

Retrospective Analysis of Poisoning Cases Presenting to the Emergency Department After Drug Intake: Demographic Characteristics and Necessity of Antidote Use

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Abstract

Objective: The primary objective of this epidemiological study was to systematically examine the demographic attributes of patients accessing the emergency department due to drug overdose. The study further aims to evaluate the imperative for hospitalization or intensive care and to meticulously scrutinize disparities in the clinical trajectory, specifically distinguishing between inadvertent and intentional substance ingestion.

Materials and Methods: Patients admitted to the emergency department because of drug intake were retrospectively evaluated. The analysis encompassed the evaluation of presenting symptoms and emergency department interventions. Parameters such as the duration of emergency department stay, blood tests conducted during the initial assessment, requested consultations, necessity for clinic or intensive care unit hospitalization, and administration of a specific antidote in the emergency setting were systematically examined. Additionally, the impact of antidote use on patient outcomes, as well as the correlation between antidote administration, hospitalization requirements, and subsequent follow-up for referred patients, were subjected to comparative analysis.

Results: Among the examined patient cohort, a predominant 156 individuals (89.7%) manifested a deliberate suicidal intent, while 34 patients (20.6%) had a documented history of psychiatric illness. It is noteworthy that a mere 3 patients (1.8%) were referred to our institution, and conspicuously, none of these cases warranted the administration of antidotes. In totality, the imperative for antidote utilization was identified in 15 patients (8.7%). A statistically significant differentiation emerged between admissions characterized as suicidal and accidental, particularly with regard to 28-day mortality ($p=0.001$). The mortality rate in cases of accidental admissions stood at 17.6%, exhibiting statistical significance. However, no statistically significant relationships were discerned between polypharmacy, antidote utilization, and 28-day mortality ($p=0.164$, $p=0.246$).

Conclusion: Identification of critically ill patients, consideration of specific antidote treatments, strategic determination of treatment options from the point of initial presentation, foresight into potential additional pathologies during follow-up, and recognition of the potential need for a multidisciplinary approach within the scope of third-tier health services collectively constitute integral facets of an effective and comprehensive treatment paradigm for cases involving drug overdose. These measures are essential for ensuring a nuanced and thorough approach to address the evolving clinical needs of affected individuals.

Keywords: Intoxication, drug-related intoxication, antidote use, emergency department

Introduction

Poisoning is a clinical picture that occurs as a result of substance intake intentionally or accidentally into the body. In acute poisoning, the fundamental objective of medical management, which often occurs in emergency departments, is to recognize the conditions that disrupt clinical stability, provide the

necessary supportive treatment, and eliminate these toxic effects with specialized treatments when necessary. In our country, poisoning cases constitute approximately 0.5-2.1% of emergency room admissions, and therapeutic drugs (tricyclic antidepressants, analgesics, and antihypertensive drugs), and pesticides constitute the most common exposure groups [1,2].



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Poisoning cases may vary from region to region in terms of demographic characteristics, poisoning agents, frequency, and social characteristics. For instance, the rate of insecticide poisoning is 3.22% in the United States and 10% in Türkiye. Accordingly, various poisoning profiles should be determined for each country or region, and measures should be taken [3,4].

Mistakes in the hospital environment and unconscious drug use are among the causes of poisoning. In particular, overdose and unwanted intake of narcotics and recreational substances can cause poisoning. Suicidal drug use is when people take unwanted or toxic doses of drugs with the intention of ending their lives. Such suicide attempts represent a serious public health problem and have become a major health concern worldwide. Suicide is a complex situation resulting from a combination of psychosocial, emotional, economic, and environmental factors. Drugs are easily accessible for suicidal use, and they are therefore among the most preferred methods for suicide attempts.

Early recognition and treatment of poisoning are vital. When poisoning cases admitted to the emergency department in our country were analyzed, differences in the number of cases were observed. Because they are widely used and easily accessible, drugs are among the most common agents causing poisoning today. In order to shed light on the future planning and health policies of hospitals and especially emergency medicine clinics, information about demographic characteristics, active substances, and prognosis of poisoning cases is of great importance. Although poison counseling centers have been established in Türkiye to address the situation, data on drug poisoning are limited.

