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ORIGINAL RESEARCH

Analysis of medical evacuation following the Tünektepe cable car accident in Turkey in 2024

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Abstract

Background: The Tünektepe Touristic Cable Car accident happened on 12 April 2024, when a support pole collapsed, causing the nearest cabin to crash to the ground. One cabin fell to the ground, while 35 others were left suspended in the air. This study aims to analyze the demographic characteristics and medical conditions of the 182 victims of the accident. **Methods**: Transportation records and other related documents were analyzed retrospectively. The demographic data, clinical symptoms, Injury Severity Scores (ISS), medications administered, and prognoses of the accident victims were examined separately. **Results**: Rescue efforts lasted 23 hours, and the mean age of the victims was 32 years. One person (0.54%) died at the scene, 20 people (11%) sustained injuries, and 161 people (89%) were asymptomatic. The fatality was attributed to severe head and neck trauma. Among the rescued patients, 14 (7.7%) sustained extremity injuries. ISS distribution was as follows: nine patients (43%) scored 1, four (19%) scored 4, two (9.5%) scored 13, two (9.5%) scored 10, one (4.7%) scored 50, one (4.7%) scored 25, one (4.7%) scored 9, and one (4.7%) scored 0. Triage codes included (5%) black, (10%) red, (40%) yellow, and (50%) green cases. Patients in the impacted cabin most frequently suffered extremity and spinal fractures due to being thrown and then falling from a height. In contrast, patients in the stranded cabins presented only with soft tissue injuries to the extremities, without fractures, and all were discharged directly from the emergency department. **Conclusions**: Cable car accidents are rare. Effective evacuation requires highly trained personnel, appropriate equipment, and careful planning.

Keywords

Cable car; Cable car accident; Aerial evacuation; Injury severity score

1. Introduction

Tünektepe Touristic Cable Car (TTCC) is a gondola-type cable car located in the Konyaaltı district of Antalya, Turkey. The system has an inclined length of 1706 meters, a total cable length of 3604 meters, and an elevation difference of 604 meters between its two terminals. The facility has 36 cabins, each with a capacity of eight passengers, and can transport up to 1200 passengers per hour. The average travel time is approximately nine minutes. The TTCC became operational on 04 February 2017 [1].

On 12 April 2024, at 17:28, one of the cable car poles collapsed and struck one of the cabins. Eight passengers inside the cabin fell approximately 20 meters onto the rocky terrain. As a result, one person died and seven others, including two children, were injured at the scene. An additional three individuals sustained injuries during the rescue operation. In total, 174 passengers stranded in midair were rescued over the course of 23 hours [2] (Fig. 1).

No similar incident has previously been reported in Turkey, and to our knowledge, no published cases describe a cable car accident with such a large number of casualties worldwide. Therefore, this study, representing the first report of its kind in the literature, aims to examine the TTCC accident that occurred in Antalya.

2. Materials and methods

2.1 General information about the scene

The collapse occurred on 12 April 2024, and the rescue operation was carried out on 12–13 April 2024. Firefighting teams were the first to arrive. The first victim was located using a drone and reached within approximately 20 minutes via off-road vehicles and on foot.

Cable car pole number 5, which collapsed in the accident, was located close to the stabilized road used for the facility's construction. As a result, reaching the eight injured passengers in the first cabin (including one fatality at the scene) was relatively fast and straightforward using all-terrain rescue vehicles. On 12 April 2024, the highest temperature in Antalya was 23 degrees Celsius during the day and 14 degrees Celsius at night. In such rescue operations, there is a

FIGURE 1. Image of broken cable car pole and falling wagon.

daytime risk of hyperthermia and dehydration, and a nighttime risk of hypothermia due to the dropping temperature. Teams were prepared with intravenous (IV) hydration supplies and hypothermia blankets to address these risks.

2.2 Accident mechanics

A 52-page expert report was prepared following the investigation. According to the report, the accident occurred because one of the 10 pulleys on pole number 5 (return side to Tünektepe station) broke, yet the system continued to operate. The pole, unable to withstand the sudden pulling force, fractured at its midpoint. When the pole collapsed, it snapped downward and struck the nearest cabin, causing the cabin to crash to the ground. The cabin first hit the top of the tower, shattering its windows. Immediately after the impact, the cabin separated from the rope and fell about 20 meters [3]. Upon impact, the cabin shattered at the base. As a result, the eight passengers inside the cabin suffered trauma from both being thrown and from the vertical fall to the ground.

