

# Adolescent patients presenting to the emergency department due to falls from heights: a comparative analysis of suicidal and non-suicidal cases

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## ABSTRACT

**Aims:** This study aims to categorize adolescent patients presenting to the hospital due to falls from heights into two groups: suicidal and non-suicidal. It seeks to compare the clinical characteristics, trauma patterns, and outcomes between these groups.

**Methods:** A total of 69 patients were included in the study. The demographic features, trauma patterns, imaging methods, medical interventions, and clinical outcomes of the patients were retrospectively assessed.

**Results:** 63.8% (n=44) of the patients were categorized in the suicidal group, while 36.2% (n=25) were in the non-suicidal group. There was no statistically significant difference observed between the mean age of the suicidal group (16.27±2.52) and the non-suicidal group (15.96±2.85) (p=0.638). In the suicidal group, the incidence rates of maxillofacial trauma, pelvic trauma, and thoracic trauma were statistically significantly higher compared to the non-suicidal group (respectively; p=0.041, p=0.014, p<0.001). The in-hospital mortality rate in the suicidal group (22.7%, n=10) was statistically significantly higher than in the non-suicidal group (0%, n=0) (p=0.007).

**Conclusion:** Cases of falls from heights due to suicide attempts result in more severe outcomes compared to accidental falls. These patients require a more comprehensive medical assessment and intervention.

**Keywords:** Adolescent, suicide, fall from height

## INTRODUCTION

A fall from a height can be defined as an individual descending to a lower level without experiencing syncope or stroke.<sup>1</sup> In Türkiye, falls from heights rank as the second most common cause of trauma, following traffic accidents.<sup>2</sup> According to the World Health Organization (WHO), accidental descents, whether from heights or on the same level, stand as the second leading cause of unintentional death worldwide. Each year, approximately 646,000 individuals succumb to injuries sustained from these falls.<sup>3</sup> Moreover, the WHO indicates that around 37.7 million falls are severe enough to require hospital admission annually. Concurrently, the global annual mortality rate attributed to suicide is approximated at 800,000 individuals.<sup>4</sup>

Adolescence is delineated by pronounced physical, biological, and emotional evolutions, coupled with the attainment of both sexual and social maturity. As defined by the WHO, this developmental phase spans the ages of

10 to 19, marking a period characterized by augmented independence and societal contribution. The prevalence of suicide attempts within this demographic is garnering increasing attention as a salient public health issue, ranking as the second leading cause of death among those aged 10 to 24.<sup>5,6</sup>

Globally, falls from heights account for a significant proportion of traumatic injuries and fatalities.<sup>7-9</sup> However, not all such incidents occur inadvertently. While a subset of these cases can be attributed to intentional suicide attempts, numerous incidents result from various unintentional circumstances leading to the fall.<sup>10,11</sup> Understanding the demographic, clinical, and prognostic disparities between suicidal and non-suicidal falls from heights holds critical implications for optimizing patient treatment and follow-up processes.

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In this study, the objective was to analyze and compare the suicidal and non-suicidal cases of patients presenting to the emergency department due to falls from heights, with the aim of elucidating the differences and similarities between the two groups.

## METHODS

This retrospective study was conducted under the approval of the Health Sciences University Gazi Yaşargil Training and Research Hospital Clinical Researches Ethics Committee (Date: 05.05.2023, Decision No: 383). All procedures performed adhered to the ethical standards and were in alignment with the principles of the Declaration of Helsinki. This research was undertaken at the emergency department of Gazi Yaşargil Training and Research Hospital, focusing on adolescent patients who presented due to falls from heights between January 1, 2020, and January 1, 2023.

All patients aged 10-19 who presented to the emergency department due to high falls within the specified dates were included in the study. Prior to the investigation, patients were assessed based on their medical history (anamnesis) and existing clinical documentation to determine whether their falls were suicidal or non-suicidal in nature. Methods of distinguishing suicidal cases from accidental falls in this study were based on [include specific criteria and methods used, such as psychological evaluations, witness statements, and circumstantial evidence]. Demographic information of the patients, such as age, gender, and residence characteristics (urban vs. non-urban), was collected. Additionally, details regarding the height of the fall, examinations conducted in the emergency department (including whole-body Computed Tomography [pan-CT], abdominal Computed Tomography [abdomen CT], and Focused Assessment with Sonography for Trauma [FAST ultrasound]), severity of injuries (cranial, maxillofacial, spinal, pelvic, thoracic, abdominal, extremity, and the total number of affected anatomical regions), and emergency department outcomes (including intubation, the application of Cardiopulmonary Resuscitation [CPR] within the emergency department, surgical requirements, intensive care monitoring, and in-hospital mortality) were retrospectively retrieved from hospital records.

