Semi Automatic External Defibrillation (SAED)

Learner’s Manual

2007

Updated by
Ontario Base Hospital Group Education Subcommittee
May 2007
Primary Care Paramedic Pre-Course Study Guide

The following guide will be useful for your preparation to attend and complete PCP Defibrillation training.
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PREREQUISITES FOR PARAMEDIC CERTIFICATION

To be eligible for certification by a Base Hospital at the Primary Care Paramedic level, a candidate must:

1. Be employed by an Ontario Ambulance Service as a Paramedic or be enrolled as a student in an approved Ontario Paramedic Program

2. Have approval of the Base Hospital Medical Director.

3. Have a current BCLS basic rescuer certificate.

In order to attend the SAED course Paramedic candidates must demonstrate proficiency in assessment and skills related to:

1. BCLS modalities.

2. Use of airway/breathing adjuncts:
   - oropharyngeal and nasopharyngeal airways,
   - ventilation equipment (e.g. bag-valve-mask)

3. Assessment and management of chest pain.
COURSE CONTENT

The PCP defibrillation training program is a skill oriented program. The course will be devoted to:

- equipment familiarization
- description of protocols
- learning and practising cardiac arrest management using Semi-Automated External Defibrillators (SAED).

To be successful, candidates must attain a pass standing in practical scenarios and achieve a minimum of 70% on a written test.
SKILLS OBJECTIVES

Basic Life Support Skills:

These objectives indicate what you will need to know, understand and be prepared to explain and demonstrate upon completion of the course:

Upon completion of the course the student will:

1. Demonstrate the procedure for the removal of a foreign body airway obstruction without the aid of any equipment.
2. Demonstrate one-person cardiopulmonary resuscitation (CPR).
3. Utilize a positive pressure ventilation device (BVM or automatic ventilator) while the assistant delivers chest compressions.
4. Perform chest compressions, while the assistant performs positive pressure ventilations
5. Demonstrate the procedure to switch between performing chest compressions to performing ventilations and back again
6. Performing two-person CPR where one rescuer compresses and ventilates while the other maintains head position and mask seal.

NOTE: The above competencies are to be performed on adult, child and infant patient mannequins

Airway and Ventilation Skills:

1. Upon completion of the SAED training program, the candidate will demonstrate proficient basic airway management in terms of:
   - assessment of a patient's airway and demonstration of corrective actions as required if the airway is compromised
   - positioning of the patient
   - positioning and suctioning of the airway
   - use of oropharyngeal and/or nasopharyngeal airway
   - ventilation equipment
2. State the indications for ventilation and/or hyper-oxygenation.
Primary Care Paramedic Skills:

1. Using the Semi-Automatic External Defibrillator (SAED) and mannequin, the participant will:
   - perform the procedures for cardiac arrest including proper SAED pad placement, rapid defibrillation, trouble shooting and maintenance procedures.
   - demonstrate safe operation of the SAED at all times
   - utilize protocols to manage:
     - VSA patients with shockable rhythms
     - VSA patients with non-shockable rhythms
     - treatment of cardiac arrest associated with hypothermia
     - treatment of cardiac arrest associated with blunt trauma
     - treatment of cardiac arrest associated with airway obstruction
     - neonatal resuscitation

2. State situations that require that the SAED be taken into a scene.

3. State patient situations which require that cardiac monitoring be performed

4. Demonstrate the procedure for cardiac monitoring with the SAED, including application of monitoring electrodes, rhythm interpretation, reporting and documentation.

5. Record a cardiac arrest utilizing current protocols on either a paper based or electronic ACR.

6. Deliver a verbal report of a cardiac arrest.
KNOWLEDGE OBJECTIVES

Upon completion of the SAED training program the PCP candidate will describe the following terms and concepts:

**General Material:**

- PCP Protocol
- Controlled Act
- Direct Order
- Standing Order
- Base Hospital
- Receiving Hospital
- Medical/Legal Issues
- Certification
- Re-certification
- De-certification
- De-activation
- Re-activation
- Paramedic
- Base Hospital Physician

**Cardiovascular Anatomy and Physiology:**

- blood flow through the heart
- the properties of cardiac muscle
- the electrical conduction pathways of the heart
- cardiac conduction disturbances in shockable and non-shockable rhythms

**Defibrillation:**

- types of cardiac arrest and their initial management
- defibrillation and the indications for use of the SAED
- possible outcomes of defibrillation
- safeguards necessary to ensure operator and patient safety when using the device
Cardiac Monitoring:

- the indications for cardiac monitoring
- monitoring electrodes and their correct placement
- normal sinus rhythm
- ventricular tachycardia
- premature ventricular complexes
- ventricular fibrillation
- asystole
- agonal rhythm
- Pulseless Electrical Activity - PEA
WHAT IS A PREHOSPITAL SAED PROGRAM?