2.3 Rescue efforts

As the cabin hit the ground, the facility's power line was shut down, and the emergency call center (112) was immediately alerted. A crisis center was simultaneously established. The closest fire station was activated, and teams set out along the stabilized road using off-road vehicles. Later, helicopters were deployed for air evacuations.

The crisis center was established at the coast guard headquarters, which also included a heliport. This area included AFAD (Disaster and Emergency Management Presidency), UMKE (National Medical Rescue Team), firefighters, 112 healthcare personnel, police officers, and coast guard staff. It also contained triage, examination, and, if necessary, secondary treatment and registration areas for evacuated patients. A logistics support area was organized to provide supplies for rescue teams, including water, food, rest space, restrooms, lighting, and backup power. An ambulance corridor was created to facilitate smooth entry and exit for ground ambulances, and the area was closed to pedestrian and vehicle traffic. A separate media and communication zone was established opposite the ambulance entrance and exit area to provide updates to families and the press. Asymptomatic victims were discharged directly from this area (Fig. 2). Following inspection, the Antalya-Kemer Road was initially opened to a single lane, and later fully opened to pedestrian and vehicle traffic. However, the ambulance corridor remained operational throughout.

Before rescue operations began, a briefing was held among the teams. The agreed strategy was to evacuate cabins nearest to the collapsed pole using the tower-based rescue method, and the remaining cabins using the on-line rescue method. In both approaches, double restraint for both rescuer and the victim was prioritized. Before starting rescue operations, victims were briefed via megaphones from the ground. Helmets, seating positions, rescue belts, thermal blankets, and nighttime signal sticks were prepared. The evacuation priority was determined as follows: (1) seriously injured, (2) children, elderly, pregnant women, (3) individuals at high risk of hypothermia, and (4) others. After docking, the victims were reassessed, and if necessary, the evacuation order would be adjusted.

Tower-Based Rescue: Victims in cabins near the poles were evacuated by installing ladders on the poles, climbing to the top, breaking the cabin door, and removing passengers one by one. Each victim was secured with a full-body belt and lowered vertically using rope systems. Side guards, backup fall arresters, and intermediate anchors were used for additional safety.

On-Line Rescue: Firefighters used a rescue trolley running on the towing rope. Rescuers climbed the poles, installed the trolley, and approached the cabins. Cabins could not be opened from inside, so temporary anchors were installed, and victims were secured with full-body belts before being lowered to the ground via a twin-tension system. Care was taken to minimize

FIGURE 2. The sketch of rescue setup and scene management.

cabin sway and sudden shocks.

The medical process was carried out jointly by 112, UMKE, and AFAD. Victims were evacuated first at the point of evacuation and again at the crisis center. Triage of the victims was determined according to the Simple Triage and Rapid Treatment (START) method, using the color codes Red, Yellow, Green, and Black. Initial interventions followed the ABCD approach: A (airway), B (breathing), C (circulation-bleeding control/tourniquet/hemastatic agents), D (disability), and E (exposure-body temperature management). Hypothermia prevention remained a constant priority.

Initial assessments of all seven patients evacuated from the ground were conducted by paramedics at the scene where they fell. Of the eight cases, one was declared dead at the scene (code black), and the others were triaged in green, yellow, and red. The patients were placed in a safety perimeter. All patients received IV access, and vital signs were monitored. Patients requiring IV hydration were addressed and analgesia were administered. No cases required basic or advanced life support. Cervical immobilization, vacuum splints were applied to the extremities where necessary, trauma boards were applied, and rope-compatible basket stretchers were used before transfer. The patients were then secured on the trauma boards and transported to the helicopter on basket stretchers.

Patients were airlifted by helicopters and landed at the heliport in the deployment area of the crisis center. At the landing site, 112 medical personnels met the patients and performed secondary assessments. The treatment area was divided into four zones: red, yellow, green, and transport. Patients requiring advanced life support were admitted to the red zone. However, no patient required advanced life support. Patient observation, hydration, analgesia, and other procedures were performed in the yellow zone. The green zone was reserved for those in good general condition and those with minor injuries.

After secondary assessments, trauma centers were contacted via the Command-Hospital Coordination Line. Patients were transferred by ground ambulance to the nearest trauma centers (Fig. 2).

