Basic trauma life support in non-urban setting

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Table of Contents:

List of Abbreviations:

AED	Automated External Defibrillator
AIS	Abbreviated Injury Score
ALS	Advanced Life Support
APACHE	Acute Physiology and Chronic Health Evaluation
APS	Acute Physiology Score
BLS	Basic Life Support
BTLS	Basic Trauma Life Support
CDC	Center for Disease Control
COPD	Chronic Obstructive uPulmonary Disease
CPR	Cardioplumonary Resuscitation
ECG	Electrocardiogram
EMS	Emergency Medcal Services
EMTRAS	Emergency TraumaScore
ED/ER	Emergency Department/Emergency Room
GCS	Glasgow Coma Score
ICD	International Classification of Diseases
ICU	Intensive Care Unit

ISS	Injury Severit Score
mmHg	Milimiters of mercury
PATI	Penetrating Abdominal Trauma Score
PEA	Pulseless Electrical Activity
PT	Prothrombin Time
RR	Respiratory Rate
RRR	Relative Risk Reduction
RTS	Revised Trauma Score
SBP	Systolic Blood Pressure
TCRA	Traumatic Cardiorespiratory Arrest
TL	Team leader
TM	Team member
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

Summary:

Title: Basic Trauma Life Support in Non-Urban Setting

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Trauma is one of the major causes of mortality and presents a worldwide problem. When approachig a trauma patient on the scene, safety is a priority. The emegency services use anything at their disposal within their range of knowledg to help a trauma patient. It is important to classify the injuries that the patients sustained in order to provide the most effective treatment. Patients that suffered trauma may also experience a traumatic cardiorespiratory arrest. In that case an algorithm for basic life support should be employed. This consists of opening the airway, providing rescue breaths and providing accurate chest compressions. With basic life support, an automated external defibrilator (AED) device can also be used to treat life-threatening arrhythmias related to cardiorespiratory arrest. There are six steps of trauma care, which are triage, primary survey with resuscitation, secondary survey, stabilization, transfer and definitive care. The trauma care can be provided in hospitals designed as trauma centers. Most high level centers are located in urban areas where they can provide all levels of care. Rural (non-urban) areas have lower level trauma centers. Those patients that cannot be cared for at those trauma centers shoud be transferred to a higher level one that is capable of adequately treating their injuries.

Keywords: trauma, basic life support, trauma care, rural areas

Traumatic Injuries

An injury is a bodily lesion at the organic level, resulting from acute exposure to some kind of energy (mechanical, thermal, electrical, chemical, or radiation) that exceeds the threshold of physiologic tolerability. In some cases (e.g. in drowning, strangulation, or freezing), the injury may result from an insufficiency of a vital element. The external causes of injuries are can be categorized as unintentional or intentional. Most traffic injuries, fire-related injuries, falls, drownings, and poisonings are classified as unintentional injuries; injuries due to assaults, self-inflicted violence, and war are classified as intentional injuries.[1] Therefore the mechanism of injury can indicate how much energy is transferred to the body area amount. Falls from great heights (more than 5 meters) and traffic accidents can cause very extensive blunt trauma to multiple regions of the body. Blunt trauma may be accompanied by injuries that may not be seen at first glance. Compared to penetrating trauma, more investigations should be done for blunt trauma to rule out any underlying conditions. Gunshots, stabbings and impalement constitute penetrating injuries. For these injuries, the trauma will usually be limited to the penetration point.[2] The concept of injury is correlates with the concept of disease. An acute exposure to large amounts of harmful stimulus can cause injury, but if that exposure happens over time it causes a disease.[3]

Epidemiology of trauma/injuries

Injuries are among the leading causes of death and disability in the world. They affect all people irrespective of their demographic, geographic, social or financial status. On any given day almost 16000 people die from injuries around the world, whereas those that survive can be left with serious debilitating consequences.[1] In the US injuries are the leading cause of death in the 1-44 year-olds.[4] Trauma related to motor vehicle accidents is the primary cause of death in 18-44 year olds.[5] When it comes to blunt trauma, the average survival rate is 3.1% with 1% of those having a good neurological outcome.[6] In patients under 34 years old blunt trauma is responsible for 80% of mortality.[5] In the case of penetrating trauma numbers stand at 3.3% survival rate with 1.9% having a good neurological outcome.[6]

Classification of trauma injuries/ Trauma Scoring

Trauma scoring systems assess the extent and of the injury and are associated with the probability of survival. They can include physiologic (Revised Trauma Score – RTS, Emergency Trauma Score – EMTRAS, Acute Physiology and Chronic Health Evaluation – APACHE, Systemic Inflammatory Response Syndrome Score – SIRS, Sequential Organ Failure Assessment Score – SOFA)[8] and anatomic scores (Injury Severity Score - ISS, Abbreviated Injury Score - AIS, Penetrating Abdominal Trauma Index - PATI, International Classification of Diseases (ICD)-based Injury Severity Score - ICISS)[9]. There are several different scoring systems used around the world, each with its own benefits and drawbacks. Since there is no universally accepted trauma scoring system, each trauma center in the world uses a different one.[7] One of those scores is the Revised Trauma Score (RTS)[8] . It is a physiologic score that includes Glasgow Coma Score (GCS), systolic blood pressure (SBP) and respiratory rate (RR). These parameters are one of the most commonly assed during a trauma examination.[8] RTS ranges from 0-12, shown in Table 1.

Table 1. RTS Scoring System.[8]

Pohlman, Timothy H., H. Scott Bjerke, and Patrick Offner. "Trauma Scoring Systems-Physiologic Scores". Medscape, 14 May 2014.

Coded Value	GCS	SBP (mm Hg)	RR (breaths/min)
0	3	0	0
1	4-5	< 50	< 5
2	6-8	50-75	5-9
3	9-12	76-90	>30
4	13-15	>90	10-30

For instance, if a patient has GCS score of 13, SBP 90 and RR>30, their score would be 10 (4+3+3). Patients score is lower than 11 indicates that the patients need to be transferred to a trauma center. The limitations of RTS come to light when trying to assess GCS in patients that are intubated or mechanically ventilated, or those under the influence of drugs and alcohol. However, using the best motor response in GCS does not diminish the predictability of RTS scoring.[8] Another scoring system is the Emergency Trauma Score - EMTRAS.[8] It is an accurate predictor for mortality and uses parameters that can be available within 30 minutes. The 4 parameters used are patients' age, GCS, base excess and prothrombin time (PT).

