TACHYCARDIA IN KIDS

The Good, the Bad, the Ugly

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DISCLAIMER

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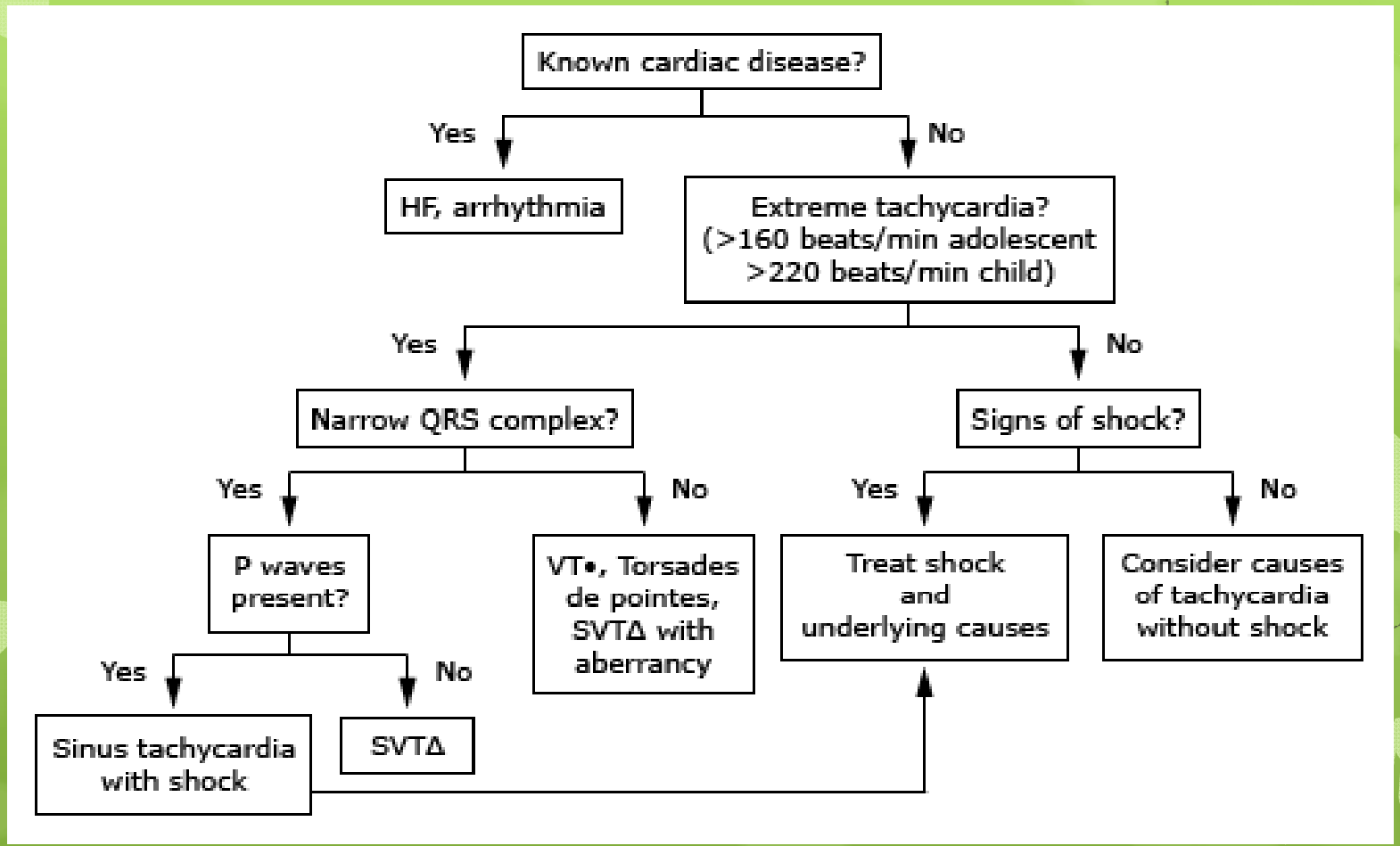
- I have no financial relationships or conflicts in relation to the products or services described in this presentation.

INTRODUCTION

- Tachycardia in children may be a sign of clinical problems that range from trivial to life-threatening.
- As a primary care provider, it would be nice to know which fall in the latter category.
- Hopefully, we can provide you with some useful hints and guidelines.