A prehospital SAED program is one component within the Primary Care Paramedic scope of practice, which includes physician supervised controlled acts in the practice of medicine."

In Ontario, the prehospital provision of a controlled act (formerly called delegated medical act) lies primarily with the Paramedics of certified ambulance services. The components of a prehospital SAED program are:

- Paramedics and other First Responders
- Base Hospital
- Base Hospital Physician
- Certified Ambulance Service
- Central Ambulance Communications Centre (CACC)/Ambulance Communications Service (ACS)
- Quality assurance program

WHAT IS A PARAMEDIC?

A person employed by, or engaged as a volunteer in, an ambulance service who meets the qualifications as a paramedic as set out in the regulations, and who is authorized to perform one or more controlled medical acts under the authority of a Base Hospital Medical Director, but does not include a physician, nurse or other health care provider who attends on a call.1

MEDICAL / LEGAL CONSIDERATIONS

The SAED provider can only perform controlled acts under standing orders from a Base Hospital or as directed by Base Hospital Physician.

If a physician is on the scene, the SAED provider will carry out treatment directed by the physician as long as they are within the paramedic’s scope of practice.

Guidelines for protection against "negligence" when functioning as a Primary Care Paramedic include:

- performing to one’s level of training within the Paramedic’s scope of practice outlined by the Ministry of Health and Long Term Care (EHSB-MoHLTC)
- complying with protocols
- documenting accurately
- ensuring equipment is functioning correctly
- troubleshooting commonly encountered problems

1 Ambulance Act, Revised Statutes of Ontario, 1990, Chapter A. 19, August 16, 2002
• checking equipment
• following local procedures for incident reporting

CERTIFICATION / RECERTIFICATION / DECERTIFICATION

On completion of the SAED Course, the Paramedic or Paramedic Student will be certified to perform that controlled act under the direction of the Base Hospital Medical Director.

A Paramedic or Paramedic student may lose the ability to perform SAED (be decertified), by the Base Hospital Medical Director if they fail to follow protocols correctly.

Successful recertification must occur annually.

The guidelines for certification, recertification and decertification have been developed by the Ontario Base Hospital Group (refer to the ALS standards).
INTRODUCTION TO DEFIBRILLATION

Since 1988 prehospital care in Ontario has included automated and semi-automated defibrillation. As CPR and defibrillation work in tandem, a greater percentage of cardiac arrest victims can be saved if treated quickly following a collapse. As the diagram below illustrates, EVERY SECOND COUNTS!

American Heart Association - ACLS Textbook - 1994
CARDIAC STRUCTURE AND FUNCTION

Structure

The heart is a muscle about the size of your fist. Its primary job is to pump blood through the body in a closed loop of arteries and veins. Located in the chest, behind and slightly to the left of the sternum, it sits in front of the spine and rests on the diaphragm.

As a pump, the heart is extremely efficient and durable. Depending on the person's age, size, sex, general health and level of activity, it usually beats sixty to ninety nine times per minute; or up to 130-160 times per minute when exercising. Rates less than 60 are considered to be bradycardic. Those > 100 are considered tachycardic.

The heart is composed of four separate, hollow chambers. The right side of the heart, consisting of the right atrium and the right ventricle, receives deoxygenated blood from the veins of the body and pumps it through the lungs, where carbon dioxide is exchanged for oxygen. The left side of the heart, which includes the left atrium and left ventricle, receives this oxygenated blood from the lungs and pumps it out of the heart through arteries to the various parts of the body. This cycle is repeated with each contraction of the heart.
ELECTRICAL CONDUCTION SYSTEM OF THE HEART

The cardiac impulse originates in the Sino-Atrial node (SA node), the first in the network of specialized conduction tissue, which is located in the right atrium. Most cardiac fibres are capable of automaticity; an ability to generate electrical impulses spontaneously. The SA node has a higher natural rate than the other tissue and, for this reason, functions as the normal pacemaker of the heart.

The SA node fibres are continuous with the atrial fibres, so that any action potential (impulse), generated in the SA node spreads to the remainder of atrial tissue.

