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Triage in Disaster Management

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Abstract

According to the World Health Organization, a disaster is an ecological phenomenon that is large and sudden enough to require foreign aid. Disaster disrupts health services in the affected community or region. The use of "disaster triage" in disaster response is considered the cornerstone in the management of mass injuries. Disaster triage systems allow rapid identification of critical injury without detailed investigation in a complex mass accident environment. In routine triage, patients with life-threatening and multiple system injuries are treated primarily. In disaster triage, if the number of injured is higher than the available medical resources, the patients who have a better chance of survival and require less time, material, and personnel in their intervention are given priority. In this way, secondary disasters are prevented in hospitals; morbidity, complications, and late deaths are reduced; survival is increased with appropriate treatment; and resources are used appropriately. Disaster triage is divided into 2 as triage applied in the field and in the hospital. Disaster triage applied in the field has 3 stages. In the first stage, casualties are quickly divided into triage categories according to their urgency. In the second stage of triage in the field, the injured are re-evaluated in the field, and treatment and referral priorities are determined. In the third stage of triage in the field, communication-based triage is applied. In this article, it is aimed to explain disaster triage, which should be applied both in the field and in the hospital environment, and the most commonly used triage systems.

Keywords: Disaster, management, triage

Introduction

Triage is derived from the French word "Trier" and means to classify, to select, or to separate. During the Franco-Russian war under Napoleon Bonaparte, the first triage was conducted by the chief surgeon, Baron Dominique Jean Larrey, to save priority soldiers regardless of rank. With the development of organized medical systems, triage has been rapidly developed and started to be used in emergency departments since the early 1900s.[1,2]

Triage is a method of systematically prioritizing the care and treatment of patients according to how urgently they need medical care.[3] Triage determines whether the patient's condition is vital, extremity threatening, and requires immediate treatment to relieve symptoms. In routine triage, patients with life-threatening and multiple system injuries are treated primarily.[1-3]

According to the World Health Organization, a disaster is an ecological phenomenon that is large and sudden enough to require foreign aid. A disaster is an event that exhausts the ability of local medical resources to provide comprehensive and definitive medical care in the region where it occurs.[4-6]

Since the resources available in a disaster will not be sufficient for all patients, disaster triage has been designed to provide priority care for the most urgent and to ensure the survival of the largest number of injured.[7,8] In disaster triage, if the number of injured is higher than the number of rescuers, those who have a higher chance of survival and require less time, material, and personnel for intervention are given priority. Disaster triage uses the categories in the routine triage system. Disaster triage focuses on ensuring the survival of the community rather than the survival of the individual.[8] In addition, it should be as fast as possible, since the prolongation of the time until the treatment will lead to fatal results.[7] The patient group that receives a red code in routine triage can be coded in black in case of disaster. Disaster triage is a difficult system that looks brutal but has rational rules. Disaster triage aims to provide treatment and care services to the maximum number of patients according to available resources by looking at the clinical status of the patients and the prognosis of the disease. With disaster triage, secondary disasters are prevented in hospitals; morbidity, complications, and late deaths are reduced; survival is increased with appropriate treatment; and resources are used appropriately.[1-3,7]

The 4 categories of triage commonly used in disasters are[6]:

- Red (urgent)—lifesaving interventions are required.
- Yellow (delayed)—immediate lifesaving interventions are not required.
- Green (minor)—minimal or patients who do not need medical care.
- Black—patients who are dead or have little chance of survival despite intensive medical intervention.

In our country, the color coding system accepted by the International Emergency Medicine Association, which is generally used in the simple triage and rapid treatment (START), North Atlantic Treaty Organization (NATO) triage systems, and pre-hospital emergency health services, is used in disasters.[8,9]

In this article, it is aimed to explain disaster triage, which should be applied both in the field and in the hospital environment, and the most commonly used triage systems.

Disaster Triage

Triage is an essential component of effective disaster management.[10] A disaster triage system must anticipate patients' needs for lifesaving interventions and evacuation with both speed and precision. It should categorize the patients and send them to a

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Table 1. Five-Category Triage System in the Field [9]

Categories	
Red (urgent)	Patients who can survive with medical intervention within minutes or hours
Yellow (delayed)	Patients who are serious but do not require immediate treatment
Green (minor):	Patients who do not require significant medical intervention
Black (dead)	Patients who are dead or incompatible with life
Gray (expectant)	Patients who have little chance of survival despite intensive medical intervention