The clinical condition and symptoms of a patient presenting to a health center with a complaint of poisoning may vary due to several factors, including the dose of the agent, duration of intake, mode of intake, sex, age, body mass index, existing diseases, and first intervention before hospital admission. The necessity of antidote use is often questioned during the initial evaluation, and patients are referred if access to antidote is not available. This increases patient care costs, hospital occupancy rates, and the risk of hospital-acquired complications. Familiarization with the frequency of antidote use and active substances can improve the quality of patient care and prevent inappropriate referrals.

This regional epidemiological study aimed to examine the demographic data of patients presenting to the emergency department because of drug overdose, the need for hospitalization, or intensive care, and to review the differences in the clinical course of accidental or intentional drug intake.

Simultaneously, the use of antidotes in the management of common poisonings is evaluated, and the frequency and diversity of antidote use in the general approach to poisonings is investigated. Within this scope, we aimed to define poisonings in the region, investigate the underlying causes, reveal their effects on mortality and morbidity, and contribute to the literature on the prevention of poisonings based on the information obtained in this direction.

Materials and Methods

Patients evaluated in the emergency department of our hospital between January 01, 2022 and March 31, 2023 for drug intake were retrospectively screened. In total, 22,000 patient files were accessed by examining forensic case registries within the specified period. Among these patients, the data of all patients recorded as “suicide by drug” and “poisoning by drug” were analyzed through the hospital automation system. In the patient diagnosis grouping by scanning forensic reports, 21655 patients were recorded for reasons other than suicide, such as vehicular traffic accidents, falling from height, and assault. In the specified time interval, 345 patients were evaluated because of drug-mediated suicidal attempts. 56 patients were excluded from the study because they could not be accessed, 114 patients were excluded because they were over 18 years of age, and 2 for being pregnant. A total of 173 patients were included in the study (Figure 1).

Ethics committee approval was obtained from Bursa City Hospital Clinical Research Ethics Committee during the planning phase of the study (decision number: 2023-9/6, date: 24.05.2023). Because the study was conducted retrospectively, patient data were obtained from the files on the hospital automation system, and no informed consent form was provided. The patient data were examined only by the responsible investigators, who took into account patient privacy. Age, gender, time of presentation to the emergency department, mode of presentation, accidental or intentional drug intake, and which drug was taken were recorded retrospectively. The presenting symptoms, blood test results ordered during the initial evaluation in the emergency department, and emergency department treatment were evaluated. The length of stay in the emergency department, the number of consultations requested, clinic or intensive care unit (ICU) hospitalization requirements, and the use of a specific antidote in the emergency department were further evaluated. The effects of antidote use on patient outcomes and the need for hospitalization and follow-up in patients evaluated as a result of referrals were compared. Patients younger than 18 years, pregnant women, and those for whom study data were not available were excluded.

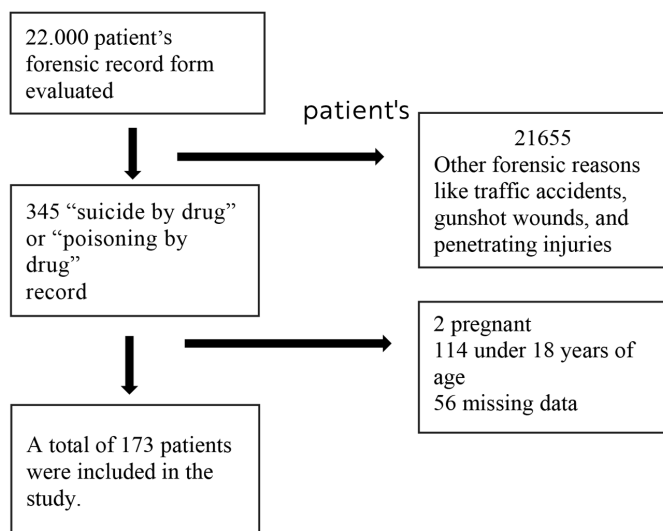


Figure 1. Flow chart of study

Statistical Analysis

The statistical analyses of the study were performed using the SPSS 29.0 package. Descriptive statistics of quantitative variables are presented as mean, standard deviation, median, minimum, and maximum values, whereas qualitative variables are presented as frequency and percentage. Conformity of quantitative variables to normal distribution was tested using the Shapiro-Wilk test. The Fisher chi-square and Fisher-Freeman-Halton chi-square tests were used to compare qualitative variables between independent groups. The relationships between quantitative variables were analyzed using the Mann-Whitney U test. In all statistical comparisons in the study, a p-value 0.05 was considered statistically significant.