The impulse is delayed at the AV node, as the conduction through these fibres is slow. This delay in conduction between the atria and the ventricles allows the atria to contract before the ventricles. This delay accounts for the delay between the P wave (atrial contraction) and the R wave (ventricular contraction) on the ECG.

From the AV node, the impulse travels into the ventricular conduction system as seen below in the following diagram and flow chart.

**Normal Sequence of Conduction:**

```
SA NODE
↓
AV NODE (slow)
↓
BUNDLE OF HIS
↓
RIGHT & LEFT BUNDLE BRANCHES
↓
PURKINJE FIBRES
↓
VENTRICULAR MUSCULATURE
```

The conduction system in the heart provides the most coordinated, efficient means for the transmission of an electrical impulse.
THE ELECTROCARDIGRAM (ECG)

The ECG records the electrical energy generated by the heart and is essentially a graphic representation of the heart’s electrical activity. The P wave is caused by the spread of electrical current or depolarization throughout the atria, which results in atrial contraction.

The conduction delay at the AV node is represented by the PR interval. The QRS complex of the ECG is the depolarization of the ventricles, and results in ventricular contraction. The T wave represents ventricular repolarization and occurs just after ventricular contraction.

It is important to always keep in mind that the ECG is an assessment of the electrical activity in the heart. To assess mechanical function the Paramedic must evaluate mechanical activity (e.g. pulse and blood pressure). One cannot assume that a normal ECG equates to an adequate cardiac output. Assess the patient not the machine.
CARDIAC CYCLE

The period of time from one ventricular contraction (R wave on ECG) to the next is called the cardiac cycle. The ventricular contraction phase is called systole. Ventricular contraction is responsible for the pulse. The relaxation phase, during which the ventricle fills with blood, is called diastole.

The cardiac cycle is represented on the normal ECG as the period between two R waves.

[Diagram of the cardiac cycle]

Electrical anatomical relationship
**SHOCKABLE RHYTHMS**

**Ventricular Fibrillation and Pulseless Ventricular Tachycardia**

The victim of cardiac arrest will be apneic (or exhibit agonal respirations), pulseless and unresponsive. CPR should be started immediately if arrest is unwitnessed and continued for 2 minutes. For witnessed arrest defibrillation of ventricular fibrillation should occur quickly.

*Ventricular fibrillation* (VF) is a common initial arrest rhythm in cardiac arrest. In VF there are multiple ectopic foci in the ventricle resulting in a quivering mass of myocardium. *Pulseless ventricular tachycardia* results from a single focus in the ventricle and presents as cardiac arrest with a wide complex tachycardia. Normal cardiac activity can only be restored by means of defibrillation – i.e. although all elements of cardiac arrest management are essential, defibrillation is the definitive treatment.

Defibrillation is the delivery of Direct Current (DC) through the heart muscle. Defibrillation depolarizes the entire myocardium. This is generally followed by a brief period of asystole. The aim is that following defibrillation the heart will repolarize uniformly and that the heart’s intrinsic pacemaker, the SA node, will resume pacing the heart. CPR alone does not restore the heart’s normal rhythm in ventricular fibrillation or pulseless ventricular tachycardia.
Ventricular Fibrillation

Ventricular Fibrillation (VF) presents with chaotic electrical activity as the result of multiple ectopic foci originating in the ventricles. There are no organized QRS complexes. This lethal rhythm is seen in approximately seventy percent of sudden cardiac arrests. Fine and Coarse VF are differentiated by the amplitude of the activity. Fine VF has an amplitude of less than 5 mm (1 large square) whereas coarse VF is greater than 5 mm in amplitude.

A patient with this dysrhythm has no output.

Ventricular Tachycardia

Ventricular Tachycardia (VT) is characterized by a wide complex, rapid rate that is generally regular in nature. A patient with this dysrhythmia may or may not have a cardiac output depending on the rate. The faster the rate the less likely it is that the patient will have a pulse.

* Ventricular tachycardia may deteriorate to ventricular fibrillation.
Causes of VF or VT

The following is a list of common causes of lethal dysrhythmias (e.g. ventricular tachycardia or fibrillation):

- electrical instability due to cellular ischemia/injury (e.g. Acute angina/myocardial infarction)
- respiratory failure - increased CO$_2$ - decreased O$_2$ (eg. strangulation, respiratory arrest, asthma, COPD)
- potassium imbalance
- electrocution
- near drowning
- irritation, inflammation or injury of electrical conduction system (eg. myocarditis)
- temperature extremes (patient hypo/hyperthermic)
- chest wall trauma

The success of defibrillation depends on:

1. Time elapsed since arrest.
2. Timely performance of effective CPR
3. Quality of electrical contact between treatment electrode and chest wall.
5. Defibrillating energy.
6. The total number of shocks delivered.