Table 2. Stages of Field Triage in Disaster

Triage in the Field	
Primary triage	In the field, the injured are divided into triage categories. Priority is determined according to emergency treatment needs.
Secondary triage	Injured in the field are reevaluated. Treatment and referral priorities are determined. ✓ Patients who require hospital-level treatment ✓ Patients requiring treatment in the field ✓ Patients with minor injury
Tertiary triage	It is communication-based triage. The following questions are sought to be answered? ✓ Which patient will go to which hospital? ✓ Will the patient transfer by air or by road? ✓ Will the ambulance use a light or a siren?

pre-designed care area in order of priority and ensure that their treatment is started appropriately.[1,7]

Disaster triage systems require rapid identification of critical injury without detailed investigation in a complex mass accident environment. In general, triage systems classify patients into 4 or 5 categories based on their basic physiological criteria. Physiological variables used in current triage systems include the assessment of walking, respiration, circulation, and consciousness.[1,2,7,10]

In cases where the number of patients exceeded transport and treatment resources in a short time; "Disaster triage," which includes response plans that involve sharing resources, should be implemented.[8] Disaster triage is divided into 2: in the field and in the health institution.

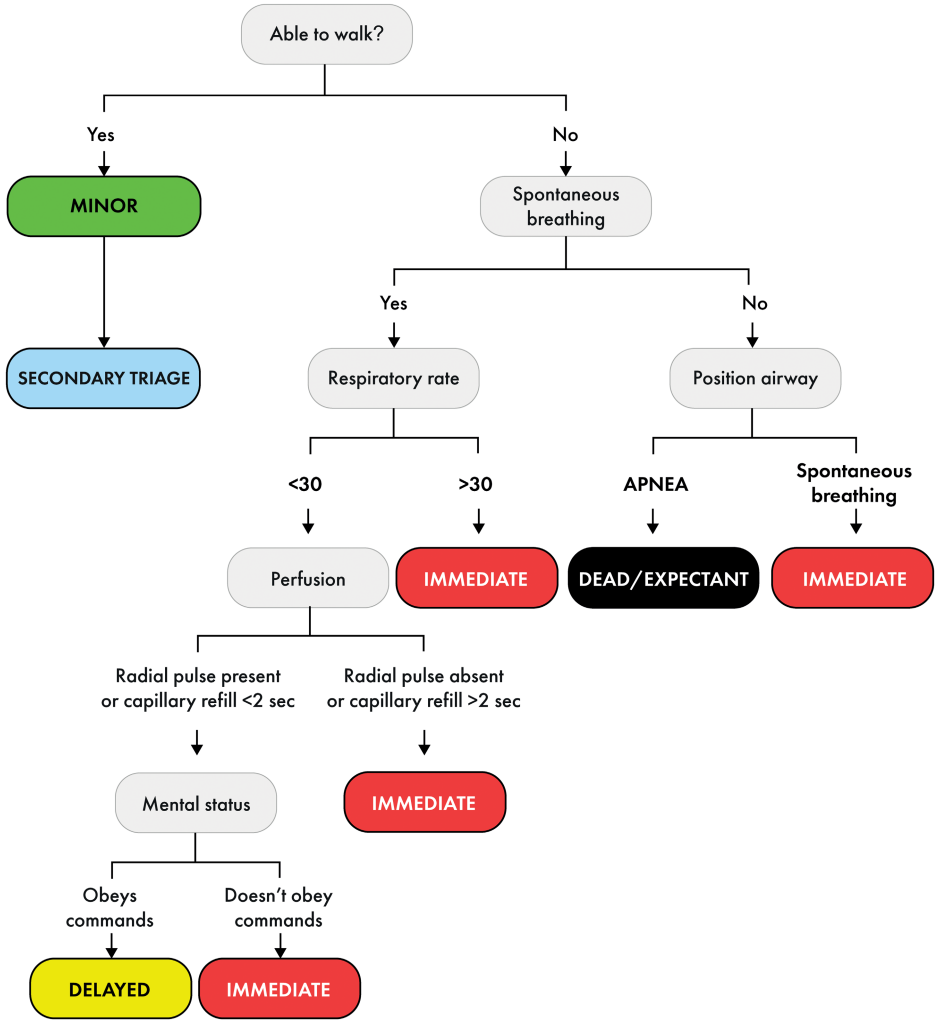

Figure 1. Simple triage and rapid treatment triage algorithm.

