Tachycardia-Adult

Aliases

Supraventricular tachycardia (SVT), ventricular tachycardia (VT), multifocal atrial tachycardia (MAT), torsades, atrial fibrillation (A-FIB), atrial flutter

Patient Care Goals

1. Maintain adequate oxygenation, ventilation, and perfusion.
2. Control ventricular rate.
3. Restore regular sinus rhythm in unstable patient.
4. Search for underlying cause:
    a. Medications (caffeine, diet pills, thyroid, decongestants)
    b. Drugs (cocaine, amphetamines)
    c. History of dysrhythmia
    d. CHF

Patient Presentation

- Elevated heart rate for age with or without associated symptoms such as palpitations, dyspnea, chest pain, syncope/near-syncope, hemodynamic compromise, altered mental status, or other signs of end organ dysfunction.

Inclusion Criteria

Heart rate greater than 100 bpm in adults

Exclusion Criteria

Sinus tachycardia

Patient Management

Assessment, Treatments, and Interventions

Adult Management

a. Manage airway as necessary.
b. Administer oxygen ***[EMR]*** as appropriate for dyspnea or distress with a target of achieving greater than 93% saturation for most acutely ill patients.
c. Initiate ECG monitoring and perform 12-lead ECG
d. Establish IV access ***[AEMT].***
e. Check blood glucose ***[EMR]*** and treat hypoglycemia per the Hypoglycemia guideline.
f. Consider the following additional therapies if tachycardia and symptoms or hemodynamic instability continue:
    i. **Regular Narrow Complex Tachycardia—Stable (SVT)**
        1. Perform vagal maneuvers. ***[PARA]***.
        2. Administer **Adenosine** ***[PARA]*** (proximal site)
            a. **6mg IV (proximal site) followed by 10ml fluid bolus, repeat 12mg IV, as needed, up to three doses total**
            b. May consider initial dose of 12mg IV as initial dose and repeat X 1
            c. If no effect with 6mg followed by 12mg dose do not need to administer additional 12mg dose but may be administered if clinically appropriate
        3. Consider Calcium Channel Blocker **[PARA]** or Beta Blocker ***[PARA].***
            a. Preferred Calcium Channel Blockers
                a. **Verapamil**
                    i. **0.075mg/kg IVP over 2 minutes (average dose 5-10mg)**
                    ii. **If no change, may repeat after 15 minutes: 0.15mg/kg IVP over 2 minutes**

            b. **Diltiazem**
                i. **0.25mg/kg (typical 20mg) IV/IO, may repeat in 15 minutes 0.35mg/kg (typical 25mg) IV/IO**
                ii. **Infusion: 5-15mg/hr**
        b. Preferred Beta-Blocker: **Labetalol**
            a. **10-20 mg IV/IO, may repeat q10min, Max 300mg**
            b. **1-2 mg/min infusion, Max 300mg per day**

ii. **Regular Narrow Complex Tachycardia—Unstable**
    1. Deliver a synchronized shock ***[PARA]*** 50-150J, repeat and increase Joules up to 200J
    2. Consider sedation and analgesia for responsive patients.

iii. **Irregular Narrow Complex Tachycardia—Stable** (atrial fibrillation, atrial flutter, multifocal atrial tachycardia), administer:
    1. Administer Calcium Channel Blocker **[PARA]** or Beta Blocker ***[PARA].***
        a. Preferred Calcium Channel Blockers
            a. **Verapamil**
                i. **0.075mg/kg IVP over 2 minutes (average dose 5-10mg)**
                ii. **If no change, may repeat after 15 minutes: 0.15mg/kg IVP over 2 minutes**
            b. **Diltiazem**
                i. **0.25mg/kg (typical 20mg) IV/IO, may repeat in 15 minutes 0.35mg/kg (typical 25mg) IV/IO**
                ii. **Infusion: 5-15mg/hr**
        b. Preferred Beta-Blocker: **Labetalol**
            a. **10-20 mg IV/IO, may repeat q10min, Max 300mg**
            b. **1-2 mg/min infusion, Max 300mg per day**

iv. **Irregular Narrow Complex Tachycardia—Unstable**
    1. Deliver a synchronized shock ***[PARA]*** 120-200J, repeat and increase Joules up to 200J
    2. Consider sedation for responsive patients.