Table 2. EMTRAS[8]

Pohlman, Timothy H., H. Scott Bjerke, and Patrick Offner. "Trauma Scoring Systems-Physiologic Scores". Medscape, 14 May 2014.

Score	Age	GCS	Base excess	PT
0	<40	13-15	>-1	<80%
1	40-60	10-12	-5 through -1	80-50%
2	61-75	6-9	-10 through -5.1	49-20%
3	>75	3-5	<-10	>20%

An alternative physiologic scoring system is the Acute Physiology and Chronic Health Evaluation – APACHE[8]. It is not very adequate for trauma patient assessment; however different versions can be used to assess severity of injury in surgical ICU. The two main components of the APACHE scoring system are the chronic health evaluation (diabetes mellitus, renal failure, heart disease, malignancy, etc.) and the Acute Physiology Score (APS: includes major physiologic systems-neurologic, cardiovascular, respiratory, renal, gastrointestinal, metabolic, and hematologic). APACHE II is the most widely used APACHE system.

The most commonly used anatomical scoring systems are the Injury Severity Score (ISS)[9] and Abbreviated Injury Score (AIS)[9]. “ISS is defined as the sum of squares of the highest AIS grade in the 3 most severely injured body regions. Six body regions are defined, as follows: the thorax, abdomen and visceral pelvis, head and neck, face, bony pelvis and extremities, and external structures.”[9] ISS score ranges from 1-75 and a score of 75 is assigned to patients with AIS of 6. Since only one injury per body part is allowed, the ISS does not account for multiple injured in the same body region. The AIS is consensus-derived and scores injuries on a simple scale of 1 (minor injury) to 6 (lethal injury). However the AIS does not take into account the effects of compound injuries. The values assigned to each injury ad body region is the same, disregarding the importance of some injuries over others (head injuries often have higher mortality). Another limitation is that there can be only 3 contributing injuries as seen in the table 3.[9]

Table 3. ISS Calculation[9]

Pohlman, Timothy H., H. Scott Bjerke, and Patrick Offner. "Trauma Scoring Systems-Anatomic Scores." Medscape, 14 May 2014.

Region	**Injury**	**AIS**	**AIS²**
Head/Neck	Single cerebral contusion	3	9
Face	No injury	0	0
Chest	Flail chest	4	16
Abdomen	1. Liver laceration	4	25
	2. Completely shattered spleen	5	16
Extremity	Fractured femur	3	9
External	No injury	0	0
Injury Severity Score (ISS) = 50			

Trauma Care

There are four main phases of trauma care. Phase I care is provided from the moment the ambulance arrives on the scene to patient's admittance to the emergency department. Phase II included all the procedure done in the Emergency Department. In Phase III, the patient is transferred for further care to the surgery, ICU or hospital floor. Phase IV includes patient recovery at home.[10]

Trauma Center

Trauma center is a specifically equipped and staffed hospital that can provide emergency medical services to patients that have suffered traumatic injuries.[11] Even though most emergency departments are capable of dealing with injuries, trauma centers become convenient when patients sustain complex traumatic injuries. According to the American College of Surgeons Committee on Trauma, trauma centers can be organized by levels of care, from Level I to Level V.[12,13] Level I centers are the most specialized, while Level IV centers usually provide only initial care before transferring the patient to a higher level trauma center. Therefore patients with severe and life-threatening injuries will be transported to a higher level trauma center, Level I or II. Less severely injured patients will be transferred to a Level II or IV trauma center or the nearest ED. Treatment of injured patients at a trauma center significantly improves their chances of survival.[13] Level I can provide all the levels of care from prevention to rehabilitation. As a tertiary level facility, they have coverage by surgeons (general surgery, orthopedic surgery, neurosurgery, oral and maxillofacial surgery, plastic surgery) and other doctors from anesthesiology, emergency medicine, radiology, internal medicine, pediatric and critical care departments around the clock. They can also be a referral center to the neighboring area. Level II centers are able to treat the injured patient, but are not able to provide tertiary care. A Level III center is covered by doctors in emergency medicine, general surgery and anesthesiology. These centers can assess, treat and perform emergency surgery in order to stabilize the patient. A Level IV trauma center has the capability to deliver Advanced Trauma Life Support (ATLS), stabilizing the patient

before transport to a higher level trauma center. If available, it can provide surgical and critical care. Last level, Level V trauma center can only evaluate the patient and stabilize him/her before transporting him to a Level I or II trauma center. A Level V center may have certain protocols in place if it is not open 24 hours per day.[12] The distribution of trauma centers is variable, with most high level centers located in bigger cities. The problem arises in rural areas, with centers located further away, meaning more time spent in transport, taking away from the valuable definitive treatment in the hospital.

Six Steps of Trauma Care

Even before the EMS team arrives at the scene, they have certain information about what to expect upon arrival. Once they have arrived, it is necessary to assess the scene first. First thing to look at s scene safety, then making sure the EMS team has all the necessary medical and protective equipment. A quick look at the number of injured patients will let the team know if they need to call for any additional help and equipment. The last thing to look at is the mechanism of injury which may give an indication of what injuries to expect or be wary of.[14] The six steps of trauma care will start with phase I which is triage. This involves identifying the injured and treating them according to severity with the most severe being treated first. Phase II involves the primary survey which intends to identify life-threatening injuries and treating them as soon as possible.[15] The ABCDE survey (Airway, Breathing, Circulation, Disability and Exposure) can be performed.[18] If the ABCs are not normal resuscitation is performed according to the BLS protocol discussed earlier. D for disability is used to ascertain the patients' level of consciousness using the short AVPU scale (Alert, Voice, Pain, and Unresponsive). Exposure means undressing the patient and looking for injuries beneath the clothes. After the primary survey, we continue on to phase III which is the secondary survey. The secondary survey is a detail head-to-toe examination looking for abnormalities in the head, neck, chest, abdomen and pelvic regions as well as the spine and the limbs. The neurological status is also established here by testing the motor, sensory and reflex properties as well as testing the brain functions using the Glasgow Coma Scale (GCS). If the patient deteriorates at any point during the secondary survey, the ABCs are performed again and resuscitation is initiated. After the secondary survey is completed the patient is treated and stabilized according to the means available, which constitutes

phase IV. Phase V is transport of the patient to the hospital while monitoring his vital signs. The last phase, phase VI, is patients' definitive treatment at the hospital or trauma center. Definitive care may involve surgical interventions, resuscitation and monitoring as well as patients' stay in the ICU.[2]