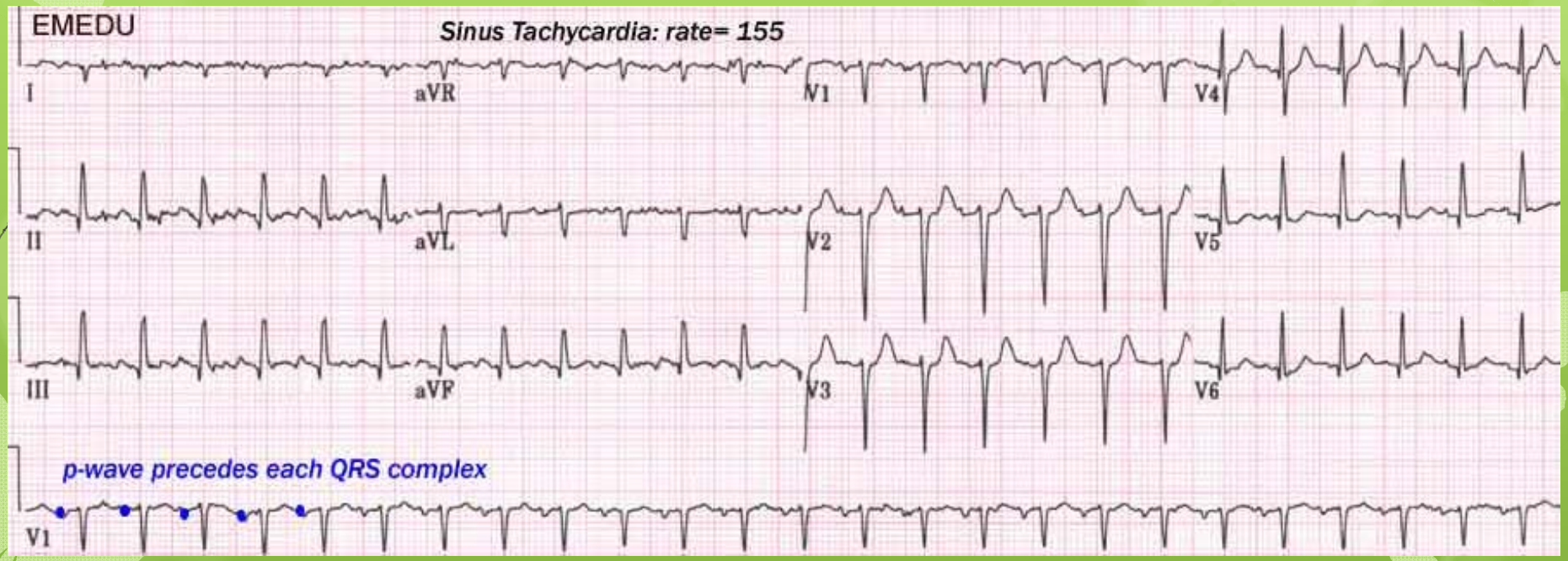
INITIAL APPROACH



THE GOOD

- Sinus tachycardia is the most frequent finding in children with rapid heart rates.
- Definition varies with age: 160-200 bpm in infants, 140-180 bpm in child, 100-150 bpm in young adults.
- For exercise stress testing, the predicted maximum heart rate = 220 – age (in years).

SINUS TACHYCARDIA



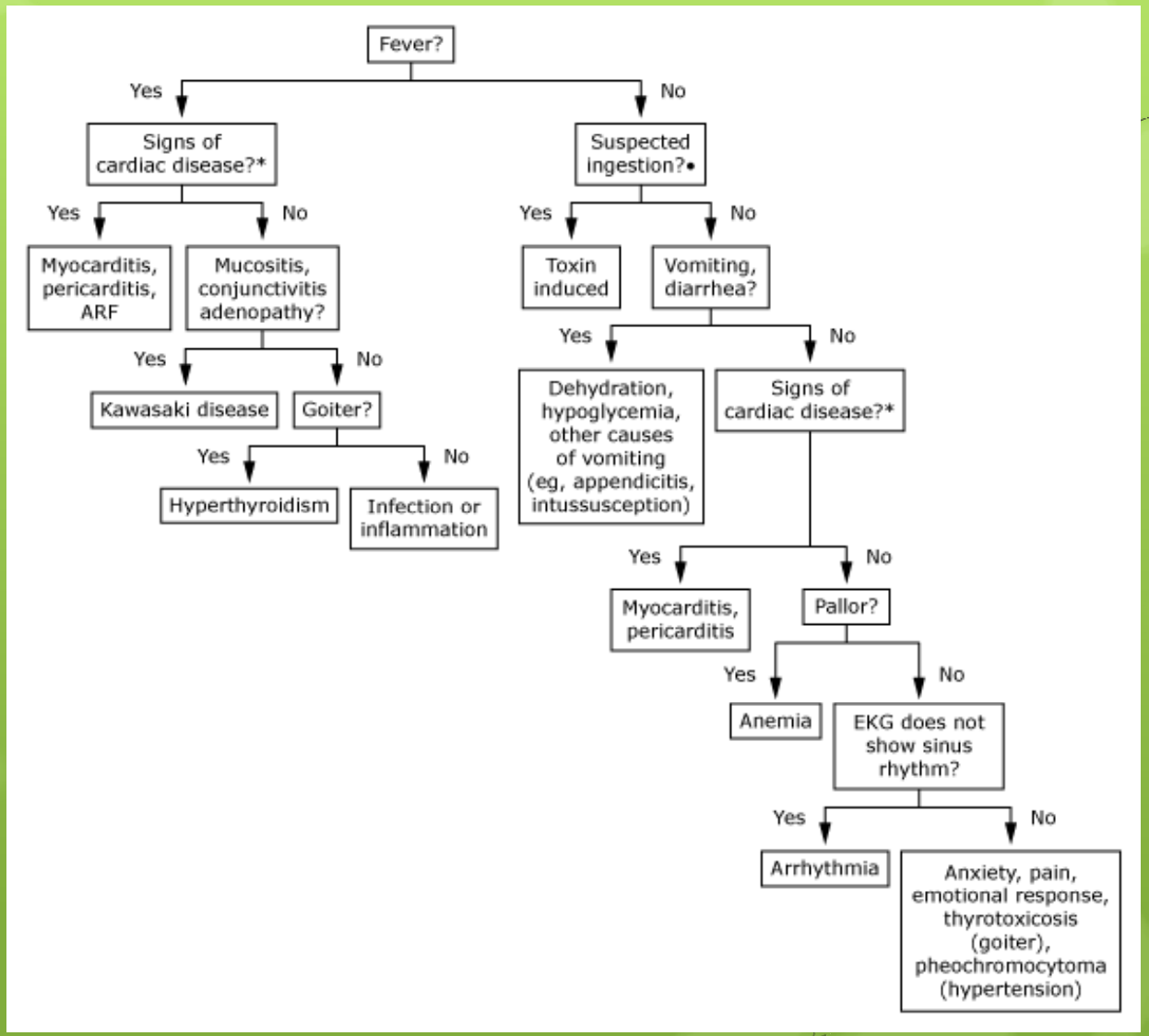
SINUS TACHYCARDIA

- May be seen with myocarditis, Kawasaki disease, acute rheumatic fever or congestive heart failure but mostly not due to heart problem.
- Consider hypoxemia, hypoglycemia, shock, sepsis, anemia, pain, fever, anxiety, hyperthyroidism, drug effect, electrolyte issues etc.
- Treat underlying cause rather than treat the tachycardia itself.

POSTURAL TACHYCARDIA SYNDROME (POTS)

- Common in teens and young adults.
- Autonomic neuropathy, baroreflex abnormalities, hypovolemia, sympathetic hyperactivity, etc.
- **Tilt table testing**: Pulse increases 30 bpm or over 120 bpm, flat to upright.
- Volume, fludrocortisone, midodrine, propranolol improve tilt table test.