v. **Regular Wide Complex Tachycardia—Stable** (ventricular tachycardia, supraventricular tachycardia, atrial fibrillation/flutter with aberrancy, accelerated idioventricular rhythms, pre-excited tachycardias with accessory pathways), administer:
    1. **Amiodarone *[PARA]* 150mg IV over 10 minutes**
        a. **Maintenance Infusions: 1mg/min X 6 hours**
    2. **Procainamide *[PARA/*Inter-facility**]
    3. **Lidocaine *[PARA].* 1mg/kg IV. May repeat every 5 min to max 3mg/kg**
    4. **Adenosine**, if monomorphic tachycardia ***[PARA]***.
        a. **6mg IV (proximal site) followed by 10ml fluid bolus, repeat 12mg IV, as needed, up to three doses total**
        b. May consider initial dose of 12mg IV as initial dose and repeat X 1If no effect with 6mg followed by 12mg dose do not need to administer additional 12mg dose but may be administered if clinically appropriate

vi. **Regular Wide Complex Tachycardia—Unstable**
    1. Deliver a synchronized shock ***[PARA]*** 100-200J, repeat and increase Joules up to 200J
    2. Consider sedation for responsive patients.

vii. **Irregular Wide Complex Tachycardia—Stable** (atrial fibrillation with aberrancy, pre-excited atrial fibrillation (i.e. atrial fibrillation using an accessory pathway), MAT or polymorphic VT/torsades de pointes.
    1. **Amiodarone *[PARA]* 150mg IV/IO over 10 minutes**
        a. **Maintenance Infusions: 1mg/min X 6 hours**
    2. Procainamide ***[PARA/***Inter-facility]
    3. **Magnesium Sulfate if torsades de pointes *[PARA]* 1-2gm IV/IO over 5-20 minutes**

viii. **Irregular Wide Complex Tachycardia—Unstable**

1. Deliver a synchronized shock ***[PARA]*** 100-200J, repeat and increase Joules up to 200J
2. Consider sedation for responsive patients.

ADULT TACHYARRHYTHMIA

ALS - 2020 VERSION

Tachyarrhythmia
- HR ≥ 150
- Relative tachycardia for patient's condition may also warrant treatment

- Maintain airway and breathing; establish pulse oximetry
- Administer supplemental oxygen (target SpO_2 of 94% to 99%) if clinically indicated
- Establish cardiac monitoring; monitor blood pressure and perfusion
- Obtain 12-lead ECG if time and resources permit
- Obtain IV access (IO access if necessary)

Evaluate rhythm

Probable sinus tachycardia
- HR usually < 150

- Monitor patient (e.g., cardiac monitoring, noninvasive blood pressure, vital signs)
- Obtain 12-lead ECG if not already done
- Identify and treat underlying cause (e.g., dehydration, blood loss, fever, infection, anxiety)

Signs of hemodynamic compromise?

YES

- Immediate **synchronized cardioversion** (pre-sedate if possible)
- Consider **adenosine** (do not delay cardioversion) for narrow-complex and regular rhythm
- If refractory, consider:
  - Need to increase energy level for next cardioversion
  - Antiarrhythmic medication (**procainamide**, **amiodarone** OR **sotalol**)
  - Underlying cause
  - Expert consultation

NO

Wide QRS (≥ 0.12 sec)?

