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A retrospective observational examination following the COVID-19 pandemic: Was everything necessary done in the management of hip fractures?

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Abstract. – OBJECTIVE: Hip fragility fracture-related mortality depends on several variables. The management of such cases during the COVID-19 pandemic is an important issue that needs to be evaluated. The aim of this study is to evaluate the management of such cases during the COVID-19 pandemic in a single trauma center in Turkey.

PATIENTS AND METHODS: In this retrospective study, the length of stay (LoS) and 30-day mortality rates in patients with hip fragility fractures, in the ICU – clinic combined follow-ups (ICU/Clinic group) combined follow-ups and in the clinic follow-ups (Clinic Only group) were compared between pre-pandemic and pandemic period.

RESULTS: The data of 393 patients, 164 (41.7%) men and 229 (58.3%) women, with a mean age of 81.22±8.37 (45-100) years, were analyzed. The total LoS during the pandemic was determined to be shorter than the pre-pandemic period in both the patient groups that followed up in the Clinic Only and those in ICU/Clinic ($p<.001$, $p=.007$). The 30-day mortality rates of the groups were similar.

CONCLUSIONS: The length of the hospital stay of hip fragility fracture patients was seen to be shorter during the COVID-19 pandemic, but this early discharge did not affect the 30-day mortality rates.

Key Words:
Hip fracture, Length of stay, Pandemic, Mortality, COVID-19.

Introduction

Hip fragility fracture is an important and life-threatening health problem in the geriatric population[1]. Hip fractures are becoming more common due to the increase in life expectancy[1,2]. It has been reported that 18% of females and 6% of males in the geriatric age group experienced a hip fracture[3]. Comorbidities, which are frequently seen in older decades, are effective on high mortality rates[4,5]. Moreover, surgery-related complications are also seen together with prolonged length of stay (LoS) in the hospital in those cases[2]. Advanced age is a cause of disability in hip fractures[6]. Increased incidence of cardiovascular disease and depression have also been reported in those patients[3]. In a recent paper[7], it has been presented that in patients with fragility fractures, besides the medical treatment, surgery remains a viable and the most important treatment modality.

An early rehabilitation and a shorter LoS are closely associated with reduced morbidity and mortality rates in patients with fragility hip fractures[7]. Knowing the risk factors and strategic management of surgeries are important components in the treatment of such cases. In this way, it is aimed to increase the postoperative quality of life, and to reduce healthcare costs and mortality rates in trauma clinics[8].

The novel coronavirus, SARS-CoV-2 infection, was first reported in the city of Wuhan, China, in December 2019. Following the first case, the effects of this virus spread rapidly to the whole world. As a result of the dissemination of SARS-CoV-2 pathogen, the condition was declared as a "Global Pandemic" by the World Health Organization (WHO) in March 2020[9]. Because of this declaration, a series of mandatory safety precautions in hospitals were implemented worldwide, including those related to orthopedic surgeries[10].

Although fragility fracture rates have been reported to have decreased during the pandemic in a recent paper[11], another study[12] has stated that although fractures of trauma origin decreased, the

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incidence of fragility fractures did not change. In a recent study[13], it is presented that, the inpatient mortality rate during the pandemic period was significantly higher among COVID-19-positive postoperative patients with hip fractures, compared to negative ones. In the same study[13], it is also presented that the deep vein thrombosis rates have been similar in the two (COVID-19 positive and negative) groups of patients. This high mortality rate is thought to be due to mainly atypical pneumonia that would induce hypoxia in those patients. According to this study, it is correct to believe that the atypical pneumonia associated with COVID-19 constitutes an additional risk factor for mortality in patients with hip fracture.

With the destructive effect of the COVID-19 pandemic in hospitals, the LoS and 30-day mortality rates of hospitalized patients with hip fractures have become a subject of interest. The aim of this study is to compare the data of the patients with fragility hip fracture in the pre-pandemic period and during the pandemic period in a single trauma center in Turkey. For this purpose, 30-day mortality rates and the LoS in the clinic and in ICU follow-ups were compared.