If the nearest trauma center is not equipped to give the patients' definitive care, he should be stabilized and prepared for transport to a higher level trauma center.[15, 16] Throughout all the phases the patient should be continuously monitored and re-evaluated. The goals of the six steps is to save the patients' life, diagnose and manage all injuries, minimize the time from injury to definitive care, prevent major disability and avoid unnecessary investigations or interventions.[2]

Triage

Since triage means sorting and testing the patients according to priority, certain parameters should be evaluated to see which patients are in life-threatening conditions. Factors that affect triage may be personnel skills and availabilities of resources.[15] The Center for Disease Control's (CDC) 'Guidelines for Field Triage of Injured Patients' is a four-step outline to help decision-making in those situations. Step one includes measuring vital signs like pulse rate, blood pressure, respiratory rate, oxygen saturation, temperature, level of alertness according to the AVPU scale and urine output. If parameters are off during the first step, an immediate transport to trauma center is necessary (GCS≤14, SBP≤90mmHg, and respiratory rate ≤10 or ≥29). Step two assesses the anatomic injury, the presence of any penetrating injuries to the head, neck and extremities, flail chest, two or more long bone fractures, a crushed, degloved or mangled extremity, amputation, pelvic fractures, skull fractures or paralysis. As with the first step, these should be transported to the highest level trauma center.[16] Patients that have any positive parameters from steps one and two are considered as Trauma I or Red emergency and their treatment should be within the 30-60 minute window from the first medical contact.[17] If none of those are present, the mechanism of injury is ascertained in step three. This looks at very high falls, high-energy car crash, or motorcycle crash. These patients should be transported to the nearest trauma center, not necessarily the highest level.[16] Patients from step three fall under the Trauma II or Yellow category, and they should be treated within 60 minutes. This also includes pregnancy.[17] Step four looks for any special patients (children, elderly) or systemic considerations (bleeding disorders, burns, renal disease, or pregnancy). These patients should be transported to a trauma center or a specific hospital capable of taking care of specific disorders. If no

special considerations are found, patients are transported according to the regular protocol (local ED).[16] Trauma III, Green, takes into account the special considerations of step four, but also includes lower level injuries as those mentioned in step three.[17]

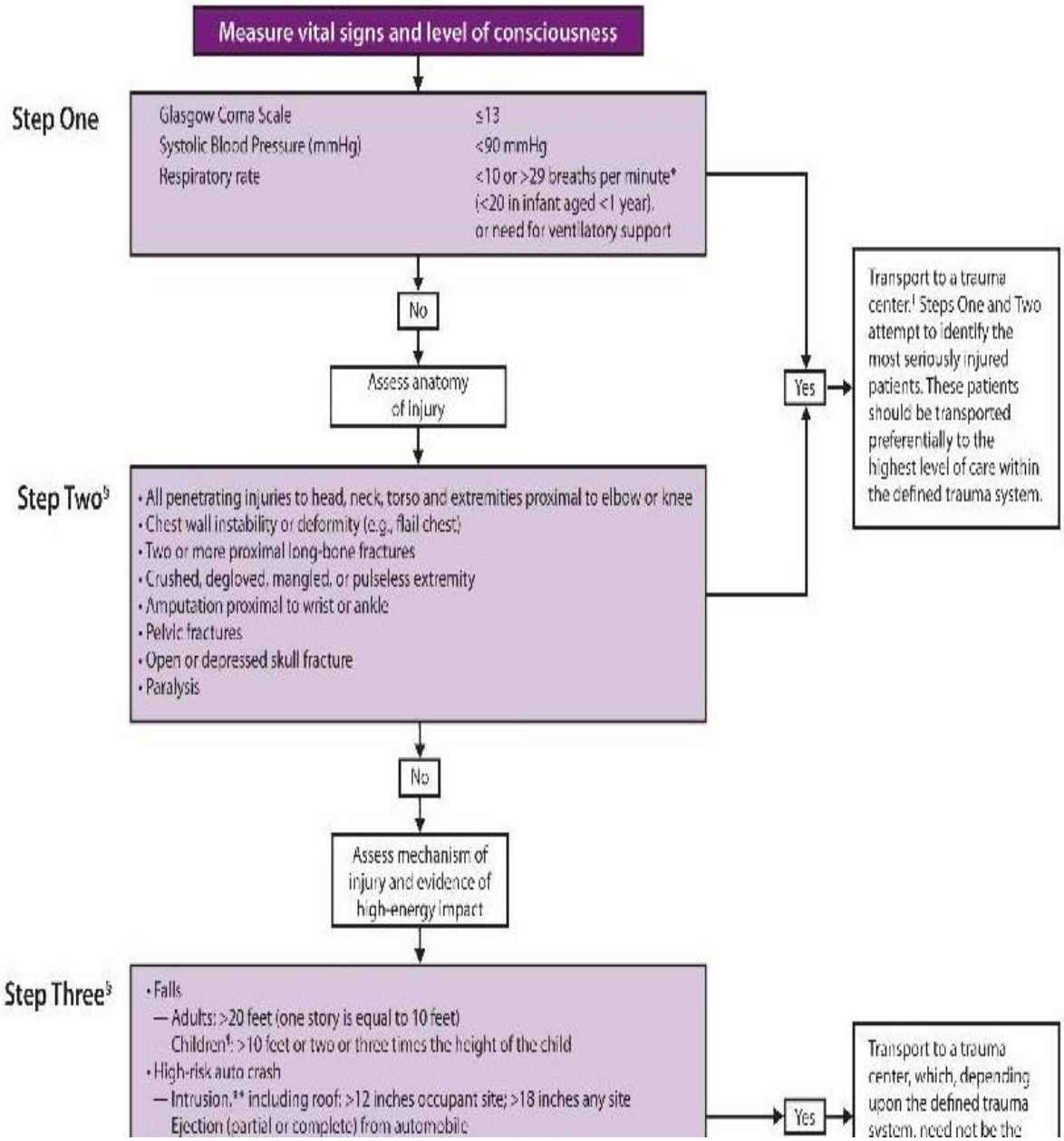

Figure 1. Guideline for Field Triage 2011 (Steps One and Two)[16]

Adult Trauma Patient Classification Guidelines REFERENCE: 190.185, 190.200, 190.243 (RSMo) n. pag. Missouri Department of Health and Senior Services, 24 May 2010. Web.

