

INTRODUCTION

Cardiac arrhythmias are common in the EMS setting. One of the fundamental concepts is the importance of recognizing those patients who are unstable or those who may become unstable during management.

SAFETY

Observe safety precautions when delivering electrical therapy.

ASSESSMENT

Clinicians need to rapidly assess and determine whether the patient is 'unstable'. Signs and symptoms of an unstable patient can be found on the initial assessment as illustrated in the table below:

Patients are unstable if:	
LOC	Abnormal
Airway	Lacking protection
Breathing	Resp distress/CHF
Circulation	Shock/Hypotension
History	Chest Pain

Hypoxemia is a common cause of both brady- and tachy-arrhythmias, therefore initial assessment should include looking for tachypnea, accessory muscle use, and other signs of increased work of breathing, as well as obtaining an SpO₂ level.

Staying Ahead of the Monitor

By obtaining a rate and rhythm (regular vs. irregular) with the first palpated pulse check, the clinician can 'predict' what they will see on the cardiac monitor. By noting if the rate is fast, slow, or normal and whether it is regular or irregular, the clinician can begin to rule in or rule out certain rhythm diagnosis right away, before the monitor is even applied.

For both brady- and tachy-cardias, a rhythm strip and 12-lead ECG should be obtained as quickly as possible.

Bradycardia

Bradycardic rhythms can have multiple causes. Some people have a slow heart rate normally, due to physical conditioning, and others may have a

slower rate due to medications such as beta-blockers. Though bradycardia is defined as a heart rate less than 60 bpm, when a bradyarrhythmia is the cause of symptoms, the rhythm is most often less than 50 bpm.

Symptomatic bradycardia may present with the following signs and symptoms:

- Chest discomfort
- Shortness of breath
- Altered LOC
- Weakness/fatigue
- Light-headedness or dizziness
- Pre-syncope/syncope
- Hypotension
- Diaphoresis
- Pulmonary edema
- PVCs

The key question to ask is if the bradycardia is causing the symptoms, or is there some other pathology involved (i.e. What else could this be?)?

It is possible to have a 'relative bradycardia', where the heart rate is in a normal sinus range, but the rate is not suitable for the patient's condition. An example of this would be a heart rate of 70 when the patient is in shock.

Regular bradycardic rhythms include

- Sinus bradycardia
- 1st degree AV block
- 3rd degree AV block
- Junctional rhythms
- Ventricular escape

Irregular bradycardic rhythms include

- 2nd degree AV block - Type I
- 2nd degree AV block - Type II (in rare cases can be regular)

The overall goals of assessing bradycardia:

- Categorize the patient as stable or unstable
- Differentiate between signs and symptoms that are caused by the slow rate vs. those that are unrelated
- Correctly diagnose the presence and type of AV block

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Tachycardia

When assessing a patient with tachycardia, there are certain questions the clinician should ask:

1. Are pulses present or absent?
 - Absent pulses (radial and carotid) may indicate cardiac arrest or an unstable patient.
2. Are symptoms present or absent?
3. Are the symptoms due to the tachycardia?
 - Is the tachycardia causing the signs and symptoms and hemodynamic instability?OR
 - Are the signs and symptoms causing the tachycardia (e.g. pain, sepsis, hypovolemia)?
 - If a HR is less than 150, the associated symptoms may not be due to the tachycardia alone. A heart rate over 150 is an inappropriate response to physiologic stress.
4. Is the patient stable or unstable?
 - Signs of altered LOC, shock, hypotension, chest pain or pulmonary edema demonstrate that the patient is unstable.
5. Is the QRS narrow or wide?
 - A narrow QRS indicates the origin of the rhythm is supraventricular (SVT). Tachycardic rhythms with narrow QRS complexes include sinus tachycardia, atrial fibrillation, atrial flutter, AV nodal reentry, atrial tachycardia, and junctional tachycardia.
 - A wide QRS may indicate the origin of the rhythm is from the ventricles (e.g. ventricular tachycardia), a pacemaker, or may result from supraventricular tachycardia with aberrancy, or pre-excitation (e.g. Wolff-Parkinson-White syndrome).
6. Is the rhythm regular or irregular?
 - Atrial fibrillation is the most common irregular narrow complex tachycardia.
7. Is the QRS monomorphic or polymorphic?

- Ventricular tachycardia can be monomorphic or polymorphic (e.g. torsades de pointes).

8. Is the rhythm sinus tachycardia?
 - Sinus tachycardia is generated by the sinus node therefore is usually not higher than 130, and will not exceed 220. It has a gradual onset and termination and is usually caused by external systemic factors (e.g. fever, exercise, blood loss, or anemia), not primary cardiac rhythm disorders.

MANAGEMENT

Bradycardia

The overall goals of managing symptomatic bradycardia:

- Use atropine as the drug intervention of first choice
- Decide when to start transcutaneous pacing
- Decide when to start pharmacological agents to maintain heart rate and blood pressure

If a patient has adequate perfusion, and is not exhibiting signs of symptomatic bradycardia, do not aggressively treat the heart rate. Conversely, patients who are unstable require immediate treatment.