Clinical Scenarios that may Precede Life-Threatening Dysrhythmias

Clinical presentations, which may result in life threatening dysrhythmias, could include:

1. Patient complaining of chest discomfort: past history of MI, nitroglycerin (NTG) taken with minimal or no relief
2. heart rate $< 50$ or $> 120$ beats per minute
3. evidence of electrical instability of the ventricles (e.g. irregular pulse)
4. signs of decreased cardiac output (hypotension)
5. severe respiratory distress.
1. Acute Coronary Syndrome
   - history of angina, Mi, ischemic coronary disease
   - nitroglycerin use with minimal to no relief

2. Heart Rate
   - <40-50 or >120-140 may cause reduced cardiac output and hypotension in some patients (athletes may have normal resting heart rate less than 50 with a normal blood pressure).
   - very slow rates sometimes precede electrical instability of the heart
   - very rapid rates increase myocardial O$_2$ demand and may increase ischemia and increase death of heart muscle in acute myocardial infarction (AMI)

3. Electrical Instability of the Ventricles
   - isolated Premature Ventricular Complexes (PVC) are often well tolerated, however, with AMI, PVC’s may be a sign of ventricular irritability. An increase in the frequency or a change in the shape (morphology) of the PVCs indicates increasing ventricular irritability

4. Decreased Cardiac Output
   - pale, cold, clammy skin
   - BP <90 mmHg with weak or absent pulse
   - altered Level of Consciousness (LOC) - agitation, confusion, unconsciousness

Prehospital Treatment
   - manage any concerns with A, B, C’s
   - oxygen
   - rest and positioning
   - watch carefully for deterioration
   - monitor ECG and pulse oximetry (if available)
NON-SHOCKABLE ARREST RHYTHMS

In a number of cardiac arrests, especially when there is a delay from the time of collapse to Paramedic arrival, or a delay in the initiation of CPR, the heart may be asystolic, agonal, or the monitor may show organized electrical activity with no pulse (Pulseless Electrical Activity – PEA). These are non-shockable rhythms. **DEFIBRILLATION WILL NOT HELP**

**Normal Sinus Rhythm (NSR)**

- **Rate:** 60 - 99
- **Rhythm:** Regular
- **P-R Interval:** < 0.20 second
- **QRS Width:** < 0.12 second
- **P-QRS-T:** Normal
- **Missing / Added:** Nothing
- **Identifying Features:** All criteria normal

Impulses generated by SA Node follow normal conduction pathways.

**Premature Ventricular Complex**

**Unifocal PVCs**

- **Rate:** 60 - 160
- **Rhythm:** Irregular
- **P-R Interval:** < 0.20 seconds
- **QRS Width:** normal and > 0.12 seconds
- **P-QRS-T:** Inconsistent
- **Missing / Added:** Wide QRS complexes
- **Identifying Features:** Wide QRS complexes without P waves occurring before next expected QRS interval, similar in morphology

Unifocal PVC’s are the result of a single ectopic foci originating in the ventricle. The presence of PVCs was once thought to be of clinical significance however recent clinical practice has placed PVCs as a low treatment priority unless there is significant hemodynamic compromise or the patient is experiencing severe chest pain. Unifocal PVCs are similar in morphology. Caused by hypoxia, MI, electrolyte imbalances.
**Multiform PVCs**

Multiform PVC’s are generally the result of multiple ectopic foci originating in different locations within the ventricle. Multiform PVCs are different in morphology. Multiform PVCs are significant of more severe disease process in the setting of hypoxia, AMI and ischemia.

| **Rate:** | 60 - 160 |
| **Rhythm:** | Irregular |
| **P-R Interval:** | < 0.20 seconds |
| **QRS Width:** | > 0.12 seconds |
| **P-QRS-T:** | Inconsistent |
| **Missing / Added:** | Wide QRS complexes |
| **Identifying Features:** | Wide QRS complexes without P waves occurring before next expected QRS interval, different in morphology |

**Intervention**

1. A, B, C’s
2. If the patient presents with signs and symptoms consistent with myocardial ischemia, consider possibility of myocardial infarction.
3. Administer oxygen
4. Cardiac monitor application for rhythm monitoring.
5. SpO₂ monitoring if available