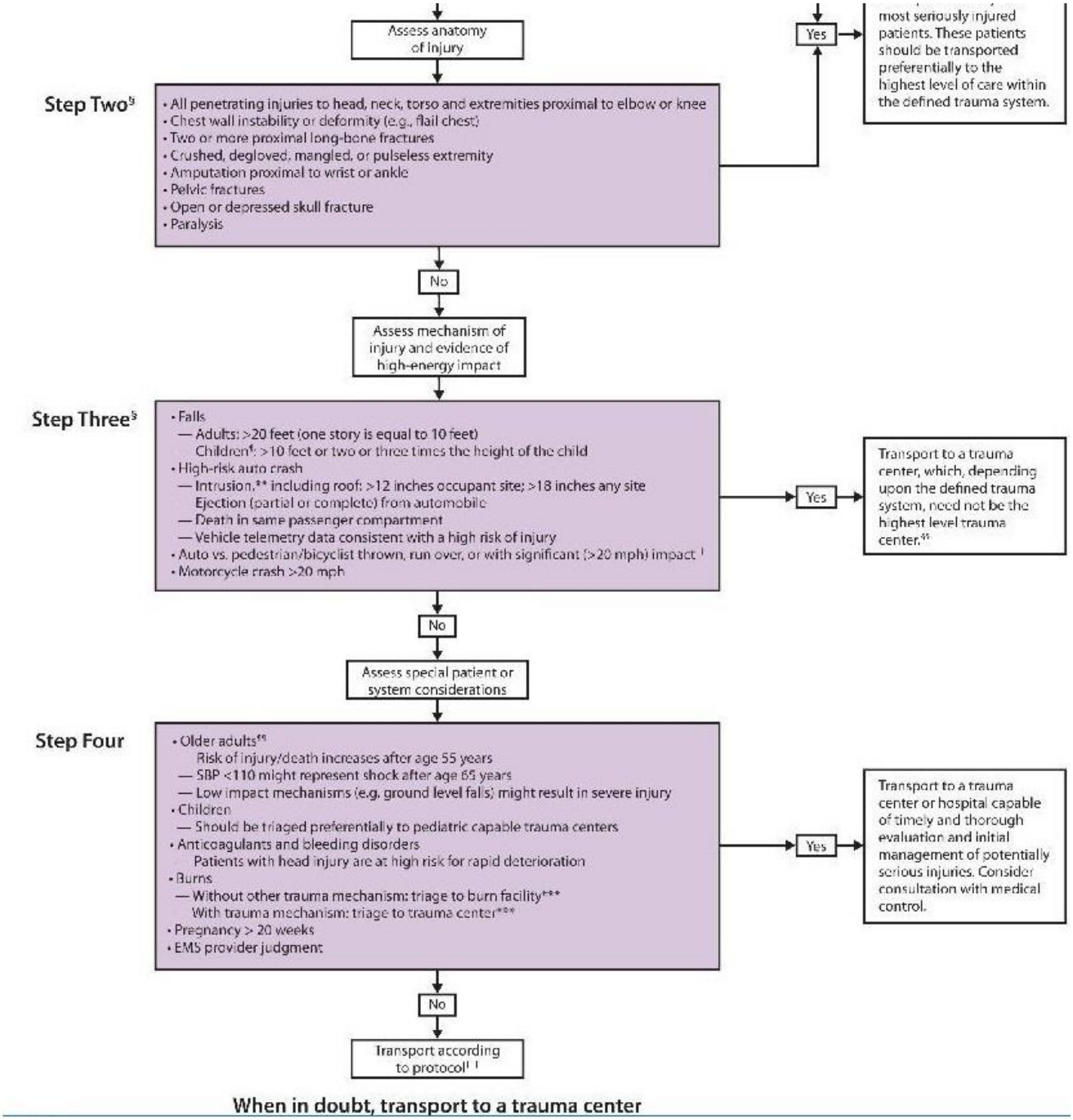

Figure 2. Guideline for Field Triage 2011 (Steps Two, Three and Four)[16] Adult Trauma Patient Classification Guidelines REFERENCE: 190.185, 190.200, 190.243 (RSMo) n. pag. Missouri Department of Health and Senior Services, 24 May 2010. Web.

Primary Survey: The ABCDE of Trauma

A general impression about the patient can be obtained before starting the primary survey. This can give information about the age and sex of the patient, position, general appearance and presence of any obvious injuries (e.g. visible external bleeding). When approaching the trauma patient we can see whether he is conscious and once we are approach him we must stabilize his head and neck. This is best done with good teamwork between the EMS team. The team leader (TL) is the one that initially does the stabilization, but another team member (TM) takes over so that team leader can continue with the rest of the examination. This is also a good time for the TL to introduce himself/the team and ask the patient if he knows what happened and where it hurts. If there is a third team member he can be tasked with stopping any visible external bleeds.[14] In the primary survey we look for any problems with the ABCs, for example, airway obstruction, difficulty breathing, and any severe external or internal bleeding. Airway can be tested by speaking with the patient and listening to any sign of obstruction to the airway. Opening the airway can be done in two ways, head tilt-chin lift or jaw-thrust. When a trauma is suspected we use the jaw-thrust maneuver in order to prevent any further damage done to the spine. With Breathing we look, listen and feel.[15] If the patient is breathing, the quality should be assessed. This step looks for frequency and depth of respirations, movement of the chest (symmetrical or not), and whether any accessory muscles are used for breathing. After assessing the breathing all trauma patients should receive oxygen via a mask with a reservoir at the highest flow (15 L/min). Circulation assesses the perfusion status. External bleeds should be stopped initially by direct

pressure and if that doesn't work more gauze should be added and bandages wrapped around the wound if possible. While the bleeding is being controlled, the pulse should be palpated at the radial and carotid arteries. If the pulse can only be palpated at the carotid artery it usually indicates that the blood pressure is below 90mmHg. Palpating the pulse can tell the TL the frequency of the pulse, its quality, the status of the skin and capillary refill time. We are also looking for any signs of shock (pale and cold skin, weak or absent radial pulses, tachycardia, and hypotension). The main point of the ABC exam is the need to "fix" the problem as soon as we encounter it. For example, if there is problem during B, we do not move onto the C part of the exam before we solve the issue.[14] Disability uses the AVPU scale for a quick assessment of consciousness. Alert means the patient is awake and able to talk to us. Voice means that he responds only to voice commands, or when called. Pain response can be elicited in several ways. Unresponsive means the patient doesn't respond to any of the previous means of arousing him. This level of consciousness corresponds to GCS≤8. Glasgow Coma Score is composed of 15 points. They are divided into eye response (four points), verbal (five points) and motor response (six points). A score of 8 or lower means the patient is in a coma. GCS is useful to ascertain the level of consciousness after a head injury.[15]

Table 4. Primary Survey and Resuscitation.[2]

Taken from "Principles of Trauma Management." SurgWiki. N.p., 16 May 2012. Web.