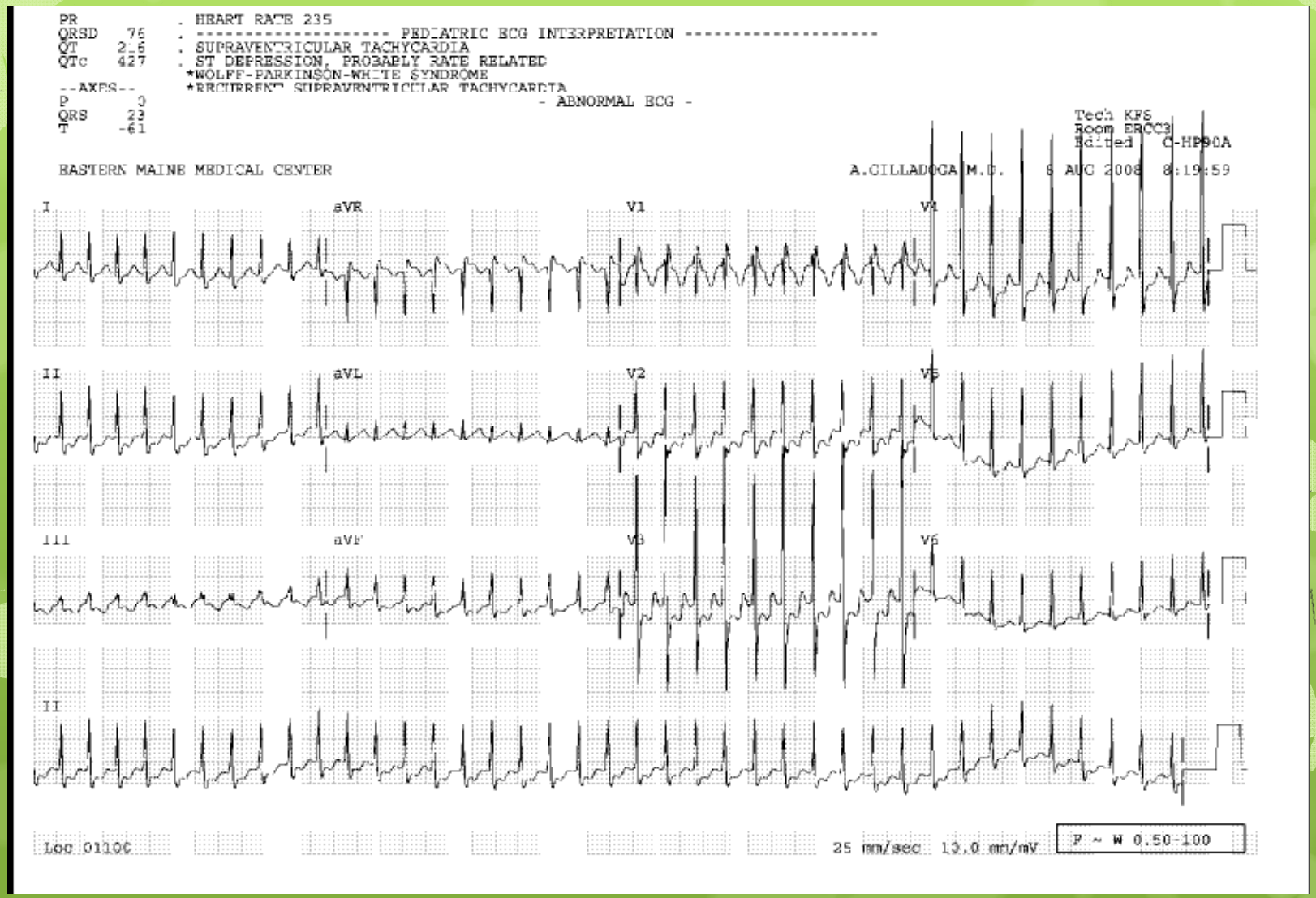
TACHYCARDIA, NO SHOCK



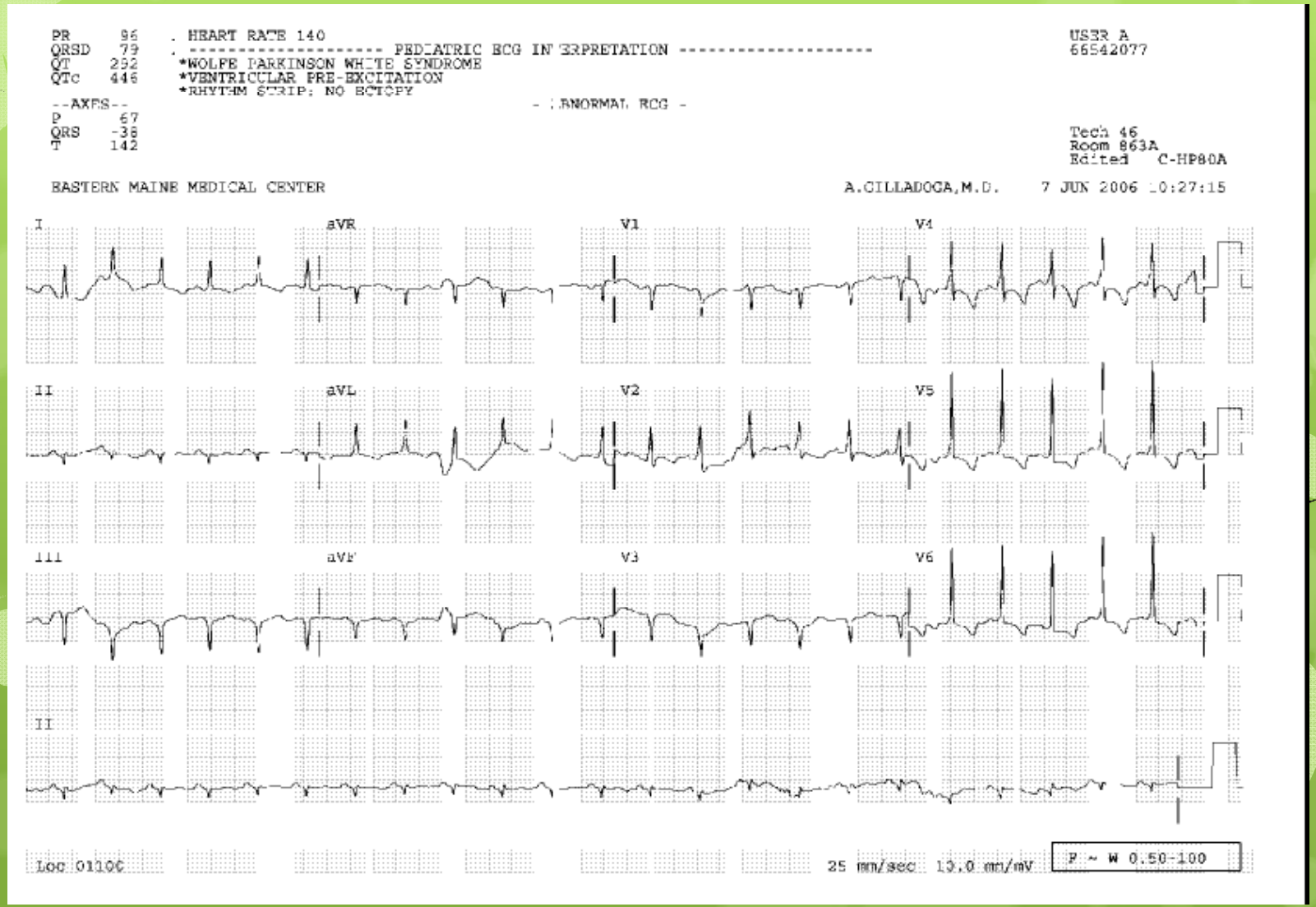
THE BAD

- Tachycardia in children causing clinical deterioration as the primary issue.
- Most often due to abnormal cardiac wiring causing electrical “short circuit”.