The goal of therapy for bradycardia is to improve the clinical status of the patient, not necessarily get to a particular heart rate. Treatment of symptomatic bradycardia may include obtaining intravenous access, pharmacological agents, and transcutaneous pacing. In unstable patients, oxygen therapy or airway management may be required.

The first medication used in treating symptomatic bradycardia is atropine (**PEP 3 neutral**). Use atropine with caution in the case of a myocardial infarction, as atropine increases the heart rate and may increase the infarct size. Atropine is also unlikely to work in the case of 2nd degree AV blocks (type II) or 3rd degree AV blocks (i.e. high degree blocks).

If atropine does not work, the patient is unstable, and/or the presenting rhythm is a high degree block and IV access is not available, it is appropriate to

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initiate transcutaneous pacing (**PEP 3 neutral**). Ensure adequate sedation is used as necessary.

An alternative to pacing is the use of beta-adrenergic agonists such as dopamine (**PEP 3 neutral**) or epinephrine. These agents have chronotropic effects and will act to improve the clinical status of the patient.

Tachycardia

Once the clinician has obtained a 12 lead and answered the assessment questions, a management strategy can be developed. If the rhythm is sinus tachycardia, management involves treating the underlying condition which may still be cardiac (e.g. STEMI, CHF, but not a primary rhythm disorder).

Treatment of tachycardia may include obtaining intravenous access, vagal maneuvers, and pharmacological and/or synchronized cardioversion. If the rhythm is determined to be sinus tachycardia, look for the cause and treat as appropriate.

Stable Tachycardia

A patient with a tachyarrhythmia is considered to be stable if they have no significant signs or symptoms caused by the increased rate.

If the rhythm is SVT attempt vagal maneuvers (**PEP 1 neutral**). If this is unsuccessful, administer adenosine (**PEP 2 supportive**).

In the case of stable atrial flutter or fibrillation, if the duration is more than 48 hours hold off on treatment as these patients have an increased risk of cardioembolic events. It is only appropriate to cardiovert atrial fibrillation or flutter in the pre-hospital setting if the patient becomes unstable.

If the patient is stable and has a wide complex tachyarrhythmia, administration of IV amiodarone (**PEP 3 neutral**) or lidocaine (**PEP white**) should be considered.

Wolff-Parkinson-White (WPW)

WPW is an accessory pathway syndrome, where there is a loss of the normal AV node conduction.

Assessment - Any tachycardia at a rate over 200 bpm should raise the suspicion of an accessory pathway like WPW. The patient may give a personal or family history of WPW or sudden cardiac death at a young age.

Diagnosis - On an ECG, WPW will have a short PR interval, wide QRS and a slurred upstroke to the QRS, referred to as a delta wave.

Management approach to WPW

Stable or unstable? If the patient is unstable proceed with synchronized cardioversion.

If stable, is QRS narrow? If it is narrow, monitor en route to hospital and consider proceeding with standard SVT treatment.

If stable, is QRS wide? Avoid use of AV nodal blockers such as adenosine. Giving adenosine in this setting may precipitate ventricular fibrillation.

WPW re-entry may also present with rapid atrial fibrillation with irregular QRS complexes that may be narrow or wide. In these cases, the rate will be extremely fast, sometimes above 300bpm. Monitor en route to hospital and cardiovert if the patient becomes unstable.

Unstable Tachycardia

If a patient has significant signs and symptoms (i.e. signs of hypoperfusion) due to the tachycardia, they are considered to be unstable and require synchronized cardioversion (**PEP white**). Remember to consider sedation when using electrical cardioversion if time allows (depending on extent of patient instability). The energy level and whether the shock is synchronized will depend on the underlying rhythm.

A patient in ventricular tachycardia without a pulse, any patient in polymorphic ventricular tachycardia (i.e. torsades de pointe), or those who are pre-arrest, will require a high-energy unsynchronized shock at defibrillation energy. Synchronized shocks can be delivered for unstable supraventricular tachycardia, atrial fibrillation, atrial flutter, or regular

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monomorphic ventricular tachycardia with a pulse. Further details can be found in the table below.

at the same rate at which international guidelines are changed. Please refer to current AHA guidelines for the most up-to-date information on best practices.

Rhythm	Type of Shock	Initial (biphasic) Energy Setting*
Monomorphic ventricular tachycardia with a pulse	Synchronized	100J
Atrial flutter	Synchronized	50-100J
Supraventricular tachycardia	Synchronized	50-100J
Atrial fibrillation	Synchronized	120-200J
Monomorphic ventricular tachycardia without a pulse	Unsynchronized	200J
Polymorphic ventricular tachycardia	Unsynchronized	200J
Any patient who is pre-arrest	Unsynchronized	200J

*Energy levels can be escalated for subsequent shocks if the initial shock does not convert the rhythm.