### Statistical Analysis

The statistical evaluation was conducted using the SPSS software for Windows (Version 29, Chicago, IL, USA). Normality of the group distributions was verified using histograms and the Shapiro-Wilk test. Data were summarized using descriptive statistics: categorical variables were presented as frequencies

and percentages, while continuous variables were described using mean  $\pm$  standard deviation or median with interquartile range (IQR, 25<sup>th</sup>-75<sup>th</sup> percentile). For categorical data, the chi-square test or Fisher's exact test was used for group comparisons when appropriate. Continuous data comparisons between the groups were executed using the Student's t-test for normally distributed datasets and the Mann-Whitney U test for non-normally distributed datasets. A p-value of  $<0.05$  was set as the threshold for statistical significance, and all tests were two-tailed.

## RESULTS

The study included 69 patients. Of these, 63.8% (n=44) were categorized under the suicide group, and 36.2% (n=25) were in the non-suicide group. The age average in the suicide group ( $16.27 \pm 2.52$ ) did not show a statistically significant difference compared to the non-suicide group ( $15.96 \pm 2.85$ ) ( $p=0.638$ ). There was no statistically significant difference observed in the male gender distribution between the suicide group (56.8%, n=21) and the non-suicide group (43.2%, n=16) ( $p=0.193$ ). It was noted that 86.4% (n=38) of the suicides occurred in the city center, while this rate was 68% (n=17) in the non-suicide group, though the difference was not statistically significant ( $p=0.068$ ). The median number of floors fallen in the suicide group (4 [IQR 3 – 5]) was statistically significantly higher compared to the non-suicide group (2 [IQR 1.5 – 2]) ( $p<0.001$ ).

For the patients in the suicide group, 97.7% (n=43) underwent a pan-CT scan, a rate statistically significantly higher than the 64% (n=16) in the non-suicide group ( $p<0.001$ ). The rate of IV contrast abdominal CT scans in the suicide group (95.5%, n=42) was statistically significantly higher than the non-suicide group (64%, n=16) ( $p<0.001$ ). There was no statistically significant difference observed in pathology detection rates using Fast USG between the suicide (13.6%, n=6) and non-suicide groups (20%, n=5) ( $p=0.241$ ).

No statistically significant differences were detected between the suicide and non-suicide groups regarding rates of cranial trauma, spinal trauma, abdominal trauma, and extremity injuries (respectively,  $p=0.286$ ,  $p=0.145$ ,  $p=0.075$ ,  $p=0.663$ ). However, the occurrences of maxillofacial trauma, pelvic trauma, and thoracic trauma were statistically significantly more frequent in the suicide group compared to the non-suicide group (respectively;  $p=0.041$ ,  $p=0.014$ ,  $p<0.001$ ). The median number of affected anatomical regions in the suicide group (3 [IQR 2 – 4.75]) was statistically significantly higher compared to the non-suicide group (2 [IQR 1.5 – 2]) ( $p<0.001$ ).

The rate of emergency intubation in the suicide group (29.5%, n=13) was statistically significantly higher compared to the non-suicide group (0%, n=0) (p<0.001). In the suicide group, CPR was administered to 6 patients (13.6%), while none of the patients in the non-suicide group required CPR in the emergency department. 54.5% (n=24) of the patients in the suicide group underwent surgical intervention, while this rate was 48% (n=12) in the non-suicide group, with no statistically significant difference between the groups (p=0.601). The admission rate to the intensive care unit for the suicide group (86.4%, n=38) was statistically significantly higher compared to the non-suicide group (28%, n=7) (p<0.001). The in-hospital mortality rate in the suicide group (22.7%, n=10) was statistically significantly higher compared to the non-suicide group (0%, n=0) (p=0.007).

**Table 1. Demographic characteristics of the groups**

	Suicide (n=44)	Accidental Fall (n=25)	p value
Age	16.27±2.52	15.96±2.85	0.638
Gender (Male)	21 (56.8%)	16 (43.2%)	0.193
Incident Location (Urban)	38 (86.4%)	17 (68%)	0.068
Number of Floors Fallen	4 (3-5)	2 (1.5-2)	<0.001
PAN-CT*	43 (97.7%)	16 (64%)	<0.001
IV contrast abdominal CT**	42 (95.5%)	16 (64%)	<0.001
FAST Ultrasound***	6 (13.6%)	5 (20%)	0.241

\*PAN-CT: Whole Body Computed Tomography, \*\*IV contrast abdomen CT: Abdominal CT scan with intravenous contrast, \*\*\*FAST Ultrasound: Focused Assessment with Sonography for Trauma procedure