**Asystole**

Asystole is represented as a flat line on an ECG and is indicative of no electrical activity occurring in the heart. The baseline will undulate in a wavelike pattern or remain almost completely flat. Asystole is generally considered a terminal event. However with Advanced Care Paramedic interventions such as intubation, IV access and cardiac drugs, asystole may be reversible.

| **Rate:** | 0 |
| **Rhythm:** | None |
| **P-R Interval:** | None |
| **QRS Width:** | 0 |
| **P-QRS-T:** | No P-QRS-T |
| **Missing / Added:** | Normal QRS |
| **Identifying Features:** | Flat line |

**Intervention**

1. Establish that the patient is unresponsive, apneic and pulseless.
2. Initiate CPR immediately.
3. Begin SAED protocol for Asystole/PEA.
4. Continue CPR during patient transport.
Artifact (Motion or Electrical Interference)

Characteristics/Significance

Artifact is any external disturbance that alters or distorts the electrical signal of the ECG display. Such disturbance can significantly interfere with accurate ECG interpretation, as artifact can mimic dysrhythmias. Common causes of ECG artifact are:

1. Patient movement is the most common cause of artifact. In addition to sensing the heart’s electrical activity, the cardiac monitor also senses skeletal muscle activity (Involuntary muscle tremors, seizure activity, etc).
2. A moving ambulance may cause artifact.
3. Alternating current generators that produce 60-cycle (Hertz) interference, i.e., electric blankets, high voltage towers, fluorescent lights, radio transmissions, mechanical ventilators, suction units, etc
4. Poor contact between skin and electrode, or defective cables, which cause chaotic and irregular deflections in the baseline that may be mistaken for ventricular fibrillation.

Intervention

Every attempt must be made to correct or eliminate the presence of artifact before the rhythm is interpreted, and every precaution must be taken to ensure that what is seen as ventricular fibrillation is not artifact in disguise.

Actions:

- Vehicle must be stopped during analysis
- No one should touch or move the patient during analysis

*Note: Remember, a normal ECG tracing does not indicate normal pulse and blood pressure. (The Paramedic must treat the patient, not the monitor).
MANAGEMENT OF THE SUDDEN CARDIAC DEATH

In general, the protocol for treatment is:

1. Scene safety and control of the scene.
2. Identify the presence of cardiac arrest.
3. One paramedic begins basic life support (CPR)
4. Second paramedic operates the defibrillator (this should occur within 90 seconds of arriving at the patient's side). For consistency, one person should operate the defibrillator only.
5. Transport the patient to emergency room without delay.

Follow local SAED protocols. The standing orders are signed by the medical director and act as the authority for paramedics to perform these specific skills without delay.

SEMI-AUTOMATED DEFIBRILLATION

Step 1: Anticipation and Planning

NB The cardiac monitor/defibrillator must be checked and appropriate documentation filled out in accordance with local policy and procedure at the beginning of each shift.

1. Monitor/Defibrillators must be brought in on the following call types:
   a. VSA
   b. Unconscious/decreased level of consciousness
   c. Collapse, falls
   d. Syncopal episode
   e. Chest pain
   f. Stroke/TIA
   g. Shortness of breath
   h. Seizures
   i. Overdose
   j. Electrocution
   k. Drowning/scuba diving incidents
   l. Hypothermia and heat related illness
   m. Unknown

2. Decide on defibrillator operator (usually the certified attending Paramedic).

3. Prepare and check equipment. The following equipment should be brought in on all calls where the SAED may be utilized:
a. Semi-automatic defibrillator (SAED) with spare battery.
b. Oxygen/airway kit.
c. Bag-valve-mask with reservoir bag attachment.
d. Portable suction.
e. CPR board as required.
f. stretcher
g. any other equipment deemed necessary based on call information

4. Anticipate the arrest and mentally visualize your roles and actions.

5. If the patient is experiencing acute cardiac symptoms, anticipate arrest and be prepared to initiate cardiac arrest protocols if required.

Step 2: Scene Entry and Placement

1. Observe for any hazards in the environment such as water or flammable gases or liquids. Move patient only if necessary.
2. Transport all the equipment needed to manage the cardiac arrest to the patient's side.
3. Position the patient for effective CPR and defibrillation.
4. Position team members and the defibrillator based on assessment of available space and layout.

Although not possible in all situations, both defibrillator and operator should be on the patient's left side. Place the defibrillator device close to the patient's head. This position provides better access to the defibrillator controls and placement of the electrodes on the chest. Alternative positioning should be practiced during the course.