Patients and Methods

All the study procedures were carried out in accordance with ethical rules and the principles of the Declaration of Helsinki. A retrospective evaluation was made of patients' data that have been operated on because of femoral intertrochanteric fractures (FIF) and femoral neck fractures (FNF). For this purpose, the patients' data, who received treatment between January 2017-February 2019, formed the first evaluation group in the pre-pandemic period. The data of patients who received treatment between March 2019-April 2022 formed the second evaluation group during the pandemic. Two subgroups were formed for each time period. The patients with no perioperative need for intensive care formed the "Clinic Only" group. The patients who were followed up in a combination of ICU and clinic formed the "ICU/Clinic" group. These two groups were further divided into subgroups according to age of <65 years or ≥65 years, and the presence of comorbidities (<2 or ≥2). Moreover, two more patient subgroups were formed according to fracture types [FIF (AO 31A type) and FNF (AO31B type)]. The LoS (days) and 30-day mortality rates in the pre-pandemic period and during the pandemic were compared between the groups. The 30-day mortality rate was calculated as the number of exitus patients/total patients x 100 and was stated as a percentage.

The primary outcome of this study is to compare the LoS and 30-day mortality rates between groups; the secondary outcome of this study is to compare the patient groups according to complications such as deep vein thrombosis rates, pulmonary embolus rates, surgical site infection rates and need for intensive care unit in the two different time period.

In the analysis of the patients' data, all of the SARS-CoV-2 PCR tests performed during hospitalization were negative. No clinical signs of infection were detected in any registered patients. In addition, a recorded COVID-19 infection history before the fracture history of these patients could not be obtained. It is thought that some of these patients may have had the infection, but they may have been unregistered patients.

The patients with multiple fractures, periprosthetic fractures, pathological fractures, and suffering from a high-energy trauma or previous revision surgery for hip fracture were excluded from the study.

Statistical Analysis

Statistical analyses of the data obtained in the study were performed using SPSS software version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics of categorical data were presented as number (n) and percentage (%). The Chi-square test or Fisher exact test was used depending on sample size in crosstab cells to compare the proportions between categorical variables. Descriptive statistics of numerical data were presented using mean±standard deviation and median (min-max) values, depending on whether the data were normally distributed. The Shapiro-Wilk test was used to determine the conformity of the data to normal distribution. The Levene test was used to test the assumption of homogeneity of variances among independent groups. For the comparison of numerical data between two independent groups, the Student's *t*-test was used when parametric test assumptions were met, and the Mann-Whitney U test when not met. A value of $p<.05$ was accepted as the level of statistical significance in all the tests.

Results

In this retrospective study, we analyzed the data of 393 patients with hip fractures in both pre-pandemic and pandemic time periods. Of those, pa-

tients that have been followed up in the trauma clinics without any intensive care unit, formed the Clinic Only group (n= 277, 70.5%), while the patients that have been followed up in both intensive care units and the trauma clinics, formed the ICU/Clinic group (n=116, 29.5%). The patients included 164 (41.7%) males and 229 (58.3%) females with a mean age of 81.22±8.37 (range, 45-100) years; 196 (49.9%) followed up in the pre-pandemic period and 197 (50.1%) during the pandemic.

The comparisons of the demographic and clinical characteristics of the Clinic Only patients and ICU/Clinic follow-up in the pre-pandemic period and during the pandemic are shown in Table I. In the patients followed up in the Clinic Only, no significant difference was determined in the mean patient age in the pre-pandemic and pandemic periods (p=.538). The distribution of gender, operated side, and American Society of Anesthesiologists (ASA) score of these patients were similar in the two periods (p=.275, p=.493, p=.136, respectively). A statistically significant difference was determined between the periods in respect of fracture types and complications (p=.046, p=.040, respectively). The total hospital LoS in hospital of the patients followed up in the Clinic Only group was determined to be significantly shorter during the pandemic compared to the pre-pandemic period (p<.001) (Table I).

In the patients followed up in the ICU/Clinic, no significant difference was determined in the mean patient age in the pre-pandemic and pandemic periods (p=.869). The distribution of gender, operated side, and ASA score of these patients was similar in the two periods (p=.111, p=.186, p=.120, respectively). The distribution of complications in these patients was similar in the two periods (p=.138). A statistically significant difference was determined between the periods in respect of fracture type, anesthesia type, and implants used (p=.006, p=.028, p=.026, respectively). The total LoS in the hospital of the patients followed up in the ICU/Clinic group was determined to be significantly shorter during the pandemic compared to the pre-pandemic period (p<.007) (Table I). The distribution of the LoS of the ICU/Clinic group in the pre-pandemic and pandemic periods is shown in a boxplot graph in Figure 1. No significant difference was determined between the total hospital LoS of the ICU/Clinic group between the pre-pandemic and pandemic periods, but it was shorter in the pandemic period and close to statistical significance (p=.082) (Table I).