- The most frequent model for reentrant supraventricular tachycardia (SVT) is Wolff-Parkinson –White syndrome.

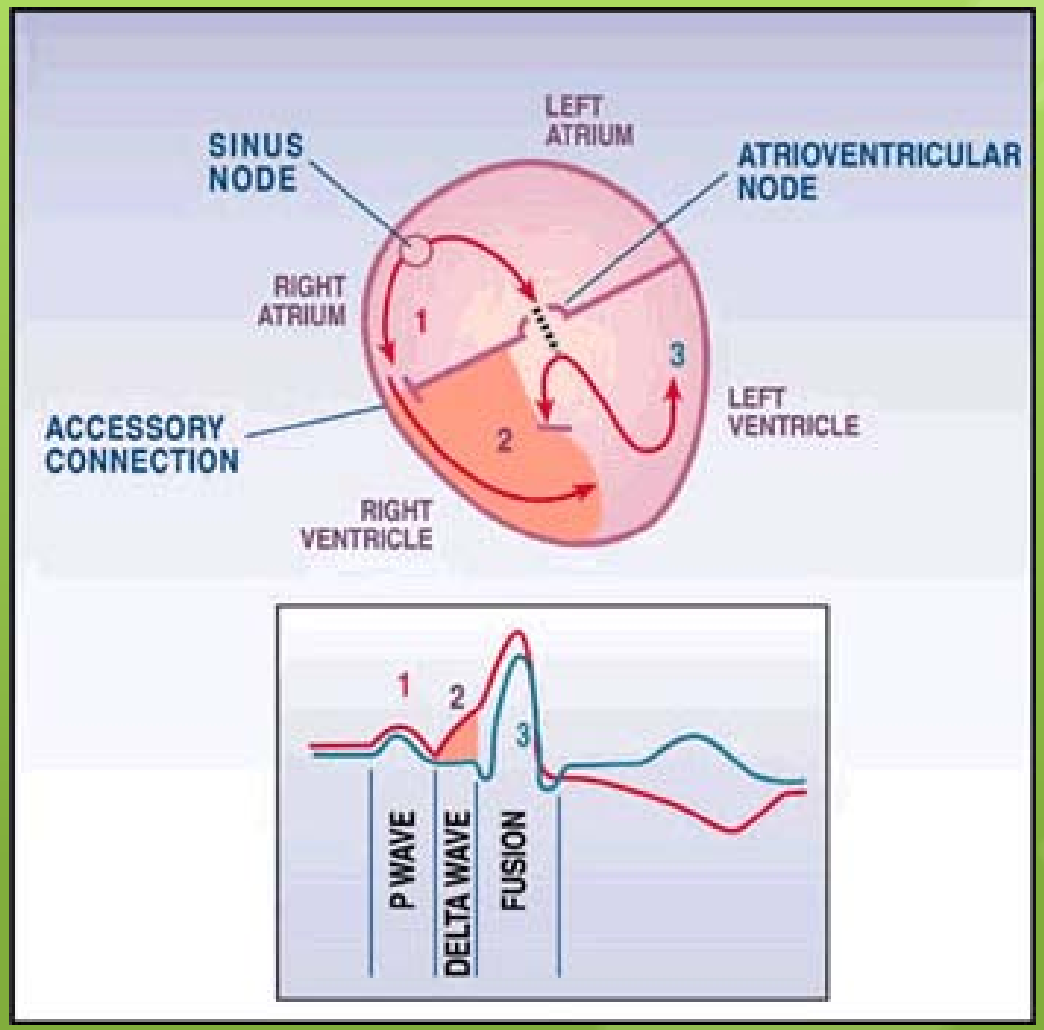
SUPRAVENTRICULAR TACHYCARDIA



WOLFF-PARKINSON-WHITE ECG PATTERN



WHY WOLFF-PARKINSON-WHITE ECG PATTERN?



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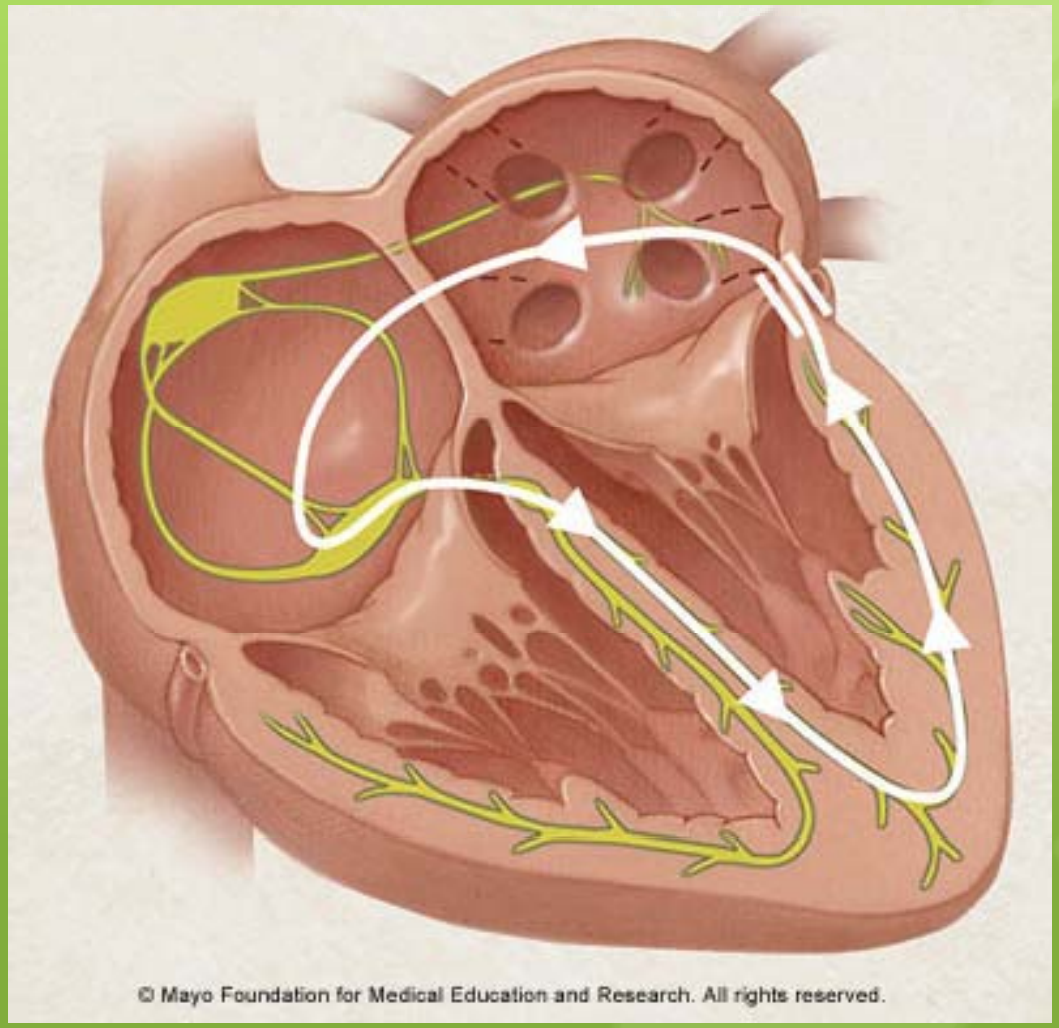


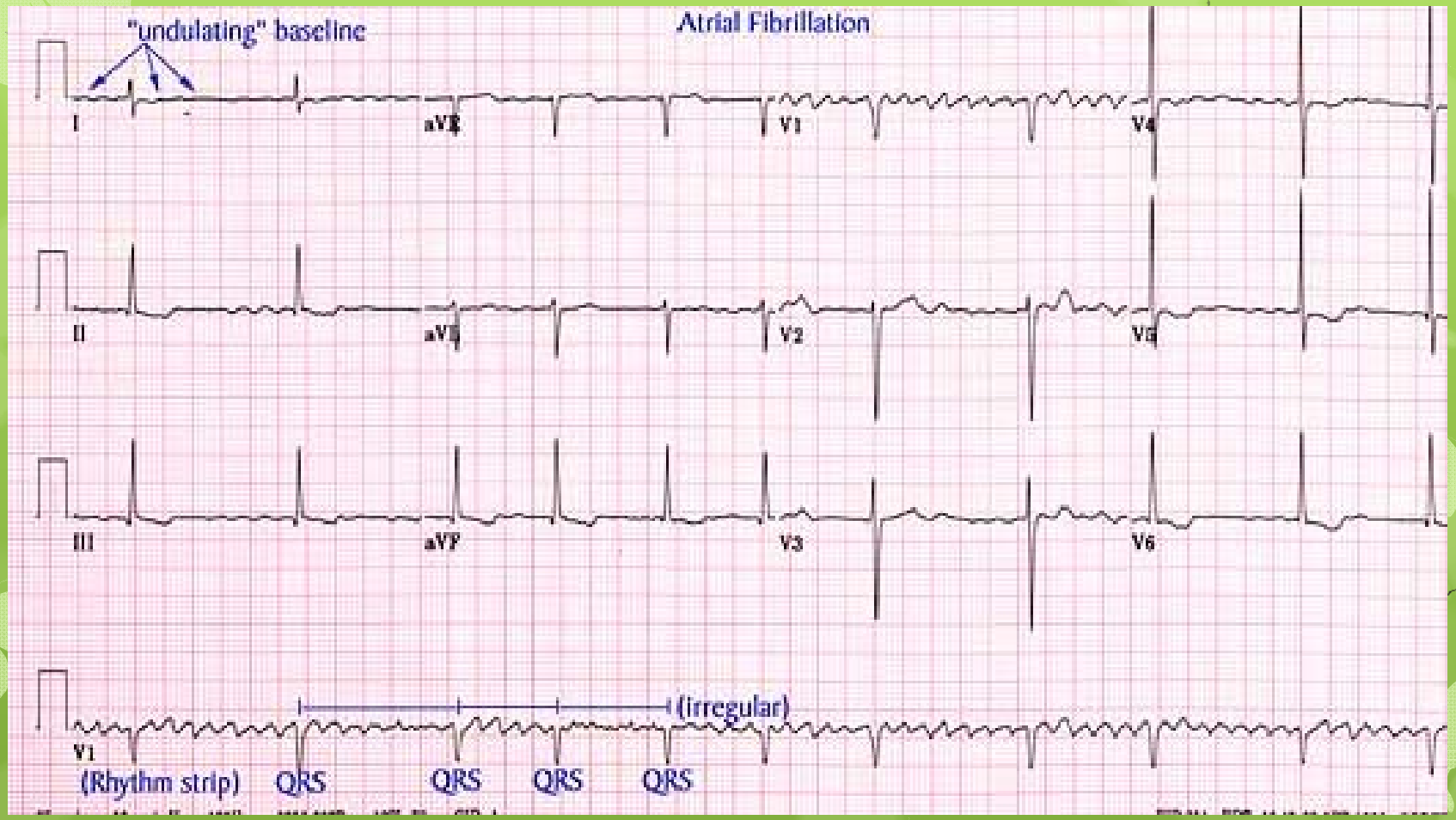
SUPRAVENTRICULAR TACHYCARDIA

- SVT has a regular, narrow QRS complex tachycardia on ECG.
- Heart rate over 220 bpm in infants, over 180 bpm in older children.
- Adenosine or DC cardioversion.
- No WPW: digoxin, beta-blocker.
- WPW: beta-blocker.
- If resistant: procainamide, flecainide, sotalol or amiodarone.

SUPRAVENTRICULAR TACHYCARDIA

- 1 in 10,000 kids. 1/3 with WPW.
- No heart disease in 90%.
- Narrow QRS complex tachycardia also includes atrial fibrillation and atrial flutter.
- Seen in normal newborns or in children with heart disease.
- Adenosine to diagnose.
- Digoxin, beta-blocker to treat.

ATRIAL FIBRILLATION

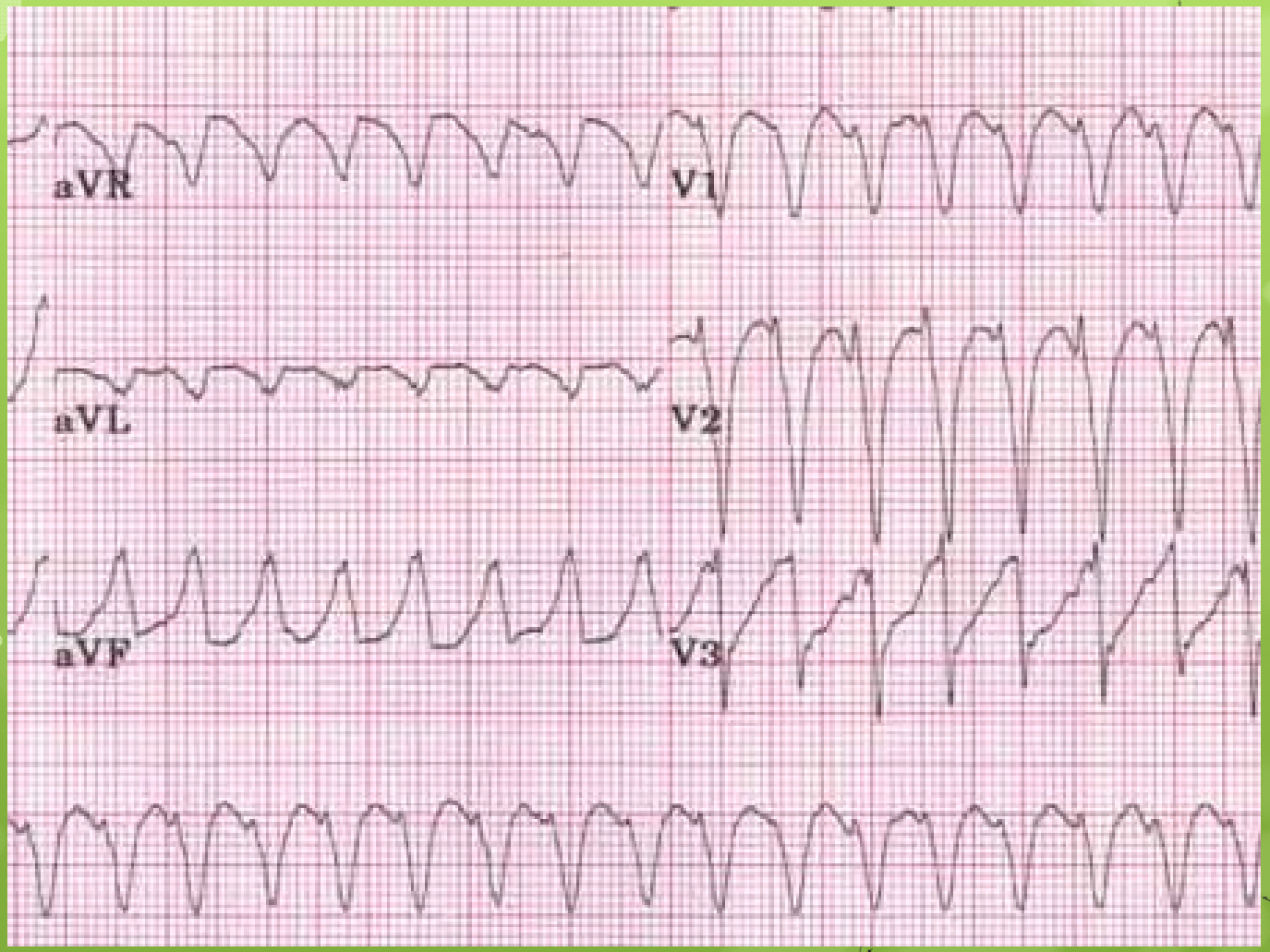


ATRIAL FLUTTER

THE UGLY

- Dangerous tachycardia that you hope not to see in your office.
- Wide QRS complex rhythms often with hemodynamic collapse.
- This group includes ventricular tachycardia, ventricular fibrillation, torsades de pointes, and atrial fibrillation with WPW.

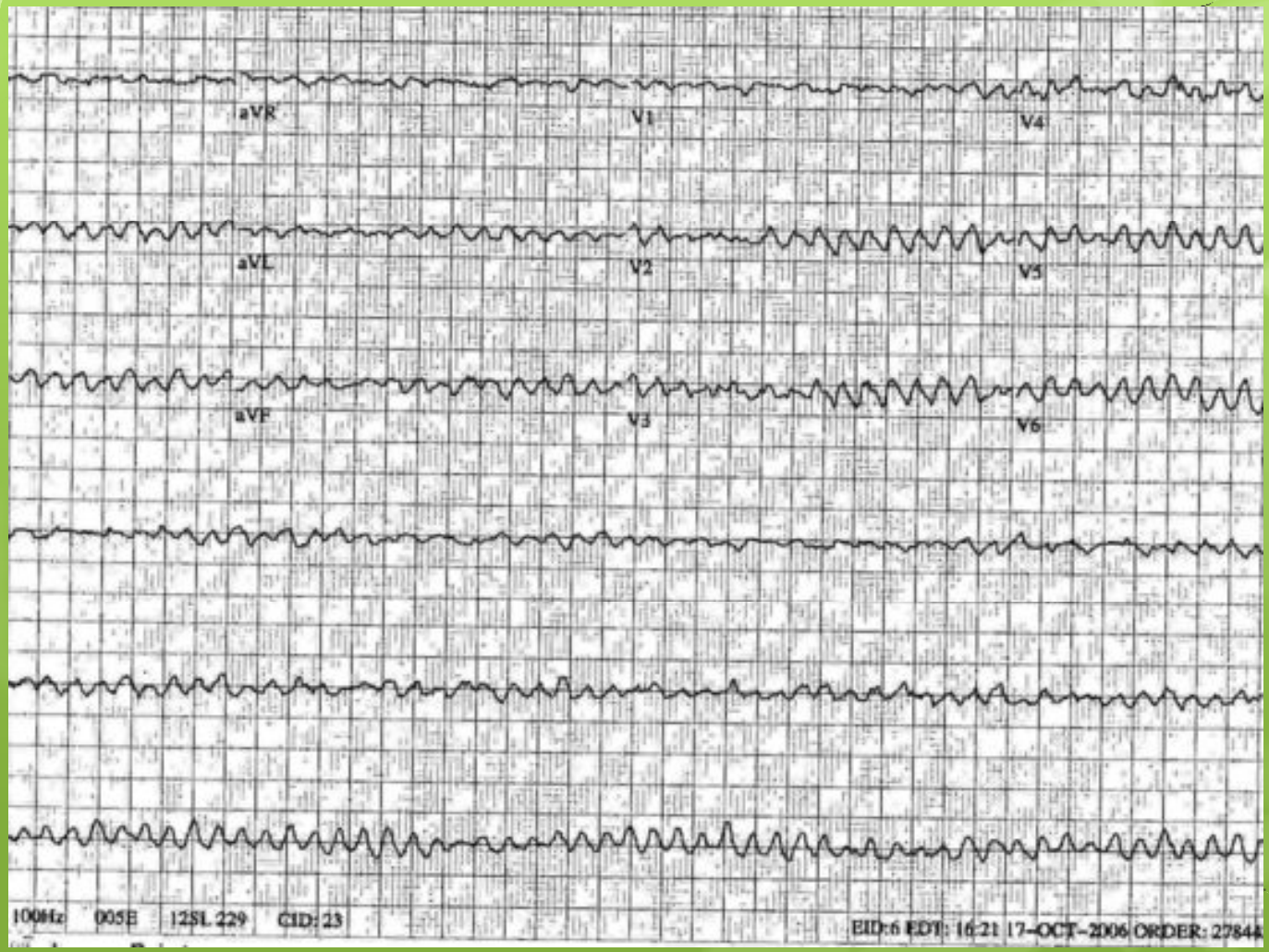
VENTRICULAR TACHYCARDIA



VENTRICULAR TACHYCARDIA

- WHO GETS IT?: Patients with myocarditis or cardiomyopathy, after cardiac surgery with ventriculotomy (e.g. tetralogy of Fallot), ingestions (e.g. tricyclic antidepressants), occasionally in setting of normal heart.

VENTRICULAR FIBRILLATION



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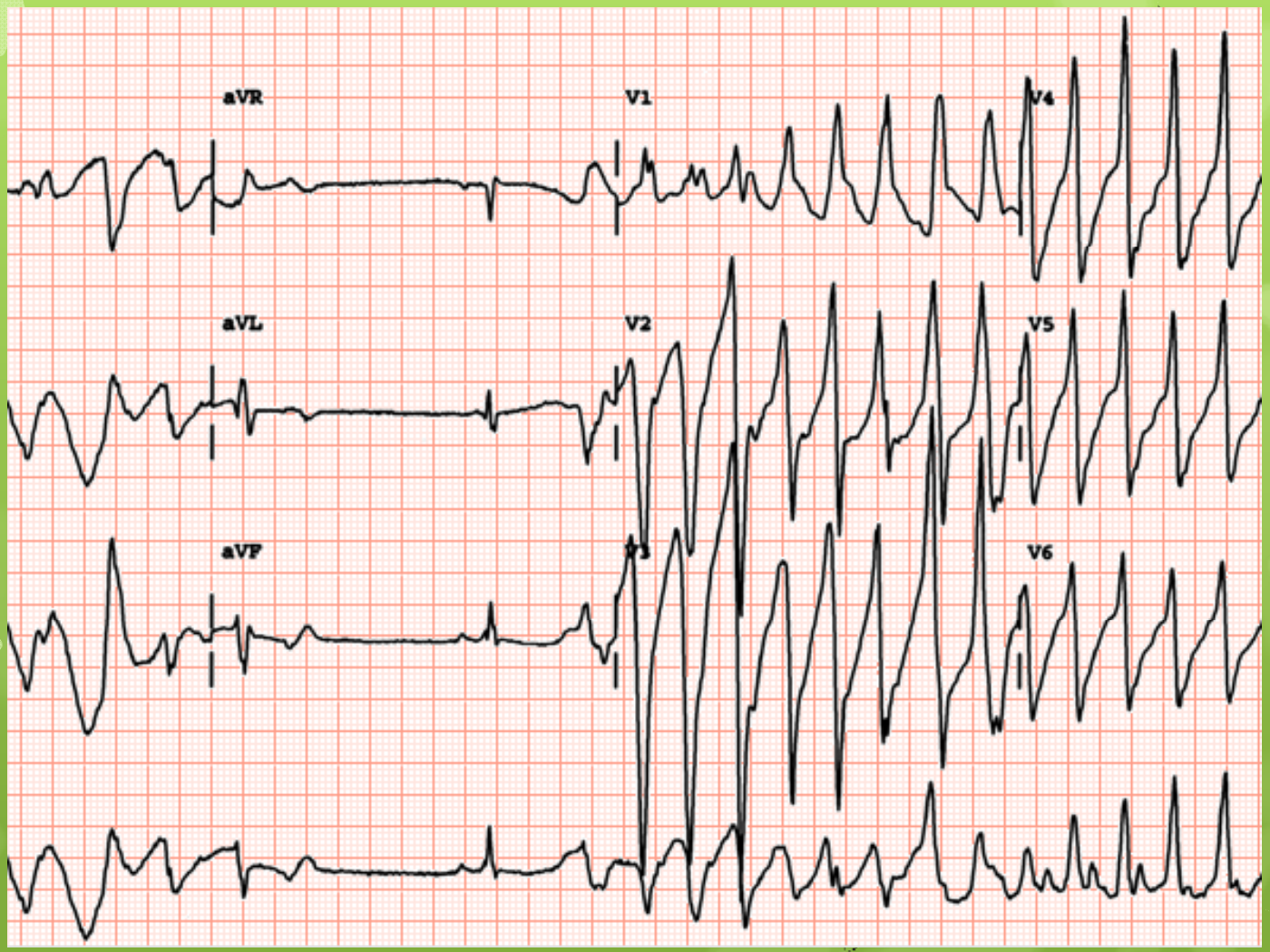
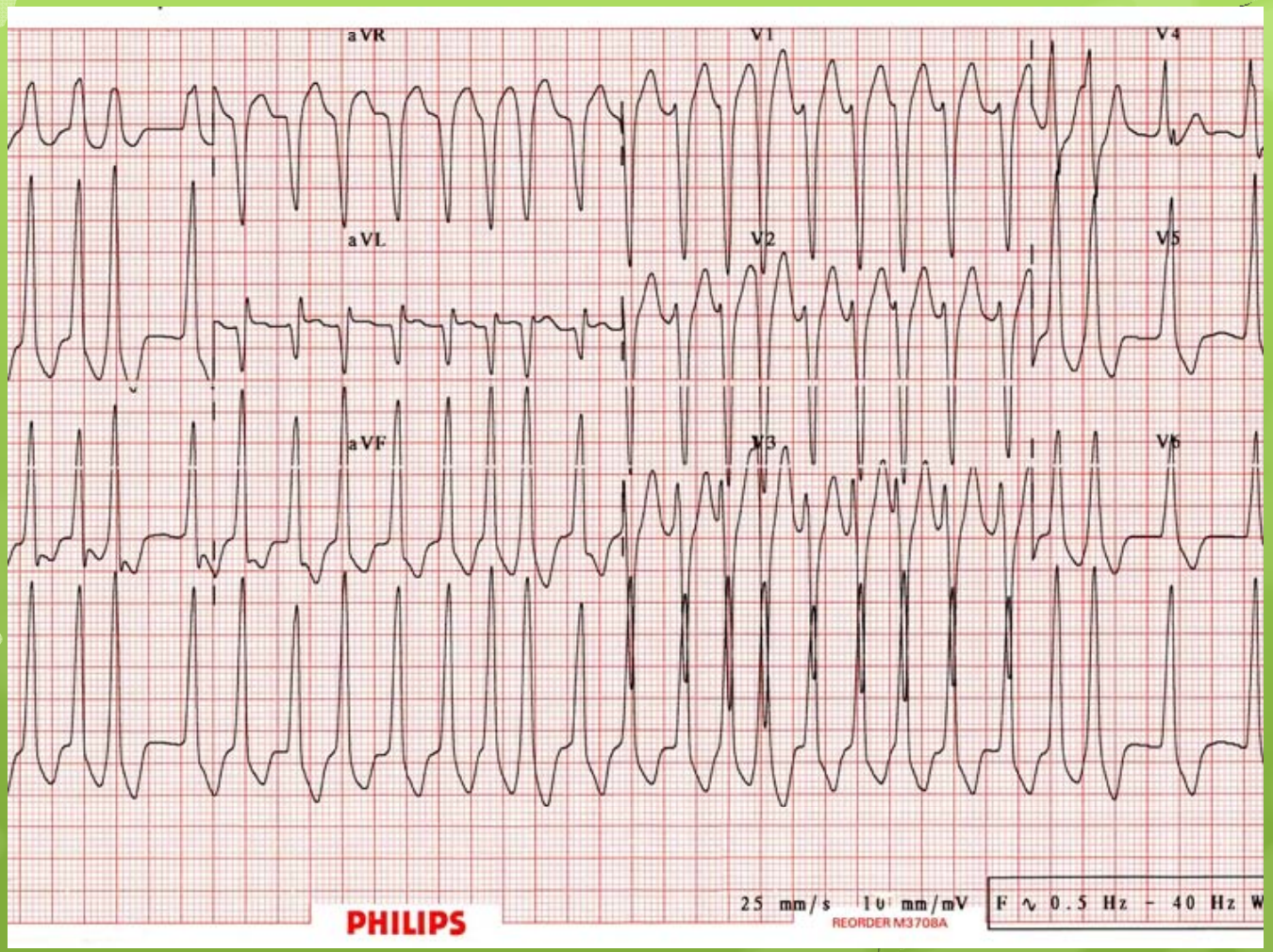
TORSADES DE POINTES



TORSADES DE POINTES

- WHO GETS IT?: Patients with long QT syndrome, either congenital from a genetic defect in ion transport, or acquired secondary to certain medications. Sudden death, syncope or deafness in family.