Step 3: Check Patient and Start CPR

1. **L.O.C.**
   Assess responsiveness
2. **A - Airway**
   Assess and manage Position and suction
3. **B - Breathing:**
   Assess and manage Ventilation with Bag-valve-mask
4. **C - Circulation:**
   Assess and manage Start cardiac compressions

As team leader, it is the responsibility of the SAED operator to see that adequate CPR is being performed. Proper CPR can make the difference between success and failure. CPR board may be required in some circumstances (e.g. patient on stretcher, bed) to provide a firm surface for CPR.
Step 4: Turn on machine before or after attaching treatment electrodes according to local protocols.

Step 5: Prepare Patient and Attach Defibrillation Pads

Expose the patient’s chest by removing clothing. Wipe the chest dry if necessary.

**Note:** Improper pad placement and poor adhesive contact are the most common errors in prehospital defibrillation.

Connect defibrillation pads to patient as per local cardiac monitor/SAED protocols. If local protocol uses the sternum/apex position for treatment pads see below for correct placement.

**Sternum** pad to the right of the sternum, with the top edge just touching the bottom of the right clavicle.

**Apex** pad to the left lateral chest at the mid-axillary line (approximately at the nipple line).

An implanted pacemaker may require you to move the pad two to four inches away from the pacemaker site.

Unless there is too much hair to get an acceptable tracing, taking additional time to clip chest hair at the pad sites may not be worth the effort, as every second counts.

**Note:** Improper positioning or connection of the pads and cables will result in either:

- An error message or "CHECK ELECTRODES" signal from the SAED.
- Less energy delivered to the myocardial cells resulting in fewer cells being depolarized and lowering the chances for a successful defibrillation.
- Skin burns

*Note: If a patient arrests while their ECG is being monitored using ECG electrodes you may have to remove the monitoring electrodes and apply defibrillation pads in order to have the SAED analyze the rhythm and deliver a shock.*

Step 6: Rhythm Analysis

The "ANALYZE" button is pressed and rhythm analysis is activated. **Everyone must be clear of the patient!** The SAED will also advise you to clear with a voice prompt, "ANALYZING NOW, STAND CLEAR". Everyone must be away from the patient before rhythm analysis starts.
**Assessment:** Rhythm assessment takes up to 5 seconds.

**Charging:** The devices will indicate that charging is under way with a tone and visual indicator. Ensure that everyone is clear and that no one is touching the patient.

**Note:** Physical motion of the patient, the defibrillator, or both (such as in a moving ambulance) may cause artifact and false rhythm interpretation. **Stop the ambulance to analyze.** Radio transmission may influence the analyze function of the defibrillator. (If possible, limit radio transmission).

**Step 7: Defibrillation (see SAED Protocol)**

In semi-automated defibrillation, the operator activates the "SHOCK" button when informed to do so by the device. A command will appear on the LCD device as well as an audible prompt. The defibrillator operator will announce **and verify**, "I AM CLEAR, YOU ARE CLEAR, EVERYONE IS CLEAR!" immediately prior to delivering each shock, be sure to look at the patient while delivering the shock.

The operator must promptly react both to the signals and messages given by the device and to the patient's response to each defibrillation.

Heart and Stroke Foundation of Ontario (HSFO) standards are used as the basis for setting the number of shocks and their energy levels in the protocols.

**SAED Outcome:**

An SAED will only shock ventricular fibrillation or rapid ventricular tachycardia. Depending on the response time of the system and the length of time the patient has been in arrest, the majority of patients encountered in the field will have a non-shockable rhythm. Hence, the device will frequently show "NO SHOCK INDICATED".

When appropriate per SAED Protocols good effective CPR will be implemented. A well oxygenated heart responds better to defibrillation than one that is hypoxic.

Possible outcomes of defibrillation are:
- Return of spontaneous circulation (ROSC) (i.e. organized rhythm with pulse)
- Ventricular Fibrillation/Ventricular Tachycardia
- Asystole
- Rhythm without pulse (PEA)
Step 8: Patient Stabilization and Maintenance

If a palpable pulse returns (ROSC), maintain a patent airway and assist ventilations with 100% oxygen to reduce hypoxia. Carefully lift and gently remove the patient to the ambulance in an expedient manner.

Be prepared for the possibility of return to cardiac arrest and re-fibrillation at any point. Available evidence indicates that re-fibrillation is likely to occur in about 25 percent of patients. Immediate SAED defibrillation is the treatment of choice until in the ER or ACP crew assumes responsibility for the patient.

Check pulse and respirations every minute. Leave the defibrillator pads in place and connected. Monitor patient very closely.