2.4 Scene management

A crisis desk was immediately established under the auspices of AFAD [4, 5]. Personnel from AFAD, UMKE, Fire Department, Turkish Armed Forces, Police, TTCC staff, volunteer professional mountaineers, and Non-Governmental Organizations (NGOs) were dispatched to the scene. Rescue efforts were conducted under joint coordination [6, 7]. The Provincial Directorate of Meteorology provided continuous updates on weather, wind, precipitation, and lightning risks. Ongoing risk assessments were conducted throughout the rescue operations.

• The activities and responsibilities of the institutions participating in the rescue operations were carried out as follows [8–10]:

• Unified Command Center: Antalya Governorship, Antalya Metropolitan Municipality, AFAD Provincial Directorate, Fire Department, UMKE, 112 Command and Control, Police/Gendarmerie, Operations Technical Chief, Meteorology Regional Directorate, Volunteer professional mountaineers, NGO, Communication teams.

• Operations Chief: Fire Department and AFAD technical rescue chiefs.

• Medical Chief (112 and UMKE): Triage, treatment, transport, and psychological support for victims.

• Logistics Chief: Logistics & Support (Lighting, generator, heater/wet-weather equipment, nutrition/water and rest rotation, hypoglycaemia/hypothermia prevention).

• Planning/Intelligence (meteorology + law enforcement): Drone flight, weather, risk assessment, mapping, digital monitoring.

• Security and Safety: Environmental safety and information verification, precautions against environmental risks (rockfall, forest barriers, wildlife).

• Media Spokesperson: Unified communication channel and regular press updates.

The Cable Car Accident Rescue Framework can be summarized in 12 steps:

(1) Rapid overview and planning;
(2) Continuous scene monitoring (meteorological support);
(3) Ensuring scene safety;
(4) Selecting rescue methods and preparing equipment;
(5) Identifying cable car-specific issues (manufacturer collaboration);
(6) Determining the cabin-specific procedure;
(7) Medical process;
(8) Communication and press management;
(9) Logistics and support;
(10) Environmental and structural risk precautions (rockfall, wildlife);
(11) Operation termination (secondary cabin inspections, inventory, waste disposal, team psychological support);
(12) Special considerations.

• Full compliance with the manufacturer's rescue manual must be maintained, and care must be taken not to place additional loads on the cabins to prevent free swinging and falling.

• Door mechanisms can be fragile. Care must be taken to prevent secondary injuries.

• Secondary safety measures are essential inside the cabins to prevent passenger falls during opening.

• Psychological first aid is important. Special briefings should be given on panic management and communication with children.

2.5 Injury severity score (ISS)

The Injury Severity Score (ISS) is a widely accepted trauma scoring system used across all age groups for over 30 years. It was developed in 1974 based on the Abbreviated Injury Score (AIS), and evaluates trauma using anatomical variables (Table 1) [11]. The human body is anatomically divided into six regions: head/neck, face, thorax, abdomen, extremities (including pelvis), and external.

TABLE 1. Abbreviated injury score (AIS).

Injury Severity	AIS Score
Uninjured	0
Minor	1
Moderate	2
Serious, not life-threatening	3
Severe, life-threatening, survival probable	4
Critical, survival uncertain	5
Maximum, lethal	6

AIS: Abbreviated Injury Score.

ISS is calculated based on the most severely injured three body regions, as determined through physical examination and trauma-specific imaging.

Each injury site is assigned a score from 1 to 6 using the AIS. The three highest scores are squared and summed to produce the ISS, which ranges from 1 to 75. A score of 75 is considered incompatible with life. A single AIS score of 6 automatically results in an ISS of 75. ISS scores below 16 are rarely fatal, while scores $\geq$16 are classified as major trauma. ISS scores are interpreted as follows: $<$9 indicates minor trauma, 9–15 moderate trauma, 16–24 severe trauma, and $\geq$25 critical trauma. The primary limitation of ISS is that it only considers one injury per body region. This may result in underestimation, as severe injuries in the same region can be overlooked while less severe injuries in other regions are included [11].

2.6 Data collection and statistical analysis

The analysis was based on the records from AFAD and 112 emergency teams collected during evacuation and patient handover. Data were compiled into SPSS 24 (IBM, Armonk, NY, USA) for analysis.