Disaster Triage in the Field

There are steps of activation, application, mitigation, and recovery in a disaster. Triage is included in the application part of disaster and is the initial part of medical management. The triage system to be used in the field should be simple and easily applied in the field. It should not contain a complex scoring system.[1]

In disasters, field triage is considered the cornerstone of disaster response. Disaster triage systems aim to achieve "the best for most people."[11] Triage systems applied in disaster require rapid identification of critical injury without detailed investigation in a complex mass accident setting.[1]

Disaster triage systems classify patients into 4 or 5 categories based on basic physiological criteria. Physiological variables used in current triage systems include walking, respiration, circulation, and consciousness.[1,2,7,8,9] In 4 triage systems, patients are categorized as red (immediate), yellow (delayed), green (minor), and black (dead or expectant). In 5-triage systems, there is an additional gray (expectant) category for hopeless patients with fatal injuries (Table 1). Patients in this category can use treatment resources after patients who are categorized as more priority.[12]

Triage in the field is carried out in 3 stages (Table 2).

Primary Disaster Triage in the Field

In the field, the injured are divided into triage categories and priority is determined according to their urgent care needs. There are many primary triage systems developed for use in disasters in the world. In this article, the most preferred triage systems will be mentioned.[1,2]

Simple Triage and Rapid Treatment Triage System

The START triage algorithm was first created and used in 1980 by the Newport Beach Fire Department and Hoag Memorial Hospital in California.[1,2,7] The START is the most common disaster triage system used in many countries including Turkey, the USA, Canada, Australia, Japan, and Israel.[1,2,8]