Step 9: Caring for Family and Managing Bystanders

The primary concern of the Paramedic is the patient, but it is both appropriate and necessary to communicate effectively with other people at the scene: family, friends and other bystanders.

- Respect the patient's and family's right to privacy. Isolate the patient and family from spectators whenever possible.

- Briefly inform the family of the patient's status and condition during and after resuscitation. It is important to identify the patient, establish the relationship of those present, accurately restate the events leading up to the cardiac arrest, briefly outline the efforts by the ambulance crew (CPR and whether the patient was defibrillated), and portray the patient's present condition - briefly and objectively.

Step 10: Transport

As soon as the patient is safely secured in the ambulance, transport without delay. Monitor vitals signs every minute. Keep your guard up. Anticipate that vital signs may deteriorate at any second. Provide oxygen via NRB mask if respirations are adequate. Assist ventilations with a positive pressure ventilation device (BVM or ATV) if respirations are inadequate or absent.. Stop the ambulance for rhythm analysis and defibrillation if arrest reoccurs as per current protocols. Notify the receiving hospital of the patient's status and ETA.

The vehicle must come to a complete stop prior to using the ANALYZE function when necessary en route.
Step 11: Transfer of Care to Hospital

Assure an orderly transfer of patient care to the hospital team. Provide a brief report of clinical information including:

- time of arrest
- witnessed/unwitnessed arrest
- duration of CPR
- treatments
- patient response to treatments
- vital signs
- allergies
- any medications (prescription or otherwise)
- history of present illness
- past medical history

Step 12: Documenting

Complete the ACR. Pertinent documentation should include:

- time of arrest
- witnessed/unwitnessed arrest
- history of present illness
- duration of CPR
- physical findings
- treatments
- patient response to treatments
- vital signs
- past medical history
- any medications
- allergies
- detailed documentation of times (call time, arrival, departure, ER arrival).

Interacting With The AED Trained Fire Department (F.D.)

- Upon arrival, Paramedics will take over responsibility for the patient care.
- Obtain report from the Fire Department staff.
- Any transfer of care, including changing to the Paramedic SAED, should take place during a period of CPR.
- Have the Firefighter who is operating the AED turn off machine and remove their treatment electrodes as per their protocol.
- Connect Paramedic SAED to the patient.
- Complete the SAED protocol.
CARDIAC MONITORING

Indications for use:

After completing an initial assessment, use the Semi-Automated External defibrillator/monitor for patient monitoring during transport to hospital for the following patients:

- Decreased level of consciousness/unconsciousness
- history of collapse or fall
- syncopal episode
- chest pain
- complaints of shortness of breath
- history of seizure
- suspected overdose
- confirmed cardiac history in some degree of distress
- patients with a suspected cerebral vascular accident (CVA)
- vitals signs indicate potential cardiac distress:
  - Pulse < 60 or > 100 at rest;
  - Respirations > 28 or laboured;
  - Blood pressure < 90 systolic.

Paramedics should use their clinical judgement and discretion for monitoring other patients not listed above.

Electrode Selection and Placement:

When using the cardiac monitoring capability of the SAED use the monitoring electrodes (not treatment electrodes).

The preferred electrode position is:

- Right Arm (white): right upper anterior chest
- Left Arm (black): left upper anterior chest
- Left Leg (red): left lateral chest wall
- Right Leg (green): right lateral chest wall – Ground (for cardiac monitors with 4 lead cable)

If there is clinical rational to perform a 12 lead ECG on the patient and local policy allows the Primary Care Paramedic to do so, the limb leads should be placed on the limbs rather then the chest. Refer to local Base Hospital policy regarding the acquisition of a 12 lead ECG.

Causes of poor ECG tracing include poor electrode contact/signal from:

- excessive body hair
- excessive moisture on the patient’s skin
• placement of electrodes over bony area
• placement of electrode over large muscle mass
• patient movement

**Reporting of Monitored Patients:**

In addition to typical information recorded on an ACR, in cases where cardiac monitoring is indicated (eg. chest pain) any pertinent history (eg. onset while chopping wood) and any pertinent events while monitoring (eg. briefly lost pulse during run of rapid beats - see ECG strip) should also be documented.

An initial ECG strip that is long enough to give a good picture of the patient’s presenting rhythm should be printed or recorded electronically. A repeat ECG strip should be printed if there is a significant change noted in the monitored rhythm. Printed ECG strips should be a minimum of 6 seconds in duration.