In this study, transportation, hospital, and autopsy records of the victims were retrospectively reviewed. Patients' demographic data, vital signs, general condition (based on clinical judgment), triage codes, complaints, diagnoses, injury locations, evacuation points, hospital departments of admission, and treatments were all examined individually. Following the identification of the injured body regions, ISS values were calculated. The triage codes of the survivors were categorized as red, yellow, and green according to the three-level triage coding system, while the deceased individual was assigned a black code.

Descriptive statistics were calculated using mean and median values. Missing data were cross-checked by contacting healthcare personnel directly. Additional data were obtained from referral forms and the hospital discharge records. All parameters were analyzed for the total of 182 patients.

No extra medical or diagnostic procedures were performed for this study, which involved only a retrospective review of standardized records. A data protection officer was appointed to ensure data security, and the availability of standardized medical data for scientific analysis was confirmed. Ethical approval was obtained from the Clinical Research Ethics Committee of the University of Health Sciences, Antalya Training and Research Hospital (approval number: 20/8).

3. Results

Between 12–13 April 2024, a total of 182 victims were evacuated from the TTCC line. Of these, 90 (49.46%) were female and 92 (50.54%) were male. The mean age was 31.85 years. Among the victims, one individual (0.54%) died, 20 (10.98%) sustained injuries, including seven who had been in the cabin that fell, while 161 (89.02%) were asymptomatic. The mean age of the asymptomatic individuals was 31.83 years; 80 (49.68%) were female and 81 (50.32%) were male.

The mean age of the symptomatic individuals was 29.52 years. Extremity injuries were found in 7.73% of all rescued victims and in 70% (14 patients) of symptomatic cases. Intravenous medication (isotonic fluids) was administered to seven patients (35%) during the rescue operations (Table 2). All patients were protected against hypothermia, and no cases of hypothermia were recorded.

TABLE 2. Sociodemographic characteristics, examination findings and ISS scores of symptomatic cases.

Number	Age	Sex	Evacuation place	ISS	Hospital service	Treatment	General situation	Triage code	SBP	DBP	Pulse	BT	SAT.O_2%
1	54	M	Ground	50	-	-	Bad	Black	0	0	0	0	0
2	39	F	Ground	13	Orthopedics	Operation	Moderate	Yellow	71	60	111	36.7	98
3	10	M	Ground	13	Orthopedics	Operation	Moderate	Yellow	142	76	87	36.2	98
4	40	F	Ground	25	ICU	Operation	Moderate	Red	123	54	67	36.7	99
5	55	M	Ground	10	Neurosurgery	Operation	Moderate	Yellow	72	77	98	36.6	96
6	42	F	Ground	9	ICU	Operation	Moderate	Red	83	50	99	36.5	100
7	24	F	Ground	4	ER	Discharged	Good	Green	88	87	103	36.1	99
8	3	M	Ground	10	Orthopedics	Operation	Moderate	Yellow	133	68	104	36.7	98
9	7	F	Car	1	ER	Discharged	Good	Green	122	90	88	36.7	97
10	37	F	Car	1	ER	Discharged	Good	Green	76	89	99	36.3	99
11	41	M	Car	1	ER	Discharged	Good	Green	79	87	91	36.2	98
12	50	M	Car	1	ER	Discharged	Good	Green	88	68	93	36.1	97
13	21	F	Car	1	ER	Discharged	Good	Green	155	66	97	36.5	99
14	17	F	Car	1	ER	Discharged	Good	Green	70	67	78	36.3	98
15	23	F	Car	4	ER	Discharged	Good	Yellow	76	68	67	36.7	99
16	17	M	Car	4	ER	Discharged	Good	Yellow	123	87	87	36.6	98
17	74	M	Car	4	ER	Discharged	Good	Yellow	151	78	88	36.1	98
18	9	M	Car	0	ER	Discharged	Good	Yellow	100	90	89	36.5	97
19	11	M	Car	1	ER	Discharged	Good	Green	88	77	90	36.6	96
20	54	M	Car	1	ER	Discharged	Good	Green	82	76	90	36.3	96
21	16	F	Car	1	ER	Discharged	Good	Green	89	87	106	36.7	96

ISS: Injury severity score; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; BT: Body temperature; SAT.O_2%: Oxygen saturation %; M: Male, F: Female; ICU: Intensive care unit; ER: Emergency room.