TRANSFER OF CARE

- [1] Contact online medical control early to consider most appropriate destination facility.
- [2] Ensure clear communication of the symptom onset metrics to receiving healthcare team.
- [3] Provide copies of the rhythms strips and 12 lead ECGs. It is critical for the attending cardiology team to see the initial underlying rhythm as they use this information to determine the treatment plan (e.g. implantable defibrillator, pacemaker etc.)
- [4] Provide summary of medications and/or electrical therapy provided prior to arrival at the hospital.

CHARTING

Ensure to upload and attach relevant 12 lead ECGs, and code summaries to ePCR.

KNOWLEDGE GAPS

It is not always possible to update all local documents regarding brady- and tachy-arrhythmias

EDUCATION

Formal certification in ACLS and PALS will enable improved standardized care in the treatment of patients with brady- and tachy-arrhythmias. Clinicians are encouraged to maintain certification in these courses. Ongoing practice in scenario management can improve the care provided in these cases as well.

QUALITY IMPROVEMENT

It is critical that the attending crew clearly documents the stability of the patient, the identified rhythm, the corresponding treatment provided, and the patient's response to treatment.

REFERENCES

- <http://www.gov.ns.ca/health/ehs/>
- <http://www.ilcor.org>
- <http://www.hsfc.ca>
- <http://emergency.medicine.dal.ca/ehsprotocols/protocols/toc.cfm>
- Sinz, E., & Navarro, K. (Eds.) (2011) Advanced Cardiovascular Life Support Provider Manual. American Heart Association.

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PEP 3x3 TABLES for ADULT ARRHYTHMIA

Throughout the EHS Guidelines, you will see notations after clinical interventions (e.g.: **PEP 2 neutral**). PEP stands for: the Canadian **P**rehospital Evidence-based **P**rotocols Project.

The number indicates the Strength of cumulative evidence for the intervention:

- 1 = strong evidence exists**, usually from randomized controlled trials;
- 2 = fair evidence exists**, usually from non-randomized studies with a comparison group; and
- 3 = weak evidence exists**, usually from studies without a comparison group, or from simulation or animal studies.

The coloured word indicates the direction of the evidence for the intervention:

Green = the evidence is supportive for the use of the intervention; **Yellow = the evidence is neutral**;

Red = the evidence opposes use of the intervention;

White = there is no evidence available for the intervention, or located evidence is currently under review.

PEP Recommendations for Arrhythmia Interventions, as of 2013/03/06. PEP is continuously updated. See: <http://emergency.medicine.dal.ca/ehsprotocols/protocols/toc.cfm> for latest recommendations, and for individual appraised articles.

Bradycardia

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)				
	2 (fair evidence exists)				
	3 (weak evidence exists)		<ul style="list-style-type: none"> • Anticholinergic • Inotrope • Transcutaneous Pacing 		

Stable Narrow Complex Tachycardia

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)	<ul style="list-style-type: none"> • Antiarrhythmic - Class IV (Ca+ channel blockers) 	<ul style="list-style-type: none"> • Carotid Massage • Vagal Maneuvers 		<ul style="list-style-type: none"> • B Blockers • Fluid Bolus
	2 (fair evidence exists)	<ul style="list-style-type: none"> • Antiarrhythmic - Class V (other mechanism) 			
	3 (weak evidence exists)				

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Stable Wide Complex Tachycardia

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)				<ul style="list-style-type: none"> Adenosine Antiarrhythmic - Class I (Na⁺ channel blockers) Cardioversion Magnesium/Polymorphic VT
	2 (fair evidence exists)				
	3 (weak evidence exists)		<ul style="list-style-type: none"> Antiarrhythmic - Class III (K⁺ channel blockers) 		

Unstable Tachycardia (Wide or Narrow Complex)

Recommendation		RECOMMENDATION FOR INTERVENTION			
		SUPPORTIVE (Green)	NEUTRAL (Yellow)	AGAINST (Red)	NOT YET GRADED (White)
STRENGTH OF RECOMMENDATION FOR INTERVENTION	1 (strong evidence exists)				<ul style="list-style-type: none"> Cardioversion
	2 (fair evidence exists)				
	3 (weak evidence exists)				

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Program Document Number Management System

PDN: 6224.04	Title: Adult Cardiac Arrhythmia	Type: CPG
Effective Date: April 3, 2013	Revision Date:	
Approval Date: March 6 2013 2013	Revision Date:	
Review Date: April 1 2013	Revision Date:	
Replaces: 6228.01, 6229.06, 6317.01	Revision Date:	
Signature of Program Director 	Signature of Program Document Coordinator 	

PDN: 6224.99.01.01	Title: Bradycardia	Type: Field Guide
Effective Date: April 2 2013	Revision Date:	
Approval Date: March 6, 2013	Revision Date:	
Review Date: April 1, 2013	Revision Date:	
Replaces: 6224.03	Revision Date:	
Signature of Program Director 	Signature of program Document Coordinator 	

PDN: 6224.99.02.01	Title: Tachycardia	Type: Field Guide
Effective Date: April 2 2013	Revision Date:	
Approval Date: March 6, 2013	Revision Date:	
Review Date: April 1, 2013	Revision Date:	
Replaces: 6225.02	Revision Date:	
Signature of Program Director 	Signature of program Document Coordinator 	

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