As the sample sizes of patients aged <65 years with FIF and FNF fracture type were not sufficient, statistical comparisons could not be made (Table II and III). The results of the comparisons of the LoS in the pre-pandemic and pandemic periods of the Clinic group *vs.* ICU/Clinic group according to FIF and FNF fracture types in patients aged ≥65 years are shown in Table IV and V.

The results of the comparisons of the LoS in the pre-pandemic and pandemic periods of the Clinic

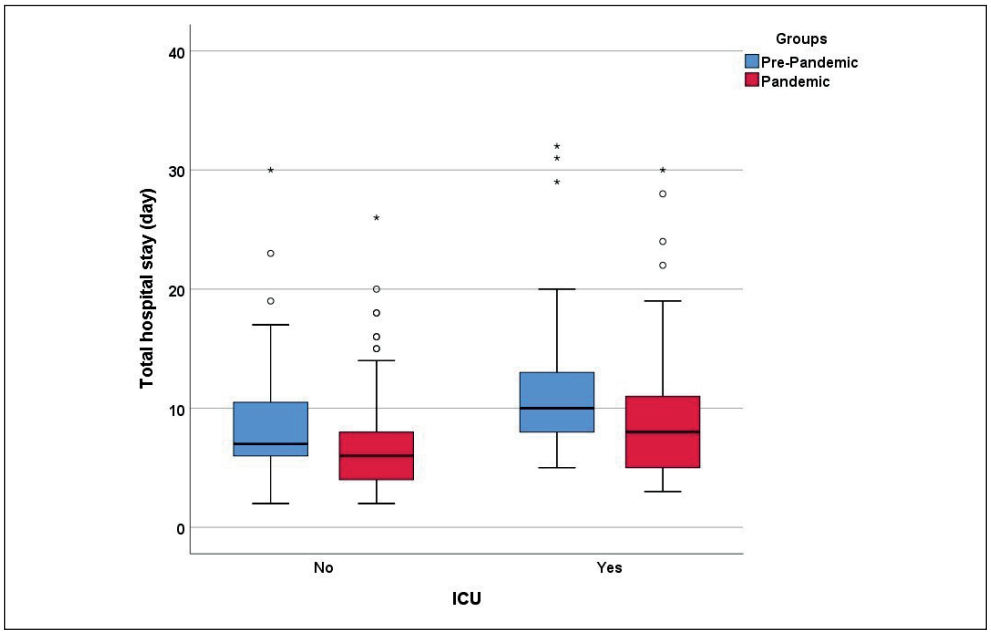

Figure 1. Box plot showing the distribution of hospital length of stay of patients in pre-pandemic period and during the pandemic.

Table I. Data of patients who were followed up in the clinics (Clinic Only) and combined postoperative intensive care unit-clinics (ICU/Clinic) because of hip fractures.