	Problem	**Asses**	**Interventions**
Airway	Direct trauma: disruption/edema Obstruction Foreign bodies Blood and vomit Soft issue edema Deteriorating consciousness	Cyanosis Tachypnea Voice Stridor Confusion 'Respiratory distress' Air movement	Laryngoscope, forceps Oxygen Chin lift/jaw thrust Oropharyngeal airway Nasopharyngeal airway Orotracheal tube Surgical airway
C-spine	Unstable fracture	If patient is: Unconscious Head and face injury	Semi-rigid collar Sandbags/tape Manual in-line immobilization
Breathing	Tension pneumothorax Massive hemothorax Open pneumothorax Massive flail chest Reduction in level of consciousness High spinal cord injury	Cyanosis Tachypnea Confusion 'Respiratory distress' Shallow respiration Asymmetric expansion Hyperinflation Hyper-resonance Breath sounds	Oxygen Ventilation Needle thoracentesis Tracheal intubation Cover open wound
Circulation	Bleeding: External (scene, floor) Chest (X-ray) Abdomen Pelvis (X-ray) Femurs Combination Heart Tension pneumothorax Cardiac tamponade Contusion Infarction	Pale, clammy, cool Peripheral cyanosis Confusion Tachycardia Low-pulse volume Slow capillary refill Neck veins Heart sounds (muffled)	Oxygen I.V. access Warmed Crystalloid/colloid/blood Hemorrhage control (direct pressure) Needle/tube thoracentesis Pericardiocentesis
Disability	Secondary brain injury Intracranial hematoma Brain: Compression Contusion	Alert Voice response Pain response Unresponsive Lateralizing signs Pupils	A,B,C C-spine protection Hyperventilation
Exposure	Concealed injuries	Prepare for 2nd survey	Remove all clothes
Environmental control	Hypothermia		Warm fluids, blankets, heating mattress

Traumatic Cardiorespiratory Arrest (TCRA)

"Cardiac arrest is the abrupt loss of heart function in a person who may or may not have diagnosed heart disease."[18] The most common causes of cardiac arrest are pre-existing conditions like coronary artery disease (CAD), previous myocardial infarction, arrhythmias, cardiomyopathy, heart valve disease and congenital heart disease.[19] The main symptoms of cardiac arrest are sudden collapse, loss of consciousness, no breathing and no pulse. Since this is an emergency situation, emergency number must be contacted immediately (112 or 194 for Croatia, 911 for USA and Canada) and cardiopulmonary resuscitation should be started with the shortest delay possible. [20]

An unconscious patient that is not breathing and has no pulse in a patient in the setting of a traumatic event is considered to be in traumatic cardiorespiratory arrest. The mortality rate of traumatic cardiorespiratory arrest is quite steep with 5.6% overall survival rate which has improved in the last 5 years. In those that survived, only 1.6% had a good neurological outcome.[6]

Traumatic injuries can be due to any number of things. A medical condition (arrhythmia, hypoglycemia, seizure) that leads to cardiac arrest may cause the patient to experience a traumatic injury (fall, motor-vehicle accident, etc.). The mechanism of injury in trauma is very important. A nonpenetrating, blunt blow to the precordial area may cause commotio cordis (usually ventricular fibrillation caused by the blow in the vulnerable phase of the cardiac cycle).[21] Commotio cordis occurs most often in young males during contact sport activity. With 5-15 cases each year, the reported survival is 15% which increases to 25% if CPR is initiated in the first 3 minutes. In other cases of blunt trauma, the average survival rate is 3.1% with 1%

having a good neurological outcome. In the case of penetrating trauma numbers are 3.3% and 1.9% respectively.[6]

TRCA survival s in close relation with the length of CPR duration and the amount of time it takes to arrive at the hospital. Factors that increase survival rates include quality and fast assessment of the patient on the scene. This includes providing adequate BLS and ALS support and treating any reversible causes before the arrival to the hospital if possible. Reversible causes include hypoxemia, compressible and non-compressible hemorrhage, tension pneumothorax and cardiac tamponade and can be treated immediately with oxygenation and ventilation for hypoxemia, pressure dressings for hemorrhages, chest decompression for tension pneumothorax and immediate thoracotomy for tamponade.[6]

Table 5. Reversible causes of cardiac arrest: four “H” and four “T”

Taken and adapted from European Resuscitation Council Guidelines for Resuscitation 2010 Section 4. Adult advanced life support, pg.1315-1316

4 “H”	**4 “T”**
Hypoxia	Thrombosis (MI/PE)
Hypovolemia	Tamponade
Hypo-/Hyperkalemia Hypocalcemia/metabolic disorders	Toxins/drugs
Hypothermia	Tension Pneumothorax

Basic Life Support (BLS)

Basic Life Support is provision of emergency care to patients in life-threatening conditions. This provision of care usually consists of noninvasive methods such as securing the airway, administering oxygen, chest compressions, stopping any visible bleeding and immobilization of fractures and the spine.[22] Chest compressions are the most important step in cardiopulmonary resuscitation. It is essential that they are performed correctly by compressing the center of the chest 5-6cm at the rate of 100/min. Trained rescuers should alternate chest compressions and ventilations at the 30:2 rate, alternating 30 compressions and 2 ventilations. If providing ventilations, care should be taken to deliver breaths in an effective manner. When approaching a person suspected of being in cardiac arrest, we must employ a basic algorithm for care. This algorithm is usually abbreviated as DR ABC which stands for Danger, Response, Airway, Breathing and Circulation.[23] D is for Danger-checking the environment of the patient for safety, in order to decrease the probability of the rescuer to get injured. R stands for Response- by placing the hands on the patients' shoulders and shaking him/her gently while also shouting "Can you hear me?" This tactile and verbal stimulation should inform the rescuer about the consciousness level of the patient. If the patient is unconscious, we proceed with the algorithm. The next step is A (Airway), opening of the airway. This can be done in one of two manners; is head tilt-chin lift and the jaw thrust. Head tilt-chin lift is by far the more common maneuver; it is done by placing one hand on the forehead of the patient and two fingers from the other hand on the mandible (while being careful not to compress any soft tissue structures). Jaw trust is usually done when a cervical spine fracture is suspected. It is performed by placing the bottom of the palm of both hands on each of the patients' zygomatic bones. The rest of the fingers are placed around