**Table 2. Comparison of groups based on trauma data**

	Suicide (n=44)	Accidental Fall (n=25)	p
Cranial	12 (27.3%)	4 (16%)	0.286
Maxillofacial	10 (22.7%)	1 (4%)	0.041
Spinal	29 (65.9%)	12 (48%)	0.145
Pelvis	22 (50%)	5 (20%)	0.014
Thoracic	40 (90.9%)	10 (40%)	<0.001
Abdominal	11 (25%)	2 (8%)	0.075
Extremity	27 (61.4%)	14 (56%)	0.663
Number of affected anatomical regions	3 (2-4.75)	2 (1.5-2)	<0.001

**Table 3. Comparison of groups based on outcome data**

	Suicide (n=44)	Accidental Fall (n=25)	p value
Emergency department intubation	13 (29.5%)	0 (0%)	<0.001
Emergency department CPR	6 (13.6%)	0 (0%)	----*
Surgical intervention	24 (54.5%)	12 (48%)	0.601
ICU (intensive care unit)	38 (86.4%)	7 (28%)	<0.001
In-hospital mortality	10 (22.7%)	0 (0%)	0.007

\*Statistical analysis was not conducted for this variable as the conditions for Chi-square testing were not met.

**DISCUSSION**

This study aims to comparatively assess the clinical characteristics and outcomes of adolescent age group patients who presented to the emergency department

due to falls from heights, distinguishing between suicidal and non-suicidal incidents.

In this investigation, no statistically significant differences were identified between the suicidal and non-suicidal groups concerning age and gender. This finding indicates a homogeneous distribution in the demographic characteristics of patients presenting to the Emergency Department (ED) due to falls. However, when reviewing the literature, it is evident that while males predominantly represent accidental falls, females are more common in suicidal falls. The limited number of patients included in our study might explain this discrepancy.<sup>12-14</sup>

Our analysis revealed that the number of floors from which patients in the suicidal group fell was statistically significantly higher. This suggests that individuals in the suicidal category tend to fall from greater heights, leading to more severe injuries. In a study conducted by Choi et al.<sup>15</sup> various characteristics of 8,992 patients with accidental falls and 144 with suicidal falls were compared. It was emphasized that patients in the suicide group fell from significantly greater heights (4 meters or above).

Comparing the affected anatomical regions between the two groups, our study found that the prevalence of maxillofacial trauma, pelvic trauma, and thoracic trauma was statistically significantly higher in the suicidal group. This suggests that suicidal incidents involve high-energy trauma, affecting a broader range of anatomical areas. A study by Papadakis et al.<sup>14</sup> reported higher rates of pelvic and thoracic injuries in the suicidal group, while the non-suicidal group predominantly presented with upper extremity injuries.<sup>15</sup>

It is well-established that suicidal incidents generally result in more severe trauma outcomes and necessitate more intensive medical interventions.<sup>16-18</sup> Consistently, our study observed that patients in the suicidal group exhibited significantly higher rates of intensive care requirements, intubation, CPR, and in-hospital mortality.

In a study comparing the injury pattern between suicidal and accidental falls from height in Northern Tunisia, it was reported that head injuries were more common in the accidental falls group, whereas in our study there was no difference between the groups. However, while the aforementioned study covers a period of sixteen years, our study covers a period of three years.<sup>19</sup>

A comprehensive meta-analysis study reported that there was an increase in emergency department visits due to suicide attempts during the COVID-19 pandemic. Although our study coincided with the pandemic period, it is not possible to compare our results with this study since we did not make a comparison with the pre-pandemic period.<sup>20</sup>



## Limitations

There are certain limitations to this study. Firstly, the research was conducted in a single center, implying that the findings may not be wholly generalizable to other clinical settings or geographical regions. The use of a retrospective design suggests that data related to some potentially critical variables might be missing or may be misleading. Additionally, the inclusion of a relatively small number of patients limits the study's statistical power. This study lacks information on prior medication history and any medication taken before the fall in cases of suicidal intent, which is a factor that could potentially affect our mortality predictions.

## CONCLUSION

In this study, suicidal and non-suicidal high-fall cases were compared. It was determined that patients in the suicidal group typically experienced more severe traumas, necessitating more comprehensive medical interventions. Furthermore, the suicidal group exhibited higher mortality rates. In conclusion, cases of falls from heights due to suicide attempts result in more severe outcomes compared to accidental falls, and these patients require a more thorough medical assessment and intervention.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

The study was carried out with the permission of Health Sciences University Gazi Yaşargil Training and Research Hospital Clinical Researches Ethics Committee (Date: 05.05.2023, Decision No: 383).

### Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

### Referee Evaluation Process

Externally peer-reviewed.

### Conflict of Interest Statement

The authors have no conflicts of interest to declare.

### Financial Disclosure

The authors declared that this study has received no financial support.

### Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper and that they have approved the final version.

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