		Patients in the Clinic Only (n=277)			Patients in the ICU/Clinic (n=116)		
		Pre-pandemic period (n=135)	Pandemic period (n=142)	*p*-values	Pre-pandemic period (n=61)	Pandemic period (n=55)	*p*-values
Age (years)		80.56±7.97	79.93±9.05	0.538[a]	83.46±7.38	83.69±7.71	0.869[a]
Sex	Male	62 (45.9%)	56 (39.4%)	0.275[c]	20 (32.8%)	26 (47.3%)	0.111[a]
	Female	73 (54.1%)	86 (60.6%)		41 (67.2%)	29 (52.7%)	
Side	Right	61 (45.2%)	70 (49.3%)	0.493[c]	33 (54.1%)	23 (41.8%)	0.186[c]
	Left	74 (54.8%)	72 (50.7%)		28 (45.9%)	32 (58.2%)	
Fracture type	FNF	26 (19.3%)	42 (29.6%)	**0.046[c]**	33 (54.1%)	16 (29.1%)	**0.006[c]**
	FIF	109 (80.7%)	100 (70.4%)		28 (45.9%)	39 (70.9%)	
ASA score	2	20 (14.8%)	14 (9.9%)	0.136[c]	-	-	0.120[c]
	3	81 (60%)	78 (54.9%)		20 (32.8%)	11 (20%)	
	4	34 (25.2%)	50 (35.2%)		41 (67.2%)	44 (80%)	
Anesthesia type	Spino-epidural	117 (86.7%)	126 (88.7%)	0.600[c]	43 (70.5%)	48 (87.3%)	**0.028[c]**
	General	18 (13.3%)	16 (11.3%)		18 (29.5%)	7 (12.7%)	
Implant	Arthroplasty	39 (28.9%)	56 (39.4%)	0.065[c]	37 (60.7%)	22 (40%)	**0.026[c]**
	PFN	96 (71.1%)	86 (60.6%)		24 (39.3%)	33 (60%)	
Complications	No	117 (86.7%)	126 (88.7%)	**0.040[d]**	45 (73.8%)	48 (87.3%)	0.138[c]
	DVT	10 (7.4%)	14 (9.9%)		10 (16.4%)	3 (5.5%)	
	PTE	0 (0%)	1 (0.7%)		0 (0%)	0 (0%)	
	SSI	8 (5.9%)	1 (0.7%)		6 (9.8%)	4 (7.3%)	
Total hospital stay (days)		8.30±4.24 7 (2-30)	6.77±3.76 6 (2-26)	**<0.001[b]**	11.62±5.71 10 (5-32)	9.64±6.18 8 (3-30)	**0.007[b]**
Total ICU stay (days)		-	-		3.25±3.57 2 (1-17)	2.58±2.84 1 (1-14)	0.082[b]

ASA: American Society of Anesthesiologists, DVT: deep venous thrombosis, FIF: femoral intertrochanteric fracture, FNF: femoral neck fracture, ICU: intensive care unit, PFN: proximal femoral fracture, PTE: pulmonary thromboembolism, SSI: surgical site infection. [a]Student's *t*-test with mean±SD, [b]Mann-Whitney U test with median (min-max), [c]Chi-square test with frequency (%), [d]Fisher exact test with frequency (%).

Table II. Mean LoS (days) of patients in the ICU/Clinic and Clinic Only groups, aged <65 years and operated for femoral intertrochanteric fracture, according to the number of comorbidities.

<65 years old and FIF	LoS (days) of patients in the Clinic Only (n=277)			LoS (days) of patients in the ICU/Clinic (n=116)		
	Pre-pandemic period (n=135)	Pandemic period (n=142)	*p*-values	Pre-pandemic period (n=61)	Pandemic period (n=55)	*p*-values
<2 Comorbidities	- (n=0)	5.25±2.86 (n=8)	-	17±0 (n=1)	- (n=0)	-
≥2 Comorbidities	8.67±2.88 (n=3)	6.75±0.95 (n=4)	0.400[a]	20±0 (n=1)	10±0 (n=1)	-

FIF: femoral intertrochanteric fracture, LoS: length of stay, [a]Mann-Whitney U test with mean±SD.

Table III. Mean LoS (days) of patients in the ICU/Clinic and Clinic Only groups, aged <65 years and operated for femoral neck fracture, according to the number of comorbidities.

<65 years old and FNF	LoS (days) of patients in the Clinic Only (n=277)			LoS (days) of patients in the ICU/Clinic (n=116)		
	Pre-pandemic period (n=135)	Pandemic period (n=142)	*p*-values	Pre-pandemic period (n=61)	Pandemic period (n=55)	*p*-values
<2 Comorbidities	7±0 (n=1)	- (n=0)	-	- (n=0)	- (n=0)	-
≥2 Comorbidities	8±0 (n=1)	- (n=0)	-	0 (n=0)	17±0 (n=1)	-

FNF: femoral neck fracture, LoS: length of stay, [a]Mann-Whitney U test with mean±SD.

Table IV. Mean LoS (days) of patients in the ICU/Clinic and the Clinic Only groups, aged ≥65 years and operated for femoral intertrochanteric fracture, according to the number of comorbidities.