the mandible, with the small (pinky) finger behind the angle of the mandible. In this position only the mandible should be lifted, therefore avoiding movement of the spine. After the airway has been opened, we check for B-Breathing. While keeping the airway open we lean close to the patients' head in such a way that we can look, listen and feel. We look for any chest movements, listen for any sounds of breathing and feel the patients' breath on our face. The look, listen, feel technique should be done up to ten seconds. If after 10 seconds we do not see, hear or feel anything, we proceed with the next step of the algorithm which is assuming the patient is in cardiorespiratory arrest and starting chest compressions. Irregular gasps or agonal breathing should not be confused with normal breathing.[24]

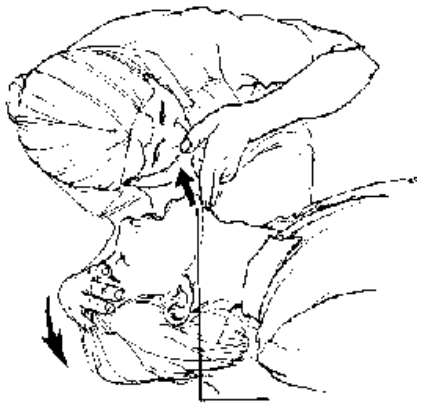

Figure 3. Head-tilt/chin-lift maneuver. Source: University of Utah. Graphical Summary of Basic Life Support

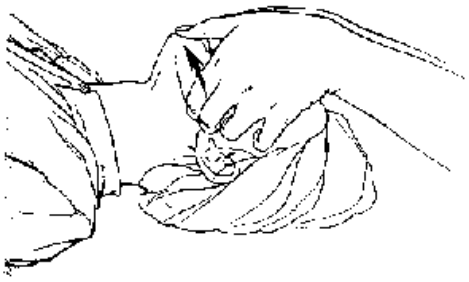

Figure 4. Jaw thrust maneuver Source: University of Utah. Graphical Summary of Basic Life Support

Chest compressions are done so that the rescuer kneels beside the patient places the bottom of the palm of one hand at the center of the chest, then places the other hand on top and intertwines his fingers. Leaning slightly forward so that his arms are

straight and at a right (90°) angle delivers compressions. The proper depth of compressions (5-6cm) and frequency (approximately 10/min) ensures quality delivering of compressions.

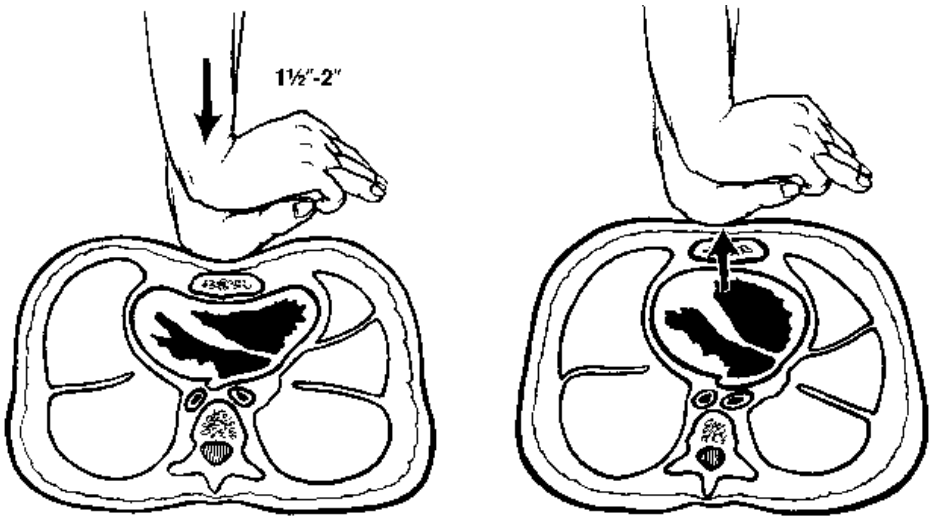

Figure 5. Depth of chest compressions: 5-6cm, allowing for relaxation of the chest. Chest Thrust. Source: University of Utah. Graphical Summary of Basic Life Support

After the first 30 compressions, the rescuer opens the airway again and delivers two breaths. These breaths should be of normal volume, delivering on breath in 1 second, allowing for expiration and delivering the second breath. This procedure should take no more than 5 seconds. While delivering the first breath, an effort is made to watch for chest movements. If the chest does not move with the delivery of breath, the rescuer must try opening the airway again, perhaps more efficiently, and delivering the second breath. If the second breath is ineffective, due to obstruction of the airway or unsuccessful opening of the airway, the rescuer must proceed with

chest compressions and avoid losing valuable time on managing the airway. An alternative to the compression-ventilation CPR cycle is ‘hands-only’ CPR. Here the rescuer deploys the regular algorithm of DR ABC, however when performing CPR they only carry out chest compressions (no ventilation).[23] Chest compressions are not indicated in the setting of cardiac tamponade because the patient will not benefit from it, so a thoracotomy or a pericardiocetesis should be performed. Severely hypovolemic patients also do not benefit from chest compressions, since their blood volume is too low to be pumped through the circulation.[6]