Results

The mean age of the 173 patients included in the study was 32.44 min: 18-max: 73, and 108 (62.1%) patients were female. It was observed that 40.8% of the admissions occurred in winter months and 53.9% of the admissions occurred between 16:00-00:00. While 156 (89.7%) of the patients had suicidal intent, whereas 34 (20.6%) had a history of psychiatric illness. In 32 (96.9%) patients with a history of psychiatric illness, the intake was suicidal.

Only 3 (1.8%) patients were referred to our hospital, and none of these patients had any indication for antidote therapy. Six patients were administered acetyl cysteine for paracetamol poisoning, 3 patients were administered calcium for calcium channel blocker, 3 patients were administered ethanol for methanol poisoning, and 3 patients were administered flumazenil for benzodiazepine poisoning. In total, the need for antidote use was present in 15 patients (8.7%). The demographic characteristics of the patients and their presentation to the emergency department are summarized in Table 1.

When the presenting symptoms of the patients were analyzed, the most common symptoms were found to be nausea and vomiting (8.6%), confusion (8.6%), dizziness (4.6%), and agitation (3.4%). In the analysis performed to evaluate the variation of admission symptoms in terms of whether the intake was accidental or suicidal, the rate of dizziness was 33.3% in accidental intakes but 1.3% in suicidal intakes, which was statistically significant ($p < 0.001^a$). Similarly, statistically significant differences were found in the incidence of headache, agitation, and confusion ($p = 0.001^a$), ($p = 0.015^a$) ($p < 0.001^a$) (Table 2).

Accidental or suicidal drug intake history, need for antidote or hemodialysis, outcome of treatment in the emergency department, and 28-day mortality were analyzed. There was a statistically significant difference in terms of sex between those who reasoned for intake was suicidal and those who took it accidentally ($p = 0.017^a$). The rate of suicidal admission was significantly higher in women than in men. There was a statistically significant difference between suicidal and accidental admissions in terms of 28-day mortality ($p = 0.001^a$). The mortality rate was 17.6% in accidental admissions, which was higher than that for suicidal use, which was statistically significant (Table 3).

When laboratory values were analyzed in terms of suicidal or accidental intake, Aspartat aminotransferaz (AST), alanin aminotransferaz (ALT), and potassium values were significantly lower, whereas creatinine and calcium ($p = 0.019^a$) values were significantly higher in those with suicidal intake ($p = 0.005^a$) ($p = 0.020^a$) ($p = 0.005^a$) ($p = 0.019^a$).

In the comparison of blood gas analysis, base deficit, lactate, and anion gap levels were found to be higher in accidental intake, and this difference was statistically significant ($p \leq 0.001^a$) ($p = 0.003^a$) ($p = 0.031^a$). Table 4 summarizes the laboratory values of the patients and their relationship with the mode of intake.

When the types of drugs causing intoxication in patients were analyzed, antidepressant drugs were the most common cause of intoxication in 53 patients (30.5%), whereas 84 (48.6%) of the patients were found to have polypharmacy (Table 5).

There was no statistically significant relationship between polypharmacy, antidote use, and 28-day mortality ($p = 0.164^a$) ($p = 0.246^a$) (Table 5).

While 30 (17.3%) patients were followed up in the ICU (17%) and 71 (41.6%) patients were followed up in internal medicine clinics, mortality was seen in 3 patients (1.73%) within the first 28 days during ICU follow-up.

Table 1. Demographic data of the patients and time of presentation to the emergency department

		n	%
Season	Winter (December - January - February)	71	40.8
	Spring (March - April - May)	31	17.8
	Summer (June - July - August)	32	18.4
	Autumn (September - October - November)	40	23.0
Time of presentation	08-16	30	18.2
	16-00	89	53.9
	00-08	46	27.9
Referral	Yes	3	1.8
	No	162	98.2
Reason for intake	Suicidal	156	89.7
	Accidental	18	10.3
Gender	Male	66	37.9
	Female	108	62.1
Additional disease	No	122	70.1
	Yes	52	29.9
Psychiatric history	Yes	34	20.6
	No	131	79.4
Antidote	No	158	91.3
	Yes	15	8.7