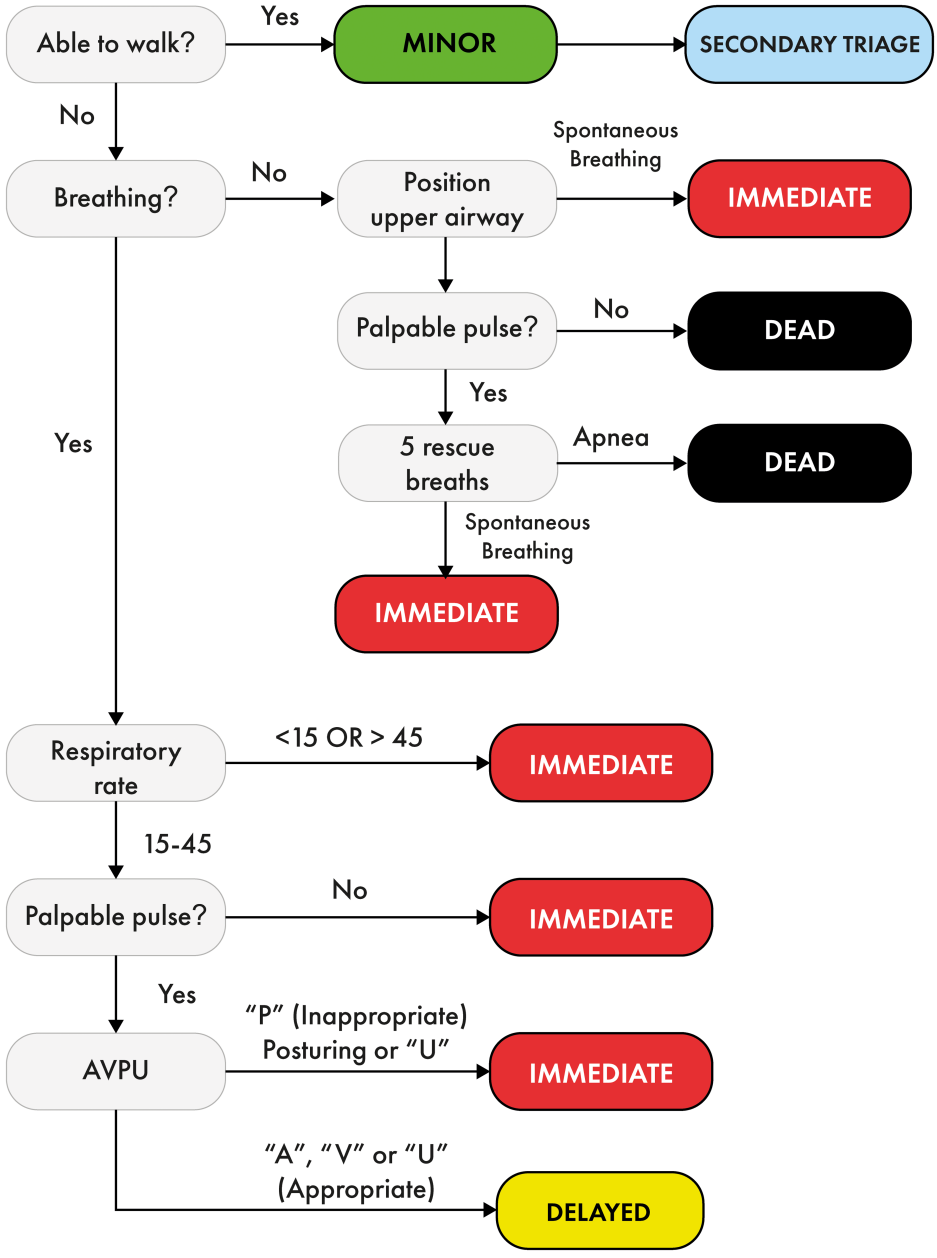

Figure 2. Jump simple triage and rapid treatment triage algorithm.

In the START triage system, it is aimed to evaluate all injured persons older than 8 years in 60 seconds or less according to the algorithm.[2,13]

The START triage system evaluates the patient's walking, respiration, perfusion, and consciousness parameters. It divides patients into 4 categories with different colors according to these parameters. Treatable life-threatening injury is coded in red, treatable but non-life-threatening injury is coded in yellow, non-serious injury is coded in green, and fatal injury or dead patient is coded in black.[1,2,7]

While applying START triage, first, patients are asked to walk a short distance to a designated place. Patients arriving on foot are coded in green (with minor injuries). These patients are then reevaluated for life-threatening injuries. Second, spontaneous breathing is examined. If the patient is still not breathing after airway patency has been established, the patient is coded "expectant" and considered unrecoverable. If the patient is breathing, the respiratory rate (RR) is checked. If the RR is > 30 per minute, the patient is considered urgent (red). If RR < 30 per minute, perfusion is evaluated. Perfusion is assessed by radial pulse or capillary refill. If there is no radial pulse or capillary refill > 2 seconds, the patient is considered urgent (red). If the patient has a pulse, the state of consciousness is evaluated in the last step. The casualty who cannot obey commands is coded as urgency (red). The injured person who obeys the commands is considered as "delayed" with a yellow code (Figure 1).[1,2,7,8,9]