An ECG strip should be attached to the ACR and an ECG strip should be given to the receiving emergency staff. **Document the patient’s name and Call ID on all ECG strips.**

**Reporting Equipment Problems:**

Report any equipment problems as per local service policies.
TROUBLESHOOTING

Paramedics must learn to recognize the most common problems that can occur when treating cardiac arrest patients with a SAED.

These include:

- Poor electrode contact on patient's chest. Diaphoretic patients need to be dried off. Excessive body hair may also cause poor electrode contact, hair may need to be trimmed. Extra sets of adhesive defibrillation pads should be readily available.

- Before placing electrodes, always be sure to remove anything on the surface of the patient's chest. This includes bandages, nitroglycerin patch(s), body piercing and other objects that might interfere with the placement of the electrodes on the patient's skin surface.

- If you encounter an implanted pacemaker, place the treatment electrode two to four inches away from the pacemaker site and as close to the normal pad placement as possible.

- If you encounter persistent problems with a set of electrodes, please follow local service policy for reporting malfunctions.

- Failed or low battery: replace with charged spare battery as soon as possible. Remember to continue CPR during battery exchange – Plug monitor into AC power if available and appropriate.

- Loose cable-electrode connections. Check to see that connectors are properly snapped into place both at the machine and on the pads. Always carry spare electrodes.

- Monitor/cable movement. Patient movement during lifting, moving, and transport may cause motion artifact.
<table>
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<tr>
<th><strong>GLOSSARY OF TERMS</strong></th>
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<tr>
<td>ACR</td>
<td>Ambulance Call Report. The form completed by a Paramedic as a record of service provided, patient assessments and care. A portion of the form is used by the receiving hospital for billing purposes.</td>
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<tr>
<td>ACS</td>
<td>Ambulance Communications Service. A dispatch center (other than a CACC) that controls the movement of ambulances from one or more ambulance services.</td>
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<tr>
<td>BASE HOSPITAL</td>
<td>A facility designated by the Ministry of Health to provide leadership, medical direction, and quality assurance to Paramedics in the provision of prehospital and interhospital emergency health services in a specified geographic area.</td>
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<td>BLS</td>
<td>Basic Life Support. Emergency care provided to an ill or injured person that does not include controlled acts.</td>
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<tr>
<td>BCLS</td>
<td>Basic Cardiac Life Support. Emergency care provided to a cardiac patient. This includes Cardiopulmonary Resuscitation.</td>
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<tr>
<td>C.A.C.C.</td>
<td>Central Ambulance Communications Centre. A dispatch centre that controls the movement of ambulances from one or more ambulance services.</td>
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<td>CONTROLLED ACT</td>
<td>A procedure traditionally considered to be within the practice of medicine that is performed by a health care professional who has received training and authorization to perform the procedure under the authority of a physician.</td>
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<td>PCP</td>
<td>“Primary Care Paramedic” means a paramedic who holds the qualifications set out in Regulation 257/00 Part III, subsection 8(1) (a) hold the qualification of Emergency Medical Attendant: and: (b) be authorized by the Medical Director of a Base Hospital program to perform the controlled acts set out in Schedule 1</td>
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<td>EMCA</td>
<td>&quot;Emergency Medical Care Assistant&quot; means an emergency medical attendant who, (i) has successfully completed an Ambulance and Emergency Care program provided by a College of Applied Arts and Technology or has experience and qualifications that are equivalent thereto, and (ii) has obtained a pass standing in an Emergency Medical Care examination set by the Director under Regulation 257/00.</td>
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<tr>
<td>EHS SYSTEM</td>
<td>Emergency Health Services System. Term for an integrated community wide system for response to a medical emergency</td>
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</table>
"Medical Director of a Base Hospital Program" means a physician so designated by a Base Hospital.

"Paramedic" means an emergency medical care assistant who is employed by, or a volunteer in, an ambulance service and who,

(i) is authorized to perform one or more controlled acts, and

(ii) has a document signed by a medical director of a Base Hospital Program that confirms that the person is capable of performing the controlled acts specified therein under the direction of a Base Hospital Physician.

The sequence of procedures that clearly delineates the standard for performance of a controlled act.

Any hospital that receives a patient transported by an Ambulance Crew.

Semi-Automated External Defibrillator. A device capable of electronically detecting ventricular fibrillation or rapid ventricular tachycardia, but requires user interaction in order to deliver a countershock.

A predefined order for the performance of a controlled act that can be carried out by the certified Paramedic in the appropriate clinical circumstances without contacting a Base Hospital Physician.