Table 2. Reasons for drug intake and symptomatology

		Suicidal	Accidental	p
Nausea/Vomiting	No	145 (92.9%)	14 (77.8%)	0.053 ^a
	Yes	11 (7.1%)	4 (22.2%)	
Abdominal pain	No	155 (99.4%)	18 (100%)	1.000 ^a
	Yes	1 (0.6%)	0 (0%)	
Dizziness	No	154 (98.7%)	12 (66.7%)	<0.001 ^a
	Yes	2 (1.3%)	6 (33.3%)	
Headache	No	156 (100%)	15 (83.3%)	0.001 ^a
	Yes	0 (0%)	3 (16.7%)	
Hallucination	No	155 (100%)	17 (94.4%)	0.104 ^a
	Yes	0 (0%)	1 (5.6%)	
Agitation	No	153 (98.1%)	15 (83.3%)	0.015 ^a
	Yes	3 (1.9%)	3 (16.7%)	
Confusion	No	149 (95.5%)	10 (55.6%)	<0.001 ^a
	Yes	7 (4.5%)	8 (44.4%)	

^aFisher chi-square test

Discussion

Acute poisoning is one of the most serious medical emergencies worldwide, resulting in high morbidity and mortality rates, especially in developing countries. It is important because poisoning is mostly observed in young people, its frequency is increasing, it is life-threatening, causes permanent damage, and requires urgent intervention.

The approach to poisoning is similar in all emergency departments. The profiles of patients presenting to emergency departments may vary due to regional conditions, age range, and place of the individual in society.

In many studies, it has been reported that among patients presenting to emergency and ICUs, the female population is higher in both accidental and intentional poisoning cases, and this rate varies between 53 and 77%. In our study, similarly, the

Table 3. Relationship between drug intake patterns and treatment and outcome in the emergency department

		Suicidal	Accidental	p
Gender	Male	54 (34.6%)	12 (66.7%)	0.017 ^a
	Female	102 (65.4%)	6 (33.3%)	
Hemodialysis	No	156 (100%)	8 (44.4%)	<0.001 ^b
	Yes	0 (0%)	2 (11.1%)	
	Continuous hemodialysis	0 (0%)	8 (44.4%)	
Outcome	Discharged	11 (7.1%)	2 (11.8%)	N/A
	Clinical hospitalization	67 (42.9%)	4 (23.5%)	
	IC hospitalization	20 (12.8%)	2 (11.8%)	
	General IC hospitalization	2 (1.3%)	6 (35.3%)	
	Treatment refusal	49 (31.4%)	3 (17.6%)	
	Referral	5 (3.2%)	0 (0%)	
	Other	2 (1.3%)	0 (0%)	
	Yes	1 (1.4%)	0 (0%)	
Antidote	No	143 (91.7%)	15 (88.2%)	0.645 ^c
	Yes	13 (8.3%)	2 (11.8%)	
28-day mortality	No	156 (100%)	14 (82.4%)	0.001 ^c
	Yes	0 (0%)	3 (17.6%)	

^aYates chi-square test; ^bPearson chi-square test; ^cFisher chi-square test, IC: Internal medicine

rate of female patients was 62.1%. We believe that reasons such as the socio-cultural structure in which women live, their close environment, and family pressure that may occur on females may trigger the tendency to attempt suicide with drugs and similar substances that can be easily accessed at home [5-8].

In a study conducted by Ödemiş et al. [9] on the distribution of drug intoxication cases according to the month of presentation, the highest presentation was observed in January (11.6%), with two peaks in January and September, and presentation to the emergency department was observed between 20.00 and 24.00. The general opinion in the literature is that suicide risk is higher in winter when air temperature and sunlight are low. This finding supports the fact that suicide attempts increase in winter months by pointing out that the increase in air temperature and sunlight intensity are negatively correlated with suicidality, whereas cloudy weather and high pressure are positively correlated. In our study, the most frequent admission was found in winter months, thereby reflected similar results. On the contrary, in another study conducted in our country, poisoning cases showed seasonal characteristics, most admissions were observed in the summer months (28.9%), and more than half of the admissions (55.2%) occurred between 20:00 and 08:00 [10].

In a large series of studies, it has been reported that although there is a history of accidental drug intake in the pediatric age group, the majority of adult patients have a history of suicidal drug intake. Studies conducted in our country also support

these data and 82.4% of the cases having a history of drug intake due to suicide attempts [11]. In our study, the rate of suicidal drug intake was 89.7%, which supports the literature.