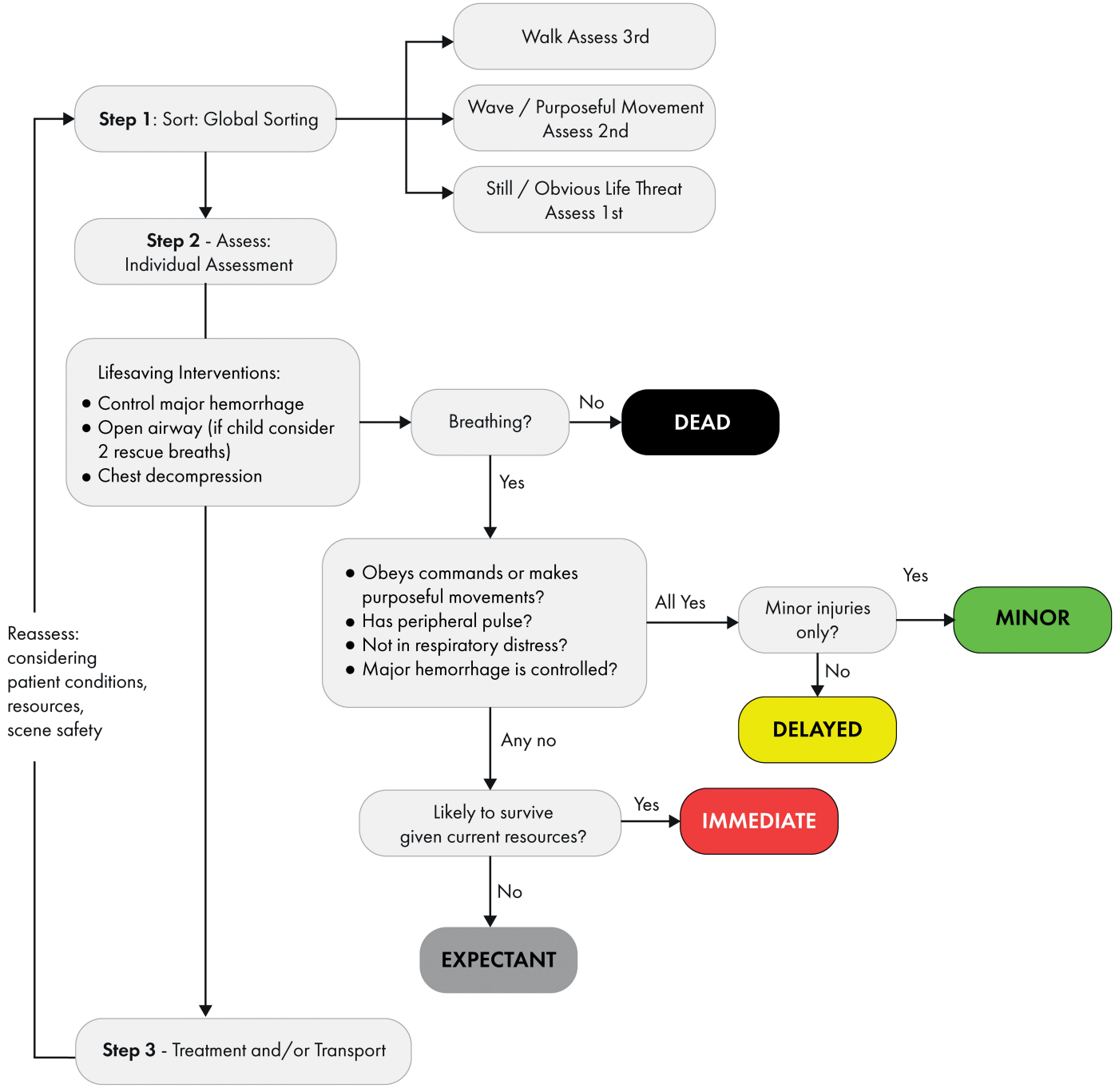

Figure 3. Sort, assess, life-saving interventions, treatment, and/or transport triage algorithm.

The START has been criticized as difficult to apply because it requires evaluating RR or capillary refill.[2,14] Since the capillary refill criterion in dark and cold environments in disasters is not an appropriate reflection of the circulatory system, this criterion was removed in the modified model of the triage system (MSTART).[2] Radial pulse assessment has been added instead of capillary refilling. Some researchers have developed new triage systems (such as Sieve) based on heart rate for circulatory evaluation.[1,2,7]

Jump Simple Triage and Rapid Treatment Triage System for Pediatric Patients

The Jump START triage system was developed from the START triage system for children aged 1-8. Jump START specifically takes into account the fact that the majority of pediatric arrests are respiratory-related.[15] In Jump START, unlike START, the circulation is evaluated before the "black triage code" is given to the child who is found to have no breathing. If there is no pulse as a result of the evaluation, the triage code is black. Five rescue breaths are given to stimulate respiration in children with a peripheral pulse (Figure 2). If breathing starts, the patient's triage code is red, if not, the triage code is black. Additionally, the triage code for children who cannot walk starts from yellow.[1,8,9]

Sort, Assess, Life-Saving Interventions, Treatment, and/or Transport Triage System

The sort, assess, life-saving interventions, treatment, and/or transport (SALT) triage system was developed in 2008 by a working group of the Centers for Disease Control and Prevention (CDC). The CDC considers SALT the most scientifically designed triage system. The SALT is designed for both adult and pediatric patients.[1,14,15]

The SALT divides the injured into 5 categories: dead (already), expectant (little chance of survival no matter what you do), immediate (needs help now), delayed (can wait a while for treatment), and minimal (get yourself to the hospital and you will be fine). These categories are usually color-coded black (dead), red (immediate), yellow (delayed), and green (minor), respectively.[2,7,9,14]

The SALT triage system includes 3 steps: (Figure 3)

The first step is also called general sorting. At this stage, patients are asked to walk toward a collection area and act purposefully. Patients are divided into 3 categories according to their responses. The patients in the first category are those who have life-threatening injuries and should be evaluated first. The second category is patients who can only move and need to be evaluated as secondary. The third category is the patient group that can walk independently and should be evaluated in the third row.[1,2,7,9,14]

The second step is evaluation and in this step, individual evaluation is made. Initially, life-saving interventions (including major bleeding control, airway opening, chest decompression, and autoinjector antidotes) are performed to protect patients' vital signs. If the patient is not breathing after life-saving interventions, the patient is considered dead. After life-saving interventions, if the patient has breathing, consciousness status, peripheral pulse, respiratory distress, and major bleeding are checked. If there is a problem in any of these, the patient is coded in red. If there is minor injury as a result of questioning the state of consciousness, peripheral pulse, respiratory distress, and major bleeding, the patient is coded in green. If the patient has a more serious injury, the patient is coded in yellow (Figure 3).[1,2,7,9,14]

The major difference in the SALT system is the expectation category represented using the gray color. Management of the expected category is highly dependent on available medical resources and the number of casualties.[1] The effectiveness of the SALT system has been proven to be as good as the Jump START system and its use in pediatric patients has been recommended.[15]

The third step is treatment and/or transport.