≥65 years old and FIF	LoS (days) of patients followed in the Clinic Only (n=277)			LoS (days) of patients followed in the ICU/Clinic (n=116)		
	Pre-pandemic period (n=135)	Pandemic period (n=142)	*p*-values	Pre-pandemic period (n=61)	Pandemic period (n=55)	*p*-values
<2 Comorbidities	6.97±3.58 (n=30)	6.10±5.28 (n=30)	0.460[a]	8.50±1 (n=4)	4.33±1.15 (n=3)	**0.004[a]**
≥2 Comorbidities	8.89±4.13 (n=76)	6.98±3.42 (n=58)	**0.005[a]**	9.68±2.96 (n=22)	9.06±5.74	0.640[a]

FIF: femoral intertrochanteric fracture, LoS: length of stay, [a]Student's *t*-test with mean±SD.

Only and the ICU/Clinic groups according to FIF and FNF fracture types in patients aged ≥65 years are shown in Table IV and Table V. No significant difference was determined between the two periods in respect of the LoS of the Clinic Only group aged ≥65 years with FIF fracture type and <2 comorbidities (p=.460). Among that group, the difference in LoS between the periods of the patients with >2 comorbidities were statistically significant (p=.005). In the ICU/Clinic group aged ≥65 years with FIF fracture type and <2 comorbidities, the difference between the two periods in respect of the LoS was determined to be statistically significant (p=.004), and the difference in LoS of the patients with ≥2 comorbidities was not statistically significant (p=.640).

Table V. Mean LoS (days) of patients in ICU Clinic and the Clinic Only groups, aged ≥65 years and operated for femoral neck fracture, according to the number of comorbidities.

≥65 years old and FNF	LoS (days) of patients in the Clinic Only (n=277)			LoS (days) of patients in the ICU/Clinic (n=116)		
	Pre-pandemic period (n=135)	Pandemic period (n=142)	*p*-values	Pre-pandemic period (n=61)	Pandemic period (n=55)	*p*-values
<2 Comorbidities	5.75±1.71 (n=4)	5.50±1.84 (n=10)	0.819[a]	9±2.55 (n=5)	13±0 (n=1)	-
≥2 Comorbidities	8.6±5.74 (n=20)	7.78±3.35 (n=32)	0.887[b]	13.57±7.16 (n=28)	11.43±7.52 (n=14)	0.374[a]

FNF: femoral neck fracture, LoS: length of stay, [a]Student's *t*-test with mean±SD, [b]Mann-Whitney U test mean±SD.

Table VI. The 30-day mortality rates of patients (= number of exitus / total hospitalized patients x100).

	Patients in the Clinic Only (n=277)			Patients in the ICU and Clinic (n=116)		
	Pre-pandemic period (n=135)	Pandemic period (n=142)	*p*-values	Pre-pandemic period (n=61)	Pandemic period (n=55)	*p*-values
≥65 years and operated for FIF	2/106 (1.9%)	3/88 (3.4%)	0.660[a]	6/26 (23.1%)	7/38 (18.4%)	0.649[b]
≥65 years and operated for FNF	1/24 (4.2%)	1/42 (2.4%)	1.000[a]	8/33 (24.2%)	1/15 (6.7%)	0.239[a]

FIF: femoral intertrochanteric fracture, FNF: femoral neck fracture, [a]Fisher's exact test, [b]Chi-square test.

No significant difference was determined between the pre-pandemic and pandemic periods in respect of the LoS of the Clinic Only group aged ≥65 years with FNF fracture type and both <2 comorbidities and >2 comorbidities (*p*=.819, *p*=.887, respectively).

As the sample sizes of ICU/Clinic patients aged ≥65 years with FNF fracture type and <2 comorbidities were insufficient, statistical comparisons could not be made. The difference in LoS between the two periods of those with >2 comorbidities was not statistically significant (*p*=.374).

The evaluations of mortality were made between the groups of patients aged ≥65 years. No statistically significant difference was determined between the pre-pandemic and pandemic periods in respect of the mortality rates of the patient subgroups (Table VI).