In our study, the most common drug group causing poisoning was antidepressants (30.5%). The antidepressant group (34.7%) also had a high rate in the study by Özdemir et al. [12]. In similar studies, the rates varied between 22.7% and 35.3% [12-14]. We believe that this high rate of poisoning cases is due to the fact that analgesic and anti-inflammatory agents and antidepressants are more easily accessible in our country as a result of their widespread use without prescription. In addition, we believe that the use of antipsychotic or antidepressant drugs due to the psychiatric problems of patients makes it possible for them to use these drugs for suicide attempts. Our rate of patients with a psychiatric history was 20.6%, which was reported to be 34.1%-35.3% in similar studies [13,14].

In the analysis of Akgün et al. [15], the most common complaints in cases of acute poisoning were central nervous system symptoms, such as confusion, tendency to sleep, convulsions, and dizziness (75.7%), while gastrointestinal symptoms, such as nausea and vomiting, ranked second with 24.3%. Similarly, neurologic and gastrointestinal symptoms, such as nausea and vomiting, were at the forefront of our study. When we evaluated the relationship between symptoms and the reasons for drug intake, dizziness, headache, agitation, and confusion were higher in accidental intake.

Table 4. Relationship between patients' laboratory values and mode of intake

	Suicidal	Accidental	p
Blood sugar	107.59±36.35 98 (60-419)	131.44±67.08 109 (60-315)	0.290 ^a
BUN	10.46 ± 3.57 9.70 (107.59±36.35)	10.53±4.85 10.65 (4.20-21.60)	0.934 ^a
Creatinine	1.31±7.07 0.72 (0.46-89)	0.97±0.37 0.93 (0.49-1.71)	0.019 ^a
AST	19.38±7.00 18 (9-45)	39.60±37.91 25 (0.70-143.5)	0.005 ^a
ALT	18.47±12.44 14.5 (6-81)	35.53±36.89 24 (7-159)	0.020 ^a
Na	138.14±11.29 139 (0.1-143)	133.65±19.89 138 (57-142)	0.276 ^a
Potassium	4.03±0.34 4 (3.2-4.9)	4.48±0.98 4.40 (2.6-6.9)	0.005 ^a
Calcium	9.52±0.44 9.5 (8-11.20)	9.11±0.67 9.30 (8.10-10.30)	0.019 ^a
pH	7.38±0.04 7.38 (7.22-7.50)	7.20±0.26 7.30 (6.62-7.47)	0.002 ^a
Base deficit	1.26±3.11 1.20 (-10-10.5)	13.45±11.36 6.50 (3-32.60)	<0.00 ^a
Lactate	1.66±1.07 1.30 (0.5-7.20)	3.55±2.69 2.70 (0.7-9.80)	0.003 ^a
Anion Gap	9.75±3.68 9.15 (3.20-23.60)	20.21±13.51 18.90 (5.70-47.80)	0.031 ^a
Blood gas bicarbonate	26.35±3.19 26.10 (17.40-39.70)	18.58±11.29 22.20 (2.70-31.40)	0.084 ^a

^aMann-Whitney U test, *Mean±standard deviation/median (min.-max.),
 BUN: Blood urea nitrogen, AST: Aspartat aminotransferaz, ALT: Alanin aminotransferaz, Na: Sodium, min.-max.: Minimum-maximum

Table 5. Relationship between drug type and mortality

		n	%
Drug types	Analgesic/antipyretic	48	27.6
	Antidepressant	53	30.5
	Antibiotics	15	8.6
	Antiepileptics	3	1.7
	Anxiolytics	10	5.7
	Antihypertensive	13	7.5
	Antiarrhythmics	2	1.1
	Other	29	16.7
Drug intake	Single	89	51.4
	Multiple	84	48.6
		Drug intake	
		Single	Multiple
Antidote	No	78 (89.7%)	79 (96.3%)
	Yes	9 (10.3%)	3 (3.7%)
28-day mortality	No	86 (96.6%)	84 (100%)
	Yes	3 (3.4%)	0 (0%)

^aYates chi-square test

We believe that this difference may be a result of increased anxiety about accidental or intentional intake or a result of ignoring affective disorders and complaints about suicidal intake.