YES

- Obtain IV access and 12-lead ECG if not already done and time and resources permit
- Consider **adenosine** if regular and monomorphic
- Consider antiarrhythmic medication (**procainamide**, **amiodarone** OR **sotalol**)
- If refractory, consider:
  - Underlying cause
  - Cardioversion
  - Adjustment of dose or change/ addition of another antiarrhythmic medication (**procainamide**, **amiodarone** OR **sotalol**)
  - Expert consultation

NO

- Obtain IV access and 12-lead ECG if not already done and time and resources permit
- Attempt **vagal maneuver** if rhythm is regular
- Consider **adenosine** if rhythm is regular
- Consider **calcium channel blocker** OR **β-blocker** if rhythm is not regular, adenosine is ineffective or tachyarrhythmia recurs
- Consider expert consultation

Medications

Adenosine
- First dose: 6 mg via rapid IV push
- Second dose: 12 mg if needed

NOTE: Follow each dose with a rapid 10- to 20-ml NS flush

Amiodarone
- 150 mg IV over 10 min; repeat as needed if arrhythmia recurs
- Maintenance infusion: 1 mg/min for first 6 hours

Procainamide (avoid if prolonged QT or congestive heart failure)
- 20 to 50 mg/min until arrhythmia is suppressed, hypotension develops, QRS duration increases by more than 50% or max dose of 17 mg/kg is given
- Maintenance infusion: 1 to 4 mg/min

Sotalol (avoid if prolonged QT)
- 100 mg (1.5 mg/kg) over 5 min

Synchronized Cardioversion Energy Doses

Follow device manufacturer's recommendations for energy doses

Vagal Maneuvers
- Valsalva maneuver
- Cold stimulus
- Gagging
- Carotid massage (use with caution in those with vascular disease, older adults)

Signs of Hemodynamic Compromise
- Changes in mental status
- Ischemic chest discomfort
- Hypotension
- Signs of shock
- Acute heart failure

Copyright © 2021 The American National Red Cross

Notes and Educational Pearls Key Considerations

- Causes:
  - Hypovolemia

    - Hypoxia
    - Hydrogen (acidosis)
    - Myocardial infarction
    - Hypokalemia or hyperkalemia
    - Hypoglycemia
    - Hypothermia
    - Toxins or Overdose
    - Tamponade
    - Tension pneumothorax
    - Thrombus—central or peripheral
    - Trauma
    - Hyperthyroidism
- Atrial fibrillation rarely requires cardioversion in the field. As it is difficult to ascertain onset of rhythm, risk of stroke needs to be considered prior to cardioversion.
- A wide-complex irregular rhythm should be considered pre-excited atrial fibrillation; extreme care must be taken in these patients.
    - Characteristic ECG findings include a short PR interval and, in some cases, a delta wave.
    - Avoid AV nodal blocking agents such as adenosine, calcium channel blockers, digoxin, and possibly beta-blockers in patients with pre-excitation atrial fibrillation (e.g. Wolff-Parkinson-White Syndrome, Lown-Ganong-Levine Syndrome) because these drugs may cause a paradoxical increase in the ventricular response.
    - Blocking the AV node in some of these patients may lead to impulses that are transmitted exclusively down the accessory pathway, which can result in ventricular fibrillation.
    - Amiodarone or procainamide may be used as an alternative.
- Amiodarone or procainamide can be used as a rate-controlling agent for patients who are intolerant of or unresponsive to other agents, such as patients with CHF who may not otherwise tolerate diltiazem or metoprolol.
- Biphasic waveforms have been proven to convert atrial fibrillation at lower energies and higher rates of success than monophasic waveforms. Strategies include dose escalation (70, 120, 150, 170 J for biphasic or 100, 200, 300, 360 J for monophasic) versus beginning with single high energy/highest success rate for single shock delivered.
- Studies in infants and children have demonstrated the effectiveness of adenosine for the treatment of hemodynamically stable or unstable SVT.
- Adenosine should be considered the preferred medication for stable SVT.
    - Verapamil may be considered as alternative therapy in older children but should not be routinely used in infants.
    - Procainamide or amiodarone given by a slow IV infusion with careful hemodynamic monitoring may be considered for refractory SVT.