Of the 20 symptomatic patients, 14 (70%) were in good general condition, six (30%) were in moderate condition, and one (5%) in bad condition, who was deceased at the scene. Among the symptomatic patients, 10 (50%) were hypotensive and 4 (20%) were tachycardic. Triage codes were as follows: 1 (5%) black, 2 (10%) red, 8 (40%) yellow, and 10 (50%) green. Of the 182 rescued individuals, 20 (11.04%) were transported to hospitals, while 161 (88.95%) were discharged directly from the scene. Of those transferred to hospitals, 6 (30%) were admitted and 14 (70%) were discharged from the emergency department. Among hospitalized symptomatic patients, 3 (15%) were admitted to orthopedics, 1 (5%) to neurosurgery, and 2 (10%) to intensive care.

Among symptomatic cases, the most common injury was extremity trauma (14 patients, 70%), including 9 lower extremity and 5 upper extremity injuries. Other injuries included lumbar vertebra fractures in 5 (25%), head and neck trauma in 4 (20%), thoracic trauma in 1 (5%), and abdominal trauma in 1 (5%). The Injury Severity Scores (ISS) for symptomatic patients were as follows: 9 cases (45%) scored 1; 4 (15%) scored 4; 2 (10%) scored 13; 2 (10%) scored 10; 1 (5%) scored 50; 1 (5%) scored 25; 1 (5%) scored 9; and 1 (5%) scored 0. During follow-up, 6 patients (30%) underwent surgery. All patients were discharged without sequelae. Aside from the individual who died at the scene, there were no fatalities before or after treatment in the subsequent year (Table 2). The cause of death in the deceased case was reported as head and neck trauma.

Patients from the Impacted Cabin: When symptomatic patients were analyzed by cabin location, extremity and spinal fractures were seen in those from the impacted cabin, reflecting trauma from being thrown and then falling from a height. In contrast, stranded-cabin patients sustained only soft tissue injuries from being thrown, without fractures.

Among the impacted cabin passengers, one of the patients died at the scene due to head and neck trauma. One had a right forearm double-bone fracture and lumbar vertebrae fracture, one had a right fibula fracture and head trauma, one had a left humerus fracture, a right forearm double-bone fracture, a lumbar fracture, and abdominal trauma, one had a left foot tibia and fibula fracture and widespread body pain, one had a lumbar fracture and widespread body pain, one had a rib and thoracic vertebrae fractures, and one had a left tibia fracture and widespread body pain. The mean ISS for the impacted cabin was 16.75. One patient was discharged, while the others were hospitalized (3 in orthopedics, 2 in the intensive care unit, 1 in neurosurgery). General condition assessments showed: one poor, one good, and six fair. Triage codes were: 1 black, 1 green, 2 red, and 6 yellow. The mean systolic blood pressure (SBP) of the cases in the falling cabin was 89 mmHg, diastolic blood pressure (DBP) was 59 mmHg, pulse 83.6 beats/minute, body temperature (BT) was 31.9 degrees centigrade, oxygen saturation ($SAT.O_2\%$) was 86 (Table 2).

Patients from the Stranded Cabins: Among the stranded cabin patients, seven had widespread body pain, one had an external ear hematoma, one had a left leg soft tissue injury, one had a head injury, one had nausea and vomiting, and two had low back pain. The mean ISS for stranded-cabin patients was 1.61. All were discharged from the emergency department, all were in good general condition, and no fractures were reported. Nine patients had a green triage code, and four had a yellow triage code. The mean SBP of the cases in the suspended cabins was 99.92 mmHg, DBP 79.23 mmHg, pulse 89.46 beats/minute, BT 36.43 degrees Celsius, and $SAT.O_2\%$ 97.53% (Table 2).

Asymptomatic Victims: A total of 161 (89.02%) of the victims were asymptomatic. All were discharged from the scene with stable vital signs, good general condition, and green triage codes. No subsequent hospital admissions related to the accident were reported.

4. Discussion

To the best of our knowledge, this analysis of the victims rescued after a tourist car accident is the first report to present systematic data on such events both nationally and internationally. For this reason, a comprehensive head-to-head comparison with the existing literature was not feasible. Nevertheless, our findings inform the challenges faced by the rescue teams during the operation, improving patient transportation procedures and decision-making regarding hospital referrals.