Routine biochemical parameters used during the evaluation of patients in the emergency department and blood gas analysis, which are particularly useful in guiding the decision on severity, are often used effectively in treatment follow-up, not in the diagnostic process. In our analysis, AST, ALT, and potassium values among biochemical parameters were found to be high in accidental intake. Accidental intake may be associated with an increase in the amount of intake or prolonged admission time, contrary to planned interventions. In blood gas analysis, parameters such as lactate and base deficit, which indicate impaired tissue perfusion, were also found to be elevated in accidental intake. This difference reflected the fact that most of our study patients presented with more serious clinical symptoms as a result of accidental intake, as we encountered in our three patients who died. The reflection of metabolic changes in biochemical and blood gas parameters as a result of intoxication may be an important indicator of impaired tissue perfusion. Increased liver function tests and elevated potassium levels after accidental ingestion may reflect, in particular, renal and hepatic tissue involvement. In cases of suicidal intake, a higher drug dose or earlier presentation may reflect the treatment administered.

The primary and first goal of treatment for acute poisoning is to eliminate threats related to vital signs, correct the symptoms and pathological conditions of the patient, and reduce the complaints, which constitute the basis of supportive treatment. Activated charcoal, gastric lavage, and the use of active drugs containing known antidotes are the first steps of treatment. In addition to supportive treatment, specific antidote treatment was administered to 28% of patients. N acetyl cysteine (NAC) was the most commonly used antidote in 59.1% of patients receiving antidote treatment. Atropine, PAM, vitamin K, fresh frozen plasma, and desferoxamine have also been reported as antidotes [16]. In our study, the rate of antidote use was 6.35% (n=11) and the most commonly used antidotes were NAC and calcium. The data of our study showed that antidote treatment in the emergency management of patients with poisoning is important only for specific agents, and the majority of these cases can be managed with supportive treatment.

In our study, 17.4% of patients were followed up in the ICU, and the mortality rate was 1.73%. Suicidal intake may be the result of underlying psychological stress and completion of the attempt with more easily accessible drugs or earlier presentation. In the literature, there are data showing that 5.5-12.8% of drug intoxication presenting to the emergency

department are followed up in ICU [17,18]. In our country, this rate can go up to 37% [19]. Although in-hospital mortality is around 33% in certain patient groups in ICU patients, this rate is only 2.1% in those with drug intoxication [17,20,21].

In most of the drug intoxications presenting to the ICU for various reasons, no treatment (such as mechanical ventilation, hemodialysis, or vasopressor therapy) is applied to support vital functions, and patients are hospitalized only for observation [17,18]. Despite the low mortality rates, relatively high rates of ICU hospitalization may be considered logical in terms of patient safety due to the concern that patients may develop severe symptoms in the following hours; however, this is not acceptable both economically and in terms of unnecessary intensive care bed occupation. Although most patients had no significant symptoms, ICU admission was requested for observation given the concern that life-threatening complications might occur later. Appropriate emergency department follow-up for the management of poisoning patients, prediction of serious poisonings specific to active substances, early recognition of patients requiring antidotes, and referral to appropriate treatment may prevent unnecessary hospitalization indications.

Study Limitations

The first limitation of our study was that it was conducted retrospectively and in a single center. For this reason, patient data may be lost at the point of access. Second, data loss due to missing demographic data in the patient files may not reflect the actual number of patients. Additionally, we considered the subgroup of drugs that direct the patient's clinic to multiple drug intake as pimer, so we could not obtain any data on drug interactions.

Conclusion

Supportive treatment is essential for the evaluation of poisoning cases in emergency departments. It is important to ensure appropriate stabilization of patients and to decide on the necessary follow-up and treatment periods. Recognizing the critical patient and evaluating the need for specific antidote treatments, determining the appropriate treatment options from the moment of presentation at this point, predicting additional pathologies that may develop during follow-up, and determining the need for a multidisciplinary approach within the scope of 3rd step health services, if necessary, constitute effective treatment steps. In this way, patients can be ensured to receive effective treatment at appropriate healthcare institutions while preventing inappropriate referral requests.

Ethics

Ethics Committee Approval: Ethics committee approval was obtained from Bursa City Hospital Clinical Research Ethics

Committee of our hospital (decision number: 2023-9/6, date: 24.05.2023) during the study planning phase.

Informed Consent: The study was conducted retrospectively, patient data were obtained from the files on the hospital automation system, and no informed consent form was provided.

Footnotes

Authorship Contributions

Surgical and Medical Practices: S.E., Concept: E.D., Design: S.E., Data Collection or Processing: E.D., Analysis or Interpretation: E.D., Literature Search: S.E., Writing: E.D., S.E.

Conflict of Interest: No conflict of interest was declared by the authors.

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