Discussion

Millions of people across the world were infected with the SARS-CoV-2 virus, and hundreds of thousands of lives were lost during COVID-19 pandemic[14]. The volume of orthopedic surgical interventions worldwide decreased after that outbreak[15,16]. In accordance with the pandemic-related Ministry of Health declaration[17] in Turkey, orthopedic elective surgery was halted, as in other branches as in other surgical departments. Only emergency surgeries were performed, like traumas or infections. A study[18] conducted in Turkey has reported that, as expected with the effect of lockdowns, there was a reduction in the number of patients hospitalized because of trauma. Kumar et al[12] reported that the fragility fracture rate in the geriatric population was not correlated to lockdowns, and the incidence did not change during the pandemic. The results of the current study showed that the total number of patients, in both the ICU/Clinic and Clinic Only groups, that operated because of hip fracture was similar in the pre-pandemic period and during the pandemic (Table I).

It has been reported that despite precautions taken during the pandemic for patients undergoing surgery, mortality rates increased because of especially pulmonary complications[19].

The surgical management for hip fragility fractures changed during the pandemic period, and it has been reported that this difference affected mortality rates compared to the pre-pandemic period, with decreased mortality within the first 24-48 hours of the surgery performed[20]. Other than surgery timing, the mortality rates show variability according to the presence of comorbidities and hospital LoS in such patients[21].

Previous studies[10,20] have shown that the incidence of hip fractures decreased during the pandemic, but no comparison in respect of FIF and FNF hospitalization rates in the same period has been reported as yet. In the whole group in current study, patients in Only Clinic follow-ups with intertrochanteric hip fractures were higher in both pre-pandemic and pandemic periods. It is noteworthy that the pandemic changed this rate in terms of ICU/Clinic group, meaning that there was a higher rate of femoral neck fractures follow-ups (Table I).

Interestingly complication rates were seen to be lower during the pandemic in the Clinic Only group (p=.040). For example, surgical site infection (SSI) can be considered to be a factor in the formation of this difference (Table I). As we have been known, SSI rates in patients during the pandemic were lower in perioperative periods where N95 respirators were used by surgical teams[22].

In a series of 27 patients examined by Topor et al[23], no difference was reported in LoS and mortality rates of hip fractures during the pandemic compared to the pre-pandemic period. Walters et al[24] reported that because of the need for beds in the clinics during the pandemic, the mean LoS of patients hospitalized for hip fracture decreased compared to the pre-pandemic period but the overall 30-day mortality rates were not affected. In the current study, we obtained LoS and 30-day mortality rates similar to Walters et al[24]'s study results. In this respect, the total LoS in both the ICU/Clinic group and the Clinic Only group was shorter during the Pandemic period compared to the pre-pandemic period (p=.007, p<.001) (Table I). And the overall 30-day mortality rates were similar in both periods (Table VI). Yawar et al[25] reported that LoS associated with hip fractures was reduced during the pandemic and these rates were associated with the mean ASA score. As the ASA scores of the patient groups in the current study were similar, the effect of this variable on LoS could not be evaluated in the current study.

Limitations

One of the important limitations of this study is the evaluation of patients made in a single center. Secondly, the fact that the patient discharge decision was made by more than one surgeon in the same clinic reduces the homogeneity of this decision. Third, it is unclear whether certain medical conditions are underdiagnosed due to early discharge of patients during the pandemic. Fourth, it is not clear whether the SARS-CoV-2 PCR tests used in the diagnosis of COVID-19 during the pandemic period have sufficient sensitivity. Finally, it is true to say that we could not evaluate the effect ASA score on LoS or 30-day mortality rates because of similar groups by mean of same variable.

Conclusions

This study shows us that timing from hospitalization to surgery is the most important determinant factor on mortality rates in hip fragility fractures also during COVID-19 pandemic. The fact that the length of stay is lower during the pandemic period is actually a result of the clinicians' precaution to try to prevent the spread of SARS-CoV-2 infection. But those early discharges of patients did not change the 30-day mortality rates. It is obvious that these obtained results, will shed light on surgeons in terms of priorities that should be given in the fragility hip fracture management.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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Informed Consent

The patient informed consent is not applicable for this research due to the retrospective design of the study.

Availability of Data and Materials

The data supporting this study's findings are available from the corresponding author [E.H], upon reasonable request.

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Authors' Contributions
Project supervision, writing-reviewing, and editing, data collection, data checking, data entry, and analysis: EH, TA.

Ethics Approval
This study was conducted with Hitit University, Ethics Committee's approval (Decision number: 2023.05, date: 03.05.2023).

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