Although our findings are generally consistent with prior reports on the epidemiology of injuries following cable car accidents [4–6, 12], we observed a higher incidence of orthopedic injuries, particularly lower extremity trauma. The most frequently injured anatomical regions were extremities (70%) and the lumbar vertebrae (25%), followed by the head and neck (20%), thorax (5%), and abdomen (5%). These patterns align with prior studies identifying extremity trauma as the most common injury type [12]. The concurrent frequency of vertebral and head-neck injuries underscores the need to avoid overlooking these regions while treating prominent extremity trauma.

In Turkey's Eastern Black Sea region, rural communities have developed a simple cable car system known as the "varangel" to overcome difficult terrain along steep hills and mountain slopes. Despite limited safety features, it remains widely used. In a study of 16 patients admitted to the emergency department of Karadeniz Technical University between 01 January 2001, and 31 December 2005, due to varangel accidents, 7 (43.8%) had extremity amputations, 2 (12.6%) sustained extremity crush injuries, 2 (12.6%) had skull fractures, 2 (12.6%) suffered closed head trauma, 1 (6.2%) had a vertebral fracture, 1 (6.3%) had an orbital fracture, and 1 (6.3%) had a mandibular fracture; no fatalities were reported [12]. While instructive, direct comparison is limited by significant differences in the accident mechanisms and scales between the modern cable cars and varangel systems.

In another report summarizing two separate varangel incidents covered in the national media, three individuals aged 12, 27, and 60 died [13]. Following a modern cable car accident in Austria in 2003, crew members were reported to have a higher risk of spinal injuries than diesel bus drivers. Even with modern chairlifts, a retrospective study found that 13 out of 101 injuries associated with winter sports were caused by falling from the chairlift [14–16].

A study of autopsy records over 10 years (2007–2016) identified eight fatalities from varangel accidents, which were classified as primitive cable cars. These deaths were primarily caused by blunt trauma (cage collisions, cable strikes, and falls from height) and electric shocks. Most of the victims were workers in the tea and timber industries. According to autopsy findings, intracranial hemorrhage was identified as the leading cause of death [12].

In cable car accidents, injuries are generally caused by cable failure or electrical hazards. As with many metals, wire ropes develop fatigue under repeated loading [17]. Moreover, the material used may be inappropriate. To prevent potential problems, such as corrosion over time or issues caused by friction, the cables require regular lubrication [17]. Accordingly, attention must be paid to the mechanical and material properties of the cables during the design process. In addition, safety conditions must be ensured. Worldwide, there are various specifications related to this issue. According to these specifications, cable selection is a critical factor for safety. The most frequently reported causes of death in the literature are falls due to entrapment of clothing or body parts, being suspended in the air, or falling from a height, as well as various blunt or other types of traumas and electric shock, particularly in rainy weather [18].

In the rescue operation of the cable car accident, aerial evacuation by helicopter played a significant role and enabled the rapid transfer of the severely injured to nearby hospitals within the first few hours. Reasons for the greater importance of aerial evacuation in this process include the mountainous nature of the region, the presence of forested terrain, and the high altitude of the area, which causes ground transportation to take longer. Furthermore, due to the physical conditions of the region, fixed-wing aircraft or land vehicles couldn't approach the scene closely.

The optimal personnel requirement for such operations depends on the number of cabins and people to be evacuated, the duration of the rescue operation, the terrain, the technical support team, and the quantity of equipment required [19]. Strong winds further complicated operations. The rescue efforts involved one helicopter with night vision capability, four coast guard helicopters, one C-130 aircraft (Ministry of National Defense) to transport necessary materials from surrounding provinces, two rescue helicopters, 108 vehicles, six ambulances, and six drones that carried out evacuations using tethered systems.

The potential to use unmanned aerial vehicles (UAVs/drones) in disaster operations management has grown markedly. UAVs offer some advantages for their preferences in various pre- and post-disaster operations, such as being fast, safe, and flexible. The use of drones is considered to determine the conditions in the affected area after a disaster, especially when it is not possible to reach the affected area using ground vehicles. In the literature, drone applications in disasters are commonly classified into four categories: (1) mapping or disaster management, which has shown the highest contribution, (2) search and rescue, (3) transportation, and (4) training [3, 4]. Rapid delivery of essential supplies to affected regions is also critical to sustain vital activities during disasters [5].

