2020 to June 2021. Inclusion criteria included a definite diagnosis of COVID-19 based on real-time reverse transcriptase-polymerase chain reaction (RT-PCR) results and lung CT-scan findings, and having demographic information in the hospital information system (HIS) of Imam

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■ Implication for health policy/practice/research/medical education

In a retrospective cohort study conducted on 521 coronavirus disease 2019 (COVID-19) patients, we found that the correlation between thyroid status and the mortality and severity of COVID-19 patients is not significant.

Hossein hospital. Exclusion criteria included the death of a patient due to any cause except COVID-19. Data about thyroid status was collected from clinical documents and laboratory test data.

Definition of severity and mortality

Patients who needed mechanical ventilation and recovered after a period of treatment were considered severe COVID-19; however, those who died after mechanical ventilation were considered mortality patients.

Statistical analysis

For statistical analyses, SPSS version 26 was used. Quantitative variables were conducted to describe the data center means, and standard deviations were conducted to describe the data distribution. Frequency and percentage were employed to describe the data. Binary regression logistic test was employed to explore the correlation between hypo and hyperthyroidism with the severity and mortality of COVID-19 patients. A *P* value less than 0.05 was considered a significant level.

Results

Out of 521 patients who participated in this study, 298 people were male, and 223 were female. The total mean age was 56.12 ± 17.4 years. Seventy-seven patients had a severe stage of disease, and 55 patients died. Twenty-one patients had hyperthyroidism, and 53 had hypothyroidism (Table 1).

Results of binary logistic regression showed no statistically significant correlation between hypothyroidism and hyperthyroidism with mortality risk of COVID-19 patients (Table 2).

Also, the results of binary logistic regression showed that the correlation between hypothyroidism and hyperthyroidism with the severity of COVID-19 was not significant (Table 3).

Discussion

This study is a part of a big study published before (12). In the present study, results showed that hypothyroidism and hyperthyroidism aren't associated with both the severity and outcome of COVID-19 patients, such as death or recovery in the Iranian population. In line with our study, van Gerwen et al showed that hypothyroidism has no statistical correlation with the outcome of COVID-19 patients, such as mortality, hospitalization, or requiring mechanical ventilation (4); Kim et al demonstrated that

Table 1. Clinical and demographic characteristics of participating patients in the study

Variables	
Gender, No. (%)	
Male	298 (57.2)
Female	223 (42.8)
Severity, No. (%)	
Severe	77 (14.8)
Not severe	444 (85.2)
Mortality, No. (%)	
Death	55 (10.6)
Recovery	466 (86.4)
Thyroid status, No. (%)	
Hypothyroidism	53 (10.2)
Hyperthyroidism	21 (4)
Normal thyroid	447 (85.8)
Age (y), Mean (SD)	52.16 (17.4)

hypothyroidism and hyperthyroidism not correlated with outcomes of COVID-19 patients (11). Brix et al showed that preexisting hypothyroidism and hyperthyroidism aren't associated with COVID-19 outcomes (13). A cohort study in Iran did not show a correlation between thyroid dysfunction and outcomes of patients with COVID-19 (14). While in contrast with our study Gao et al stated that lower free triiodothyronine (FT3) concentration in patients with COVID-19 is correlated with the severity of the disease and may increase the risk of mortality (10), Rothberger et al showed that lower Free triiodothyronine (T3) in patients who need mechanical ventilation is associate with worse outcomes (15). Moreover, a systematic review and meta-analysis study by Damara et al showed that outcomes and morbidity of COVID-19 patients are associated with the thyroid disorder and hypothyroidism (16). Likewise, Zhang et al stated that patients with thyroid dysfunction who suffer COVID-19 have poor outcomes (17).

Thyroid disorder by several mechanisms may impact the outcomes of COVID-19 patients, such as ACE2 expression, which facilitates entry of COVID-19 virus to the body organs (18), hypercoagulable due to hyperthyroidism which may increase the coagulation factors (19), and protective impact of thyroid hormone on the lung function (20). Each of these mechanisms may affect patients with thyroid disorders suffering from COVID-19 differently and influence their outcomes and severity.

Conclusion

Based on the present study result, we conclude that thyroid status is not associated with COVID-19 severity and mortality; therefore, routine care for patients with thyroid disorders while suffering from COVID-19 seems

Table 2. Assessment of the correlation between hypothyroidism and hyperthyroidism with mortality risk of COVID-19 patients

Variables	Total cases (N=521)	Death (n=55) No. (%)	Recovery (n=466) No. (%)	OR	Logistic regression 95% CI Lower-Upper	P value
Hypothyroidism						
Yes	53	9 (17)	44 (83)	1.87	0.861-4.089	0.113
No	468	46 (9.8)	422 (90.2)			
Hyperthyroidism						
Yes	21	5 (23.8)	16 (76.2)	2.81	0.988-8.004	0.053
No	500	50 (10)	450 (90)			

OR, odds ratio; CI, confidence interval.

Table 3. Assessment of the correlation between hypothyroidism and hyperthyroidism with the severity of COVID-19 patients

Variables	Total cases (N=521)	Severe (n=77) No. (%)	Not severe (n=444) No. (%)	OR	Logistic regression 95% CI Lower-Upper	P value
Hypothyroidism						
Yes	53	8 (15.1)	45 (84.9)	1.028	0.465 – 2.275	0.964
No	468	69 (14.7)	399 (85.3)			
Hyperthyroidism						
Yes	21	2 (9.5)	19 (90.5)	0.596	0.136 – 2.614	0.439
No	500	77 (14.8)	444 (85.2)			

OR, odds ratio; CI, confidence interval.

to be sufficient and additional care is unnecessary.

Limitations of the study

Due to the being retrospective study, the incompleteness of the information in the clinical patients' documents was one of the limitations of the present study; we tried to get the information needed by making phone calls to the patients or their families. Individual, social, psychological, and family differences were uncontrollable variables of the present study that can affect the research results.

Authors' contribution

Conceptualization: EZ and EP; Methodology: HM; Validation: MA; Formal Analysis: AK; Investigation: SA and SM; Resources: EP; HM and SA; Data Curation: SM and EZ; Writing—Original Draft Preparation: SA and EZ; Writing — Review and Editing: AK; EZ and MA; Visualization: SM; Supervision: SA; Project Administration: EZ.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. Written consent was taken from participants before any intervention. The study is a part of a big research conducted in Imam Hossein hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran. A part of this research published before (12).

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