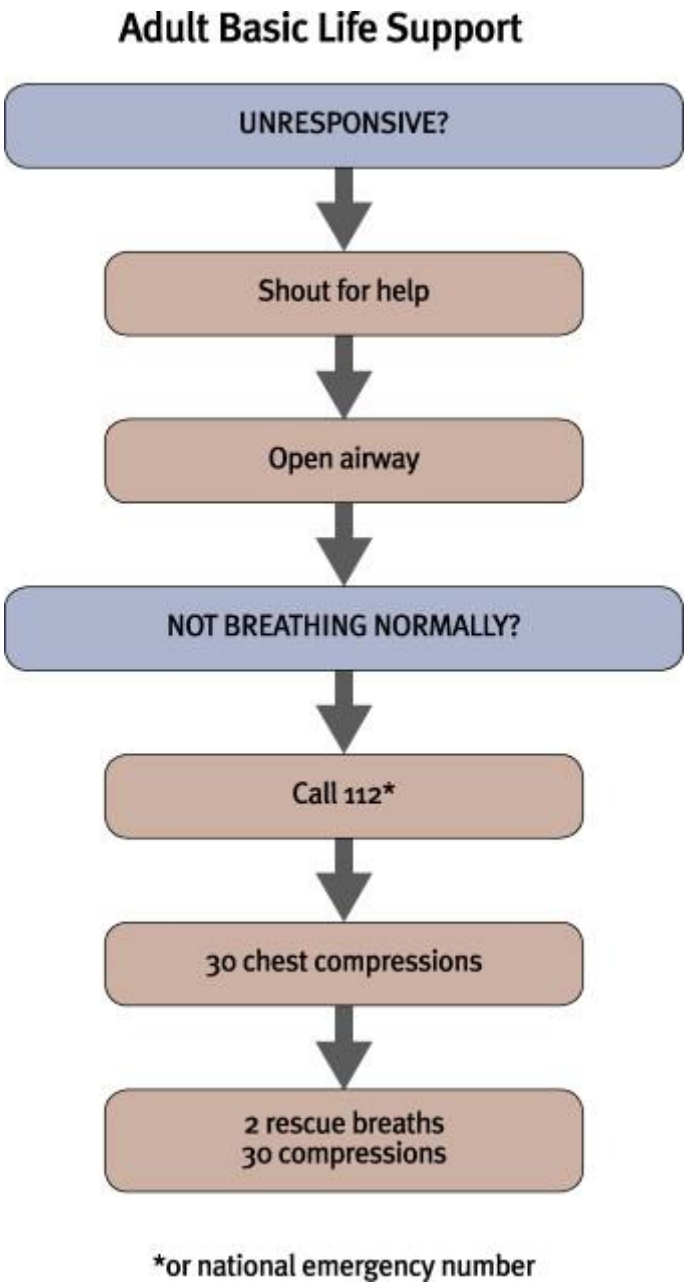

Figure 6. BLS Algorithm[23]
European Resuscitation Council Guidelines for Resuscitation 2010 Section 2. Adult Basic Life Support and Use of Automated External Defibrillators." Resuscitation 81.10 (2010): 1277-292.

BLS With Automated External Defibrillator (AED)

The BLS protocol is the same. The important thing of note is that the CPR cycle is stopped immediately when the AED device is available. The leads are placed in a way that the heart is in between the path of electricity of the electrodes. The most common electrode placement is by placing one under the right collar bone and the other in the midaxillary line on the left. Some AED may come with voice prompts guiding the rescuer.

Figure 7. AED
Source: Defibrillator AED.nl. ZOLL AED Plus

The AED can recognize life-threatening arrhythmias and indicate whether the rhythm can be shocked or not. The AED recognizes four rhythms: ventricular fibrillation, pulseless ventricular tachycardia, asystole and pulseless electrical activity (PEA).Rhythms that can be shocked include ventricular tachycardia without a pulse (VT) and ventricular fibrillation (VF). If the AED recognizes VF or VT it will advise to deliver a shock after which CPR is resumed. In case the AED recognizes a rhythm where shock is not advised, asystole or pulseless electrical activity (PEA), the recommended action is to resume CPR without delivering a shock. No matter if the

shock is delivered or not, the CPR cycle is resumed for the next two minutes before the rhythm is reassessed.[24]