The operation also involved coast guard units, AFAD, metropolitan fire services, a 20-person mountaineering team, 30 professional JAK (Gendarmerie Search and Rescue Team) mountaineers, a 25-person professional mountaineering team from neighboring provinces, 112 medical teams, UMKE, and police teams, making a total of 543 search and rescue personnel. UMKE's meticulous data recording and coordination substantially accelerated the rescue efforts. Nevertheless, the rescue operation lasted 23 hours, likely due to the large number of victims, challenging mountainous terrain, and the province's lack of prior experience with a cable car disaster.

The literature review reveals that studies on cable car accidents are generally conducted in ski resorts and that no previous analysis has focused on a cable car accident used for tourism purposes. However, our review of online sources and news reports indicates that this was not the first incident of its kind [17]. For example, Italy reported a fatal accident in 1960, resulting in the deaths of four people. In 2025, another accident involving the same cable car occurred near Naples under adverse weather conditions. One cabin fell to the ground, causing four fatalities at the scene and leaving one individual critically injured, who was evacuated by air ambulance. The remaining passengers, stranded in suspended cabins, were rescued individually. In 1998, during a training flight in the United States, a military aircraft flying at low altitude struck and severed a steel cable, leading to the crash of a cable car in the Dolomite Mountains and the deaths of 20 people. In May 2021, a cable car accident occurred near Lake Maggiore in the Alps, resulting in the deaths of 14 people [20]. Across these events, the TTCC accident involved the highest number of casualties overall, whereas the highest death toll [20] occurred in Italy in 2021. In that accident, the cabin reportedly fell approximately 20 meters and rolled downslope before being stopped by trees. This accident was higher energy due to the cabin rolling, and therefore resulted in more casualties. There was another accident in 1976 in Trentino (Italy), named the Cavalese cable car. That was the deadliest cable car crash in history, with 43 fatalities. Interesting fact, the cause of death was due to asphyxia rather than due to injuries suffered as a direct result of the fall [21].

Major accidents require medical rescue efforts supported by military-civil cooperation. Especially within the first 72 hours, referred to as the "golden hours" in trauma care, such collaboration is crucial to improve the prognosis of all types of traumas. To this end, the use of military helicopters, the involvement of professional mountaineers from JAK, the coordinated effort of police units, volunteer mountaineers, rescue personnel from civil society organizations, and healthcare teams were critical. These efforts demonstrated the importance of collaboration and communication among the national government, local administration, police, and fire departments, as well as the need for medical facilities to have evacuation plans. It is also recommended that, in major accidents and disaster scenarios, evacuations be supervised by emergency response teams and transportation managed by experienced disaster specialists [17, 22, 23].

Lessons learned from the cable car accidents and rescue operations were reflected in this manuscript as well. Accordingly, there is a need to develop new medical rescue frameworks, enhance expert training, strengthen military-civil coordination, and expand telemedicine applications for referrals and consultations. Moreover, the implementation of a field triage system ensured the timely transfer of patients to appropriate hospitals, preventing treatment delays.

Limitations of the study include that most epidemiological data on victims were obtained under chaotic disaster conditions, and changes in vital signs occurred due to the excitement of the event. This study includes only the first measurement of the vital signs. In this respect, a study design that evaluates changes in vital signs may be more useful.

5. Conclusions

To the best of our knowledge, this study is the first to analyze a cable car accident involving a system used primarily for tourism. Our findings can guide preparedness for similar incidents, including injury patterns and operational demands. To ensure preparedness for accidents on chairlift or cable car lines, including potential ground and aerial evacuations is key, training exercises should be conducted, a communication plan developed, and a dedicated response team established.

AVAILABILITY OF DATA AND MATERIALS

The data, code and materials are available on request from the corresponding author.

AUTHOR CONTRIBUTIONS

AA, DK, MK, MFG—performed the study design, data collection and analysis. AA, MK, MFG—performed the study design, data collection. DK, AA—performed the statistically analysis and article's drafting and all authors approved the study.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee. (Local ethics committee approval: University of Health Science, Antalya Training and Research Hospital Clinical Research Ethics Committee, Approval number: 20/8, approval date: 19 December 2024) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Informed consent to participate and for publication were obtained from all of the participants.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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