Pertinent Assessment Findings

No recommendations

Patient Safety Considerations

- Only use one anti-dysrhythmic at a time.
- Patients who receive metoprolol and diltiazem are at significant risk for hypotension and bradycardia.
- If using cardioversion, consider sedation and pain control.
- With irregular wide complex tachycardia (atrial fibrillation with aberrancy such as Wolff-Parkinson-White and Lown-Ganong Levine), avoid use of AV nodal blocking agents (e.g. adenosine, calcium channel blockers, beta blockers).
- Patients with Wolff–Parkinson–White should be given procainamide prior to amiodarone.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914199—Medical-Tachycardia
- 9914151—Medical-Ventricular Tachycardia (With Pulse)
- 9914147—Medical-Supraventricular Tachycardia (Including Atrial Fibrillation)

Key Documentation Elements

- Initial rhythm and all rhythm changes
- Time, dose and response to medications given
- Cardioversion times, synchronization, attempts, joules and response
- Obtain monitor strips after each intervention
- Patient weight
- Pediatric length-based tape color (for pediatrics who fit on tape)
- History of event supporting treatment of underlying causes

Performance Measures

- Time to clinical improvement from patient contact
- Blood sugar obtained
- Correct medication(s) and dose given for patient condition, age, and weight
- Correct cardioversion joules delivered given patient weight and/or condition
- Use of sedation for responsive patient
- ***EMS Compass® Measures*** *(for additional information, see www.emscompass.org)*
    - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
    - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia

References

1. DeSouza IS, Martindale JL, Sinert R. Antidysrhythmic drug therapy for the termination of stable, monomorphic ventricular tachycardia: a systematic review. *Emerg Med J.* 2015;32(2):161-7.
2. Fengler BT, Brady WJ, Plautz CU. Atrial fibrillation in the Wolff-Parkinson-White Syndrome: ECG recognition and treatment in the ED. *Am J Emerg Med.* 2007;25(5):576-83.
3. Fuster V, Rydén LE, Cannom DS, et al. [ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation – executive summary]. *Rev Port Cardiol*. Apr;26(4):383-446.
4. Link MS, Berkow LC, Kudenchuk HR, et al. Part 7: adult advanced cardiovascular life support. *Circulation*. 2015;132(18 Suppl 2):S444-64.
5. Long B, Koyfman A. Best clinical practice: emergency medicine management of stable monomorphic ventricular tachycardia. *J Emerg Med*. Epub 2016 Oct 15.
6. McNamara RL, Tamariz LJ, Segal JB, Bass EB. Management of atrial fibrillation: review of the evidence for the role of pharmacologic therapy, electrical cardioversion, and echocardiography. *Ann Intern Med.* 2003;139(12):1018-33.
7. Ortiz M, Martin A, Arribas F, et al. Randomized comparison of intravenous procainamide vs. intravenous amiodarone for the acute treatment of tolerated wide QRS tachycardia: the PROCAMIO study. *Eur Hear J*. 2017;38(17):1329-35.
8. Somberg JC, Bailin SJ, Haffajee CI, et al. Intravenous lidocaine versus intravenous amiodarone (in a new aqueous formulation) for incessant ventricular tachycardia. *Am J Cardiol.* 2002;90(8):853-9.
9. Wann LS, Curtis AB, January CT, et al. 2011 ACCF/AHA/HRS focused update on the management of patients with atrial fibrillation (updating the 2006 guideline): a report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines. *Circulation. 2011;123:104-23*.
10. Zimetbaum P, Reynolds MR, Ho KK, et al. Impact of a practice guideline for patients with atrial fibrillation on medical resource utilization and costs. *Am J Cardiol*, 2003;92(6):677-81.