Sieve Triage System

Sieve triage is used in parts of Europe, Australia, and the United Kingdom. It is similar to START triage. The only difference is the measurement of heart rate in the evaluation of circulation. If the patient's heart rate is >120 per minute or <40 per minute, the patient is coded in red. If the patient's heart rate is <120 per minute or >40 per minute, it is coded with the yellow triage code.[2]

North Atlantic Treaty Organization (Military) Triage System

It was developed for all NATO member countries to use a standardized triage system in multinational military operations. The main purpose of military triage is to treat more wounded soldiers and send them back to the battlefield. In this method, immediate and rapid classification of injured people is made according to the type and severity of injury, probability of survival, and priority of treatment in order to provide the best health care to the largest number of people.[2,8,16]

The codes, meanings, and symbols of the NATO Triage system are as follows:[16]

- T1: Unstabil Urgent (Rabbit)
- T2: Urgent (Tortoise)
- T3: Non urgent (Pedestrian)
- T4: Expectant (Cross)

Secondary Disaster Triage in the Field

In cases where the transport of patients from the scene is significantly prolonged, secondary triage should be performed in the field. These situations are the number of injured is high and it is not possible to transfer all patients to hospitals immediately, roads are closed, the number of ambulances is not sufficient, pre-hospital resources are insufficient, and hospital infrastructures are damaged.[4] The injured who have to stay in the disaster field for a long time are re-evaluated in the field. Treatment and referral priorities are determined.[2]

When hospitals become unusable in the event of a disaster, field hospitals should be established in predetermined safe areas. Field hospitals should provide health services to both hospitalized patients and those injured in the disaster.[17] However, in the early period when hospitals become unusable and field hospitals have not yet been established, patients and those injured in the disaster should be transferred to the hospitals in the centers closest to the disaster area. Under these circumstances, the importance of secondary disaster triage in the field increases.[2,4]

Secondary triage systems have also been developed to be used in this second assessment in the field. Secondary assessment of victim endpoint (SAVE) and Sort triage systems can be used in the secondary evaluation of patients.[2]

Secondary Assessment of Victim Endpoint Triage System

The SAVE triage system aims to categorize patients reflecting the balance between resource utilization and probability of survival. The SAVE triage system uses tools to predict the patient's clinical status, such as the Glasgow Coma Scale (GCS), Mangled Extremity Severity Score, and postburn survival rate data (Table 3). Once the patients are evaluated, they are grouped into 1—require hospital-level intervention, 2—will significantly benefit from interventions in the field, and 3—survive whether they receive care or not.[2,4,18]

Table 3. SAVE Triage System

Glasgow Coma Score (GCS)	Burn İnjury	Mangled Extremity Severity Score (MESS)
GCS ≥ 8: it must be treated. The chance of recovery with a normal or good neurological outcome is greater than 50%.	Less than 50% chance of survival	MESS ≥ 7: very high risk of amputation
GCS ≤ 7: comfort care only	70% TBSA burn	MESS ≤ 7: attempt limb salvage
	Age ≥ 60 + inhalational injury	
	Age ≤ 2 + 50% TBSA burn	
	Age ≥ 60 + 35% TBSA burn	
Mangled Extremity Severity Score (MESS)		
Skeletal/soft-tissue injury		
Low energy (stab; simple fracture; pistol gunshot wound)		1
Medium energy (open or multiple fractures, dislocation)		2
High energy (high speed MVA or rifle gunshot wound)		3
Very high energy (high speed trauma + gross contamination)		4
Limb ischemia		
Pulse reduced or absent but perfusion normal		1*
Pulseless, paresthesias, diminished capillary refill		2*
Cool, paralyzed, insensate, numb		3*
Shock		
Systolic BP always > 90 mmHg		0
Hypotensive transiently		1
Persistent hypotension		2
Age		
<30		0
30-50		1
>50		2

*Score doubled for ischemia > 6 hours. MESS, Mangled extremity severity score; GCS, Glasgow coma scale; TBSA, total body surface area; MVA, motor vehicle accident; BP, blood pressure.

Table 4. Sort Triage System

- 24.Evaluate GCS
- 25.GCS + RR+ SBP

Score	4	3	2	1	0
GCS	13-15	9-12	6-8	4-5	3
RR/min	≥30	10-29	6-9	1-5	0
SBP/mmHg	≥90	76-89	50-75	1-49	0

- 26.Create triage category

Total score = 12 GREEN
Total score = 11 YELLOW
Total score = ≤10 RED

GCS, Glasgow coma scale; RR, respiratory rate; SBP, systolic blood pressure, min, minute.

Sort Triage System

In the first step in the sort triage system, GCS is determined. In the second step, the patient's RR and systolic blood pressure are measured and categorized. The patient's GCS, RR, and systolic blood pressure values are added. In the third step, patients are coded (labeled) according to the score obtained. If the number is 10 or less, the injured is categorized into the red class, if the number is equal to 11, the yellow class, and if the number is 12 points, the patient is categorized into the green class (Table 4).[2,18]

Tertiary Disaster Triage in the Field

The third stage of disaster triage in the field is communication-based triage. Answers are sought to the questions of which hospital the patients will go to, whether they will go by land or air, and whether to use a light or a siren in an ambulance.[6,8]

The local emergency communications or emergency operations center should be in contact with hospitals in the affected area. The total number of casualties, the number of serious injuries (which may need intensive care unit capacity), and the number of minor injuries should be reported to the emergency contact center and hospitals. Hospitals should forward data, such as bed availability, the number of casualties received so far, and the number of additional casualties the hospital is ready to accept, to their local emergency contact center.[4] Equal distribution of the injured to hospitals should be ensured as much as possible. For this, good communication should be established between the emergency health services command in the field and the hospitals.[4]

Triage Area

It is the place where patients are classified and triage cards are inserted and should be set up in the closest and safest place to the scene. The triage responsible person organizes the rescue of patients in dangerous areas by rescue teams and commands them according to the latest developments. It evaluates, categorizes and labels life-threatening patients in the most accurate way without distruping triage. In addition, the person responsible for the triage organizes the work to determine the "danger zone" boundary. The triage supervisor keeps the condition of the patients under control by performing triage continuously and again. The triage responsible person should be clinically experienced, able to make quick decisions, be a leader, cool under stress, clear, witty, insightful, problem-solving and creative, knowledgeable about expected pathologies, and knowing the infrastructure and possibilities of the region.[19]

Triage Cards

Triage cards are cards that are colored according to classification (red, yellow, green, black), resistant to the external environment,

and designed to be attached to the patient. The injured are marked with triage cards colored according to the classification. Simple identification (number, name, gender), information about the injury, medical interventions applied to the patient, and the time of application are written on the triage cards. The use of triage cards during a disaster ensures that patient information is transferred from the scene to the last health institution to which the patient is transferred.[8,9,20]

Triage Errors

It is always possible for errors to occur in triage in disaster chaos. Over- and under-triage are triage errors. Over-triage occurs when non-critical patients without life-threatening injuries are assigned to emergency care. The higher the incidence of patients undergoing over-triage, the more overwhelmed the medical system. Under-triage occurs when critically injured patients requiring emergency medical care are assigned to a delayed category. Under-triage causes delays in medical treatment and also increases mortality and morbidity.[6]

The triage problems are listed as follows:

- Failure to perform triage correctly.
- Failure to properly distribute patients to hospitals.
- Sending patients to the same hospital all the time even though there is no place.
- Failure to follow the trace of the sent patient.
- Failure to keep accurate or sufficient records.
- Early transfer: transporting the patient to the hospital before the completion of the triage assessments after the emergency care.
- Under-triage: It is the mistaken evaluation of patients at a low level of urgency, even though it is critical and requires urgent medical intervention.
- Over-triage: Referring non-critical patients to the critical aspect area.

Disaster Triage in Hospital

In routine emergency department triage, patients with life-threatening and multiple system injuries are treated first. In the emergency department triage in disaster situations, on the other hand, if the number of injured is higher than the number of rescuers, the injured who have a better chance of survival and whose intervention requires less time, material, and personnel are given priority.[1,2]

The Emergency Severity Index (ESI), published by the American Association of Emergency Nurses and recommended by the American Association of Emergency Physicians, is widely used in routine emergency triage. This triage system is a 5-triage system and is categorized according to the resource requirement to be used (Figure 4). According to this triage system, category 1 represents the most urgent patient group, and category 5 represents the least urgent patient group.[21] The resources accepted during the application of the ESI triage system are laboratory, electrocardiography, direct radiography, ultrasound, computed tomography, magnetic resonance imaging, angiography, intravenous fluids, injection, nebula, expert consultation, and simple interventions. During the application of the ESI triage system, anamnesis, physical examination, initiation of saline or heparin, giving oral therapy, tetanus immunization, prescribing, telephone consultation, dressing, and splint applications are not considered as resources.[22]

In Türkiye, as routine emergency triage, a triple triage system has been applied since 2009 in accordance with the "Communiqué on Implementation Procedures and Principles of Emergency Services in Inpatient Health Facilities" (Table 5). According to this triage system, patients are divided into 3 groups as red, yellow, and green.[23]

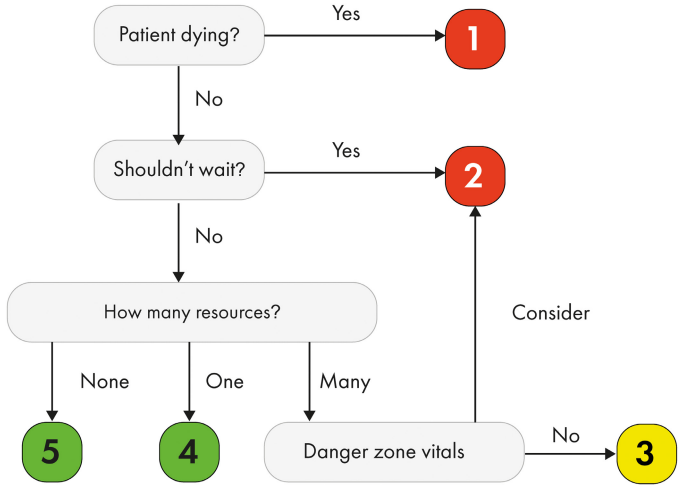

Figure 4. Emergency Severity Index Algorithm.

Triage in case of disaster has to be different from routine emergency department triage. Disaster triage starts to be applied in case of sudden development of incidents in mass injuries and inadequacy of health resources. In this case, the injured, who have a better chance of surviving, require less time, less material, and less personnel, are treated with priority.[21]

In case of disaster, it would be most appropriate to make a 5-triage system by adding gray and black areas to the triple system recommended by the Ministry of Health in the hospital triage system (Table 6). In this way, the possibilities at hand will be used more appropriately.[12]

Conclusion

The application, reliability, sensitivity, and specificity of triage systems developed for use in disasters are verified by simulations. However, the correct use of triage systems and their success rates may differ in the real chaotic environment of a disaster. A simple triage system that quickly identifies critical injuries without detailed investigation would be easy to implement in a disaster.

Table 5. Routine Emergency Department Triage Used in Türkiye

Red area	
Category 1	Life-threatening conditions that require a rapid aggressive approach, urgent simultaneous assessment, and treatment
Category 2	It includes situations that are highly life-threatening and need to be evaluated and treated within 10 minutes.
Yellow area	
Category 1	Includes potentially life-threatening conditions, risk of limb loss, and significant morbidity.
Category 2	Includes conditions with intermediate and prolonged symptoms and potential for seriousness.
Green area	
Outpatients are patients who are stable in general condition and have simple health problems that can be treated on an outpatient basis.	

Table 6. Hospital Triage Zones in Disaster

Red zone	✓ It is the area where patients with life-threatening injuries are intervened. ✓ It should be installed close to the operating room and intensive care units. ✓ There should be doctors and auxiliary health personnel who can provide emergency intervention and treatment. ✓ The "Trauma Team" should work effectively in this area.
Yellow zone	✓ Patients evaluated in this region are severely injured, but they can hemodynamically tolerate some delays in interventions. ✓ The trauma team left over from the red zone and the doctors of other branches should work in the yellow zone.
Green zone	✓ Patients who can walk and do not need emergency intervention are evaluated. ✓ After the initial assessment/intervention, patients can be sent to other centers or to their homes. ✓ Less-experienced physicians may be assigned to the green zone.
Gray zone	✓ It is the area where patients with no life expectancy are followed and their analgesia is performed. ✓ Nurses and other assistant health personnel may work.
Black zone	✓ Patients who came to the hospital as dead or died in the hospital are in this zone. ✓ Forensic Medicine Specialists, Pathology specialists, and morgue officers can work in this zone.

As a result, "triage" in disasters is considered the cornerstone of disaster response. Suggested triage systems should be learned and used in disaster situations in order to quickly recognize critical injuries in disasters and to provide care to the maximum number of patients who will benefit, taking into account available resources.

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