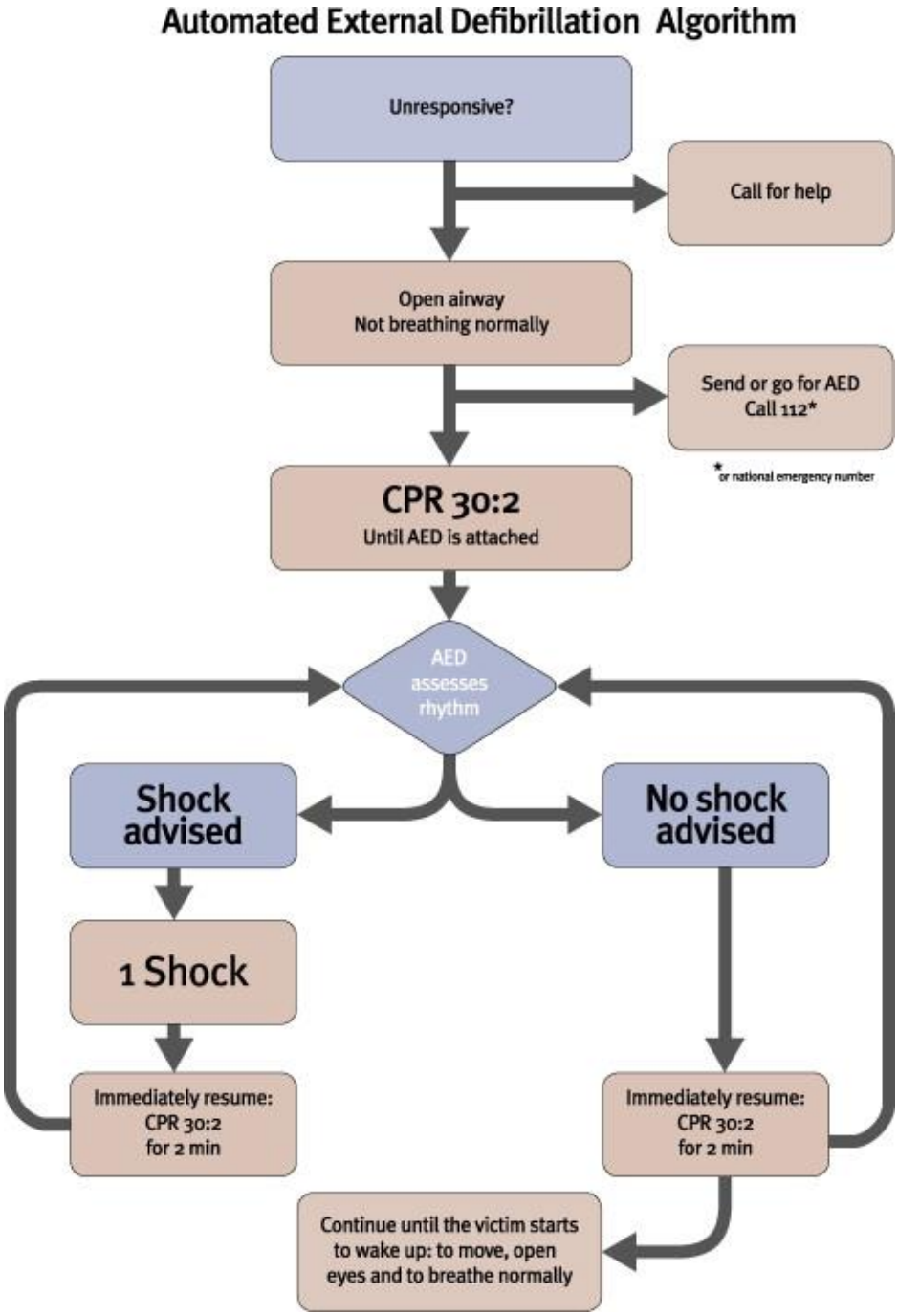

Figure 8. Algorithm for AED use [23]
European Resuscitation Council Guidelines for Resuscitation 2010 Section 2. Adult Basic Life Support and Use of Automated External Defibrillators." Resuscitation 81.10 (2010): 1277-292.

Secondary Survey

Secondary survey should only be undertaken if the patients ABCs are normal. This survey consists of inspection, palpation and auscultation.[2] Secondary survey is a generalized exam of the whole body, looking for any injuries not seen in the primary survey. The indications for a generalized exam are dangerous mechanism of injury, high-risk groups, loss of consciousness, difficulty breathing, abnormal mental status, and pain in the head or neck.[14] Starting with the head, we examine for any scalp or ocular abnormalities, periorbital soft tissue injuries and external ear. On the neck we look for any penetrating injuries, swelling, crepitus, tracheal deviation and neck vein appearance. The cervical spine vertebrae are palpated for pain, and a rigid cervical collar (also known as Schantz collar) should be placed by a different team member. Chest exam comprises of inspection for bruises or contusions, palpating for instability of ribs and listening to the heart and lungs. Heart and lung sounds together with the look of the neck veins and tracheal deviation can raise the suspicion of a possible pneumothorax or hemothorax. A tension pneumothorax should be decompressed immediately. Abdominal examination consists of looking for penetrating wounds, blunt trauma where a nasogastric tube should be inserted, urinary catheter insertion and rectal examination. We check the pelvic girdle and limbs for fractures, checking the peripheral pulses, any presence of cuts, bruises, and ecchymosis.[15, 16] In this step we can also assess the GCS. While examining the patient the TL should ask constantly if the maneuvers elicit any pain and if possible ask the SAMPLE anamnesis (stands for Symptoms, Allergies, Medicine, Past medical history, Last oral intake, and Events preceding). After the secondary survey has been completed, the patient is placed on a backboard. If the patient has an unstable pelvic girdle or bilateral femur fractures a scoop stretcher should be used.

After all major maneuvers of the patient, the ABCs need to be reassessed. All the monitoring is done during transport, once the patient is in the vehicle. This includes blood pressure, electrocardiogram (ECG), pulse oximetry, glucose measurement and pupil reactivity.[14]

Table 6. Secondary survey.[2]

Taken from "Principles of Trauma Management." SurgWiki. N.p., 16 May 2012. Web.

Head-to-toe	**Seek the following**
Glasgow Coma Scale	Tenderness
Scalp	Lacerations
Ears	Swelling
Eyes	Structural deformity
Facial bones	Discoloration
Mouth (and teeth)	Crepitus
Neck (C-spine, soft tissues, trachea)	Ischemia
Clavicles	Functional impairment
Chest (and movements)	Visceral (lungs, heart, bowel)
Lungs	Musculoskeletal neurological
Heart	
Abdomen	**Do the following:**
Pelvis	Sterile pad on wounds
Hips and thighs	Pressure on bleeding sites
Legs	Splint fractures
Knees	Traction splints
Feet	Splinting of specific pelvic fractures

Non-Urban Areas

For the prehospital setting, it is generally accepted that the patients from the rural areas, where transportation time from scene to definitive treatment is longer, benefit most from the rescue teams that include trained physician. In urban areas, the survival of trauma patients is improved by rapid transportation to a trauma center and to a lesser extent by the rescue team composition (physicians on scene versus paramedics).[3] When it comes to traumatic brain injury for example, rural doctors may face some problems. It is still important to provide the patient with aggressive resuscitation therapy and transfer them to the nearest neurosurgical facility that can be found in Level I (and maybe II) trauma centers.[25] Urban trauma center can provide support to the rural community hospital trauma care, and there should be cooperation between the two. An urban trauma center can provide access to specialists, critical care and access to blood banks.[26]The rural community may have a higher complication rates, mostly related the severity of the injuries and the longer times necessary to reach the patient from the local emergency department.[27] Also, patients transferred from rural hospitals had longer stay in the ICU, ventilator time, and more expensive medical bills because of it. These patients were more likely to be transported by a helicopter. Therefore it is essential that the rural doctors be able to recognize, stabilize and transport the patient to the nearest high level trauma center as soon as possible.[28, 29, 30]

Conclusion

Approach to trauma in a non-uban setting may be quite different than in a more densely populated area. The approach to the patient must remain the same in either setting by following the six steps of trauma care. The main drawback to the rural hospitals is that they have lower level of trauma centers. Lower level trauma centers found in these rural areas may not be equipped or staffed to deal with severe traumatic injuries. Therefore those patients need to be transferred to the nearest high level trauma center ans soon as possible. Physicians working in non-urban areas need to be actively educated in recognising traumtic injuries quickly in order to recognizepotentially life-threatening injuries and stabilize the patient as soon as possible. After the patient is stable measures should be taken to transport the patient to the nearest high level trauma center equipped and staffed to take care of the patients' injuries. One of the biggest drawback that remains for the rural centers is the large geographical area they cover. Because of the distance, the time taken to reach the patient may be longer increasing the patients' risk of complications and mortality. With this in mind, efforts should be made in the future to distribute trauma centers more evenly towards the non-urban areas and have certain protocols in place for a faster medical evacuation from rural areas.

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Biography:

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After graduation in July 2015, she plans to complete and internship in Croatia, after which she plans to take the licensing exam.

Hobies include cooking, baking, music, films and traveling.