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Systematic Approach to the Trauma Patient in Disaster

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Abstract

A disaster is an event that consumes the local medical resources necessary to provide comprehensive and definitive medical care in the area where it occurs. In a disaster, it is primarily aimed to provide care to the patients whose situation is the most urgent and who can benefit most from the treatment. Trauma is a leading cause of death worldwide. Traumatic injuries can range from small, isolated wounds to complex injuries involving multiple organ systems. Disaster situations are chaos. In this chaos, the approach to the trauma patient must be in a certain sequence, order, and speed. Injured patients should be evaluated and treated according to their current vital signs, state of consciousness, and mechanism of injury. In order to reduce morbidity and mortality after traumatic injuries, trauma patients should be managed systematically from the scene to the emergency department.

Keywords: Disaster, injuries, management, trauma

Introduction

The medical effects of disasters, whether natural or man-made, are difficult to manage. It is aimed to provide the highest benefit for the large number of patients in the management of traumatized patients in disaster.[1] All trauma patients need a systematic assessment to maximize outcomes and reduce the risk of undiscovered injury.[2] Trauma care should be organized around the concepts of rapid assessment, triage, resuscitation, diagnosis, and therapeutic intervention.[3]

Trauma is a leading cause of death worldwide. Traumatic injuries can range from minor isolated injuries to complex injuries involving multiple organ systems.[2] The main causes of death after trauma are head injury, thorax injury, and great vessel injury. Most deaths occur either at the scene or within the first 4 hours after the patient arrives at a trauma center.[2-5] Every year, more than 45 million people worldwide experience moderate-to-severe disability due to trauma.[2] In order to reduce morbidity and mortality after traumatic injuries, trauma patients should be systematically managed from the scene to the emergency department.[1-3] The purpose of systematic trauma management in disasters is to identify existing problems step by step and treat them immediately. [1-3]

Systematic Approach to the Trauma Patient

The approach to the trauma patient should be in a certain order. Injured patients are evaluated and treated according to their current vital signs, state of consciousness, and mechanism of injury.[3]

The stages of approach to the trauma patient are as follows:[1]

1. Preparation
2. Triage
3. Primer survey (airway, breathing, circulation, disability, exposure (ABCDEs)) and resuscitation
4. Consideration of the need for patient transfer
5. Secondary survey (head-to-toe evaluation and patient history)
6. Reevaluation and continued postresuscitation monitoring
7. Definitive care

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Preparation

Preparation for trauma patients takes place in 2 different clinical settings: prehospital and hospital. First, in the prehospital phase, events are coordinated with clinicians at the receiving hospital. Second, at the hospital stage, preparations are made to facilitate rapid trauma patient resuscitation.[1]

In disaster situations, the management of trauma patients should be carried out within the framework of preestablished hospital and regional disaster plans. According to the magnitude of the disaster, the emergency health services teams that will go to the field are directed first. The patients are evaluated in the field, and triage and interventions are made according to the available resources. In the next stage, the hospitals to which the patients will be transferred are determined and communication is established. Coordination between the emergency health services in the disaster area and the staff in the hospital can greatly speed up treatment in the field.[1,6,7]

Triage

Triage includes the classification of patients according to the sources required for treatment and the sources that actually exist. The order of treatment is based on airway, breathing, circulation (ABC) priorities (airway maintenance with cervical spine protection and assesment of breathing and circulation). Other factors that may affect the priority of triage and treatment include the seriousness of injury, survival ability, and existing resources.[1-3]

In the disaster, triage is performed according to the treatment needs of the patients and their priorities, depending on existing resources. In cases where the number of patients and the severity of injuries do not exceed the existing persons and resources, those who have life-threatening and multiple system injuries are first intervened. In the disaster, the number of patients and the seriousness of injuries exceed the capacity of the facility and personnel. In cases where existing resources are insufficient, critical patients

who have the greatest chance of survival with the least expenditure of time and resources (i.e., equipment, supplies, and personnel) are treated first.[1,3,7]

Primer Survey (Airway, Breathing, Circulation, Disability, Exposure) and Resuscitation

A clear, simple, and regular approach is required in the management of a seriously injured patient.[1] In the primer survey, the aim is to try to prevent and eliminate sudden and life-threatening situations (Figure 1). Trauma patients are evaluated in terms of existing injuries, vital findings, and injury mechanisms. Treatment priorities of the patients are determined. The steps in the primary survey should be applied in a system in which they are listed according to their vital importance. The problem that exists at each step is solved, and the next step is started. If the patient worsens during the evaluation phase, it is necessary to evaluate it again.[1-3,6,8] These steps are listed as AcBCDE (Table 1).

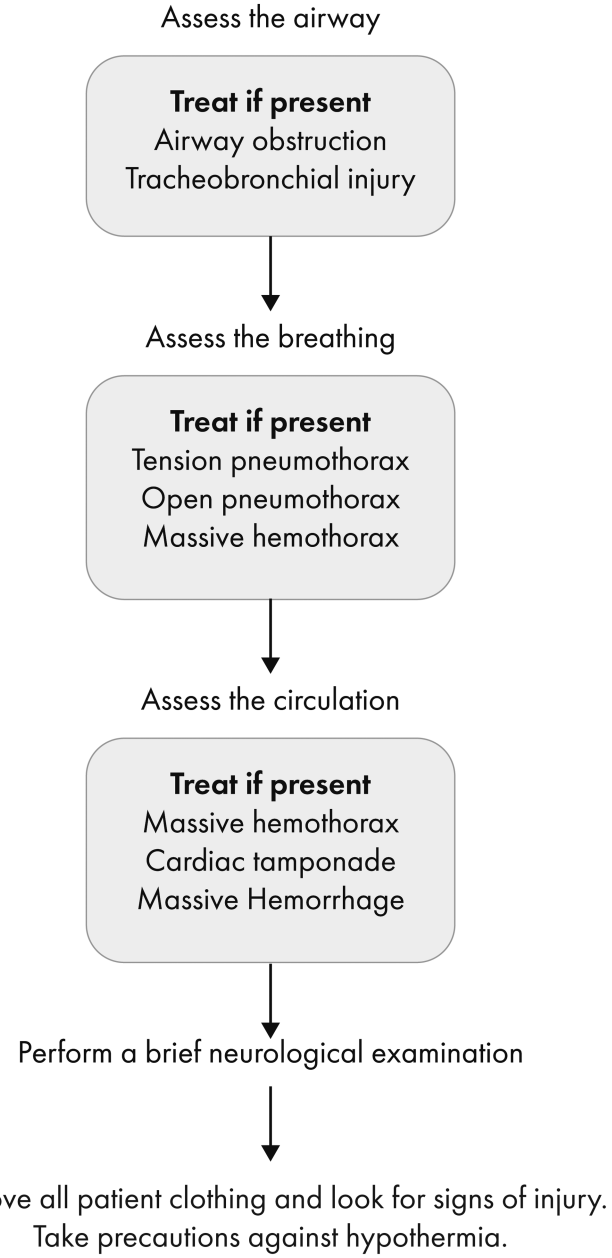

Figure 1. Primer survey in trauma patient.

Life-threatening injuries that need to be detected in the primary perspective are shown in Table 2.

Airway Maintenance with Cervical Spine Protection

Airway obstruction is an important cause of death immediately after trauma. The airway may be obstructed by tongue, foreign body, secretion, blood, maxillofacial injury, aspirated material, tissue edema, or expanding hematoma.[1-3,6] Airway assessment and management is the critical first step in the management of a seriously injured patient.[2]

First of all, hold the patient's head with both hands and ask "Are you okay." If the patient speaks rationally, it means that the patient's airway is open, and breathing and brain perfusion are sufficient. If the patient makes a rough and loud sound, it means that there is partial obstruction. In this case, the patient's mouth is cleaned, secretions are aspirated, and oxygen is started. In this way, the patient is provided to breathe easily.[1,3]

The patient who does not respond is considered unconscious. With the "Look, Listen, Feel" technique, it is checked whether there is breathing or not. If it is determined that the patient is not breathing and the mouth is clean, it is considered that the tongue is blocking the airway.[1]

Chin lift and jaw thrust maneuvers can be used to maintain airway patency. In the chin lift maneuver, 1 hand applies downward pressure to the patient's forehead, while the tips of the index and middle fingers of the other hand are placed under the patient's chin, and the chin is lifted upward. Providers should avoid hyperextending the neck when using this maneuver. The jaw thrust maneuver should be used in patients with suspected spinal injury. To perform the jaw trust maneuver, the tips of the middle or index fingers are placed behind the angle of the mandible. The mandible is lifted up until the lower incisors are in front of the upper incisors.[1-3,6,8]

If the patient is unconscious and has no gag reflex, placement of the oropharyngeal airway may help temporarily. When the patient's airway patency cannot be achieved, the definitive airway method should be applied.[1]

If breathing is insufficient or absent, the patient's breathing should be supported with an ambu mask. If we do not have an ambu mask, breathing is done from mouth to mouth or nose. Patients with a severe head injury with altered consciousness or a Glasgow Coma Scale (GCS) score of 8 or less usually require placement of a definitive airway.[1,6] Thus, the airway is protected, and secondary brain damage due to hypoxemia is prevented. Endotracheal intubation in trauma patients is often difficult because of the need for neck immobilization, presence of blood/vomit, or upper airway injury. In these cases, airway patency can be achieved with extraglottic devices such as a combitube or laryngeal mask. If video laryngoscopy is available, it will be easier to perform endotracheal intubation on the trauma patient.[1-3,6]

Spinal immobilization devices, such as a cervical collar, may make it difficult to maintain airway patency and provide adequate ventilation.[1] The motion of the cervical spine should be restricted by applying manual stabilization while maintaining airway patency. While one person provides cervical stabilization, the second person should control the airway and ventilation.[2,3,9]

All blunt trauma patients should be assumed to have a cervical spine injury until proven otherwise. Patients with isolated penetrating trauma, no secondary blunt injury, and an intact neurologic examination typically have no unstable cervical injury.[10,11]

Table 1. Evaluation Stages of Primary Survey

AcBCDE	
Ac (Airway)	Airway maintenance with cervical spine protection
B (Breathing)	Breathing and ventilation
C (Circulation)	Circulation and hemorrhage control
D (Disability)	Assessment of neurologic status
E (Exposure/environment)	Exposure and environmental control

When evaluating and managing a patient's airway, great care should be taken to avoid excessive movement of the cervical spine. Excessive neck movements should be avoided during examination or intervention, and neck movements should be limited by using a cervical collar except for patients with penetrating trauma. The use of a cervical collar and a back board is better than using a cervical collar alone to restrict cervical movements. The best protection is the use of a head support, a cervical collar, and bands together.[1-3,10]

Breathing

After the patient's airway patency is established, the adequacy of oxygenation and ventilation is evaluated.[2,11] Chest trauma is responsible for 25 percent of trauma-related deaths due to its detrimental effects on oxygenation and ventilation.[5]

All patients should be administered pulse oximetry and given oxygen. According to the patient's needs, breathing should be provided with a reservoir mask, balloon mask, or intubation. Ventilation rate, capnography, and arterial blood gas measurements should be used to monitor the adequacy of the patient's breathing.[1]

In order to evaluate breathing, the functions of the lungs, chest wall, and diaphragm are checked. Respiratory rate, depth, and pattern are evaluated. Thoracic examination is performed by inspection, palpation, and auscultation. Jugular venous distension, tracheal position, and chest wall movements are evaluated.[3,10] Injuries on the chest wall are evaluated by the mechanism of injury. Subcutaneous emphysema is investigated with palpation, and lung sounds are heard.[1,3,10]

There are 3 emergencies that affect breathing in primary survey and must be identified and treated:[1]

- Tension pneumothorax
- Open pneumothorax
- Massive hemothorax

Tension pneumothorax occurs in cases of advanced air leakage with a 1-way valve system. Clinically, hypotension, severe dyspnea, and unilaterally decreased lung sounds are seen. In addition, tracheal deviation, hyperresonance, and mediastinal shift may also occur. There is a picture of "obstructive shock" due to mediastinal shift and impaired venous return.[1-3,12]

Table 2. Conditions That Need to Be Detected and Treated in the Primary Survey

A (Airway)	**B (Breathing)**	**C (Circulation)**
Airway obstruction Tracheobronchial injury	Tension pneumothorax Open pneumothorax Massive hemothorax	Massive hemothorax Cardiac tamponade Massive hemorrhage Traumatic arrest

The primary intervention in suspected tension pneumothorax is needle decompression. In adult patients, needle decompression is recommended at the intersection of the fourth or fifth intercostal space and anterior axillary line. In pediatric patients, it is recommended to perform needle decompression at the intersection of the second intercostal space and the midclavicular line. If needle decompression fails, finger thoracostomy is recommended as a second option for experienced entrepreneurs.[1,3,12]

Open pneumothorax occurs when the injury to the thoracic wall is larger than 2/3 of the trachea diameter. The airflow passes through this injury area instead of the trachea.[1,12]

Large injuries to the chest wall that remain open can result in an open pneumothorax, also known as a sucking chest wound. The first-choice intervention in patients with open pneumothorax is applying Vaseline gauze to the wound area and taping it on 3 sides. Tape it securely on only 3 sides to provide a flutter valve effect. The definitive treatment is primarily tube thoracostomy followed by closure of the defect in the thoracic wall.[1,12]

Massive hemothorax results from the rapid accumulation of more than 1500 mL of blood or one-third or more of the patient's blood volume in the chest cavity.[1,10,12] Common causes of massive hemothorax include injury to the lung parenchyma, intercostal arteries, or internal mammary arteries. Each hemithorax may hold 40% of a patient's circulating blood volume.[12]

Massive hemothorax is life-threatening and has 3 mechanisms. First, acute hypovolemia does not allow sufficient preload to maintain left ventricular function and adequate cardiac output. Second, collapsed lung causes hypoxia by creating alveolar hypoventilation, ventilation-perfusion mismatch, and anatomical shunt.[1,3] Third, the hydrostatic pressure of the hemothorax compresses the vena cava and the pulmonary parenchyma, further disrupting the preload and increasing pulmonary vascular resistance, respectively.[1,3,12] Clinically, it can be recognized by more prominent signs of hypotension or shock, dyspnea, and decreased breath sounds at the site of injury. Its treatment is tube thoracostomy and blood replacement if indicated.[3]

Circulation and Hemorrhage Control

The most important cause of death due to injuries is hemorrhage. The hemodynamic status of the patient should be evaluated promptly. For this, the patient's state of consciousness, skin color, pulse, and capillary filling are evaluated.[1-3,6]

Clinically, altered consciousness can be seen as a result of decreased blood volume and decreased brain perfusion.[6,10]

In hypovolemia, mottling, cyanosis, and pallor are observed on the skin. Capillary refill time is viewed from the nail bed. Its normal duration is less than 2 seconds, a prolonged period indicates

decreased perfusion. However, the sensitivity of capillary refill time is low.[1,10]

The patient's pulses (carotid, femoral, and radial) are palpated, and the initial assessment of the circulatory status is made. In patients without volume loss, the pulse is usually full, slow, and regular. A rapid and superficial pulse may be an early sign of hemorrhage.[6,10] If the patient's pulses are taken and no significant external bleeding is detected, the circulation can be assumed to be temporarily intact.[2] In the primary survey, time should not be lost by trying to determine the exact value of the blood pressure. Instead, evaluation for the presence of bleeding, bleeding control, providing of intravenous/intraosseous route, and shock clinic should be investigated.[10]

In the primary examination, for severe external bleeding, the bleeding is controlled first. For this, the open wound is covered with a clean cloth, and external pressure is applied. Compression bandages and hemostatic dressings can also be used to stop bleeding. In extremity injuries, if the bleeding cannot be stopped with pressure and is life-threatening, a tourniquet can be applied. In open wounds, especially in scalp injuries, large sutures and temporary sutures can control bleeding. Blind clamping can result in damage to nerves and veins.[1-3,6]

The major areas of internal bleeding are the chest, abdomen, retroperitoneum, pelvis, and long bones. The source of the bleeding is usually determined by physical examination and imaging. The primary radiological radiographs in multiple traumas are cervical, lung, and pelvis radiographs.[1,3,10] The focus of bleeding can be determined by bedside focused assessment by sonography for trauma (FAST). It is recommended for primary survey. With FAST, free fluid is quickly searched in 4 regions.[10]

Immediate management of internal bleeding may include chest decompression, external pelvis stabilization, and application of limb splints. Vascular access must be established.[1,6]

If the patient has signs of shock (Table 3), vascular access should be established with at least 2 14-16 G intrachalet, and 1000 cc crystalloid fluid replacement should be performed.[1] In the meantime, the cause of the shock should be investigated. The most likely cause of shock in trauma patients is hemorrhage.[2] If peripheral vascular access is not established, intraosseous access, central venous catheterization, or the cutdown method can be used. First of all, blood group, cross-match, blood gas, and β-human chorionic gonadotropin should be studied in multiple trauma patients. In the case of moderate/severe shock, early blood product transfusion is recommended.[1,2] If a patient is not responding to initial crystalloid therapy, the patient should be given a blood transfusion.[1-3] It is recommended to apply tranexamic acid within the first 3 hours after injury in trauma patients with severe bleeding.[1]

Table 3. Signs and Symptoms of Hemorrhage

Parameter	Class I	Class II (Mild)	Class III (Moderate)	Class IV (Severe)
Approximate blood loss	<15%	15%-30%	31%-40%	<40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale	↔	↔	↓	↓
Base deficit	0 to −2 mEq/L	−2 to −6 mEq/L	−6 to −10 mEq/L	−10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive transfusion protocol

Disability (Assessment of Neurologic Status)

In the primary survey, a brief neurological examination is performed. The patient's state of consciousness, pupil diameter, and reaction to light, AVPU (alert, verbal, pain, unresponsive), or GCS are evaluated (Table 4).[1-3,6] In addition, if there is a spinal cord injury, lateralization signs and sensory level should also be noted. Spinal immobilization should be performed in all patients with potential for spinal cord injury.[3,6]

Exposure and Environmental Control

In the primary survey, all the clothes of the patient should be cut and removed from the seams, if possible. Cut and removed clothing should be kept as forensic evidence. The patient's entire body should be examined for signs of injury. Missed injuries can be serious.[1-3,6,10] Frequently neglected areas are the scalp, armpit folds, gluteal region, perineum, and abdominal folds of obese patients. Penetrating wounds can occur anywhere. If the conditions are suitable, the patient is turned on his side with the log maneuver and the patient's back is examined.[1-3,6,10]

After completing the assessment, the patient is covered with a warm blanket or external warming device to prevent hypothermia. Hypothermia contributes to both coagulopathy and the development of multiple organ dysfunction syndrome.[13] If the patient has hypothermia, intravenous fluids are warmed before infusion and a warm environment is maintained.[1]

Table 4. Scoring Systems Used to Assess Trauma Patient Consciousness

Glasgow Coma Scale		
Eye Opening	**Verbal Response**	**Motor Response**
Spontaneous (4)	Oriented (5)	Obeys commands (6)
To speech (3)	Confused (4)	Localizes pain (5)
To pain (2)	Inappropriate words (3)	Flexion withdrawal to pain (4)
None (1)	Incomprehensible sounds (2)	Abnormal flexion (3)
Non-testable	None (1)	Extension (2)
	Non-testable	None (1)
		Non-testable
AVPU		
A (Alert)	The patient is alert	
V (Verbal)	The patient responds to verbal stimulation	
P (Pain)	The patient responds to pain stimulation	
U (Unresponsive)	The patient is completely unresponsive	

Urinary and Gastric Catheters: Placement of urinary and gastric catheters occurs during or after the primary survey. Transurethral bladder catheterization is contraindicated in patients who may have urethral injury. The urinary catheter is not inserted without examining the perineum and genital organs.[1-3,6]

The gastric tube may be inserted to reduce gastric distension, reduce the risk of aspiration, and control upper gastrointestinal bleeding from trauma.[1] If a skull base fracture or cribriform plateau fracture is present or suspected, the tube should be inserted orally.[10]

Consideration of the Need for Patient Transfer

The injured who have to stay in the disaster area for a long time are reevaluated in the area. During the primary survey, the patient may need to be transferred from the disaster area, field hospital, or current hospital to another facility. The transfer of the patient should not be delayed for an in-depth diagnostic evaluation. It should only be aimed at resuscitation, stabilization, and ensuring the safe transport of the patient.[1]

Secondary Survey (Head-toToe Evaluation and Patient History)

At this stage, a detailed anamnesis is taken, and a comprehensive and detailed examination is performed from head to toe.[1-3,6,10]

Reevaluation and Continued Postresuscitation Monitoring

After the secondary survey, the patient should be examined at frequent intervals, and changes in the examination should be evaluated. Then, the final decision should be made for the patient.[1-3,6,10]

Conclusion

The disaster is chaos and does not comply with any rule. In the management of multiple trauma patients in disasters, existing personnel and material resources have a critical role. After a correct triage in the field, systematic patient management will reduce morbidity and mortality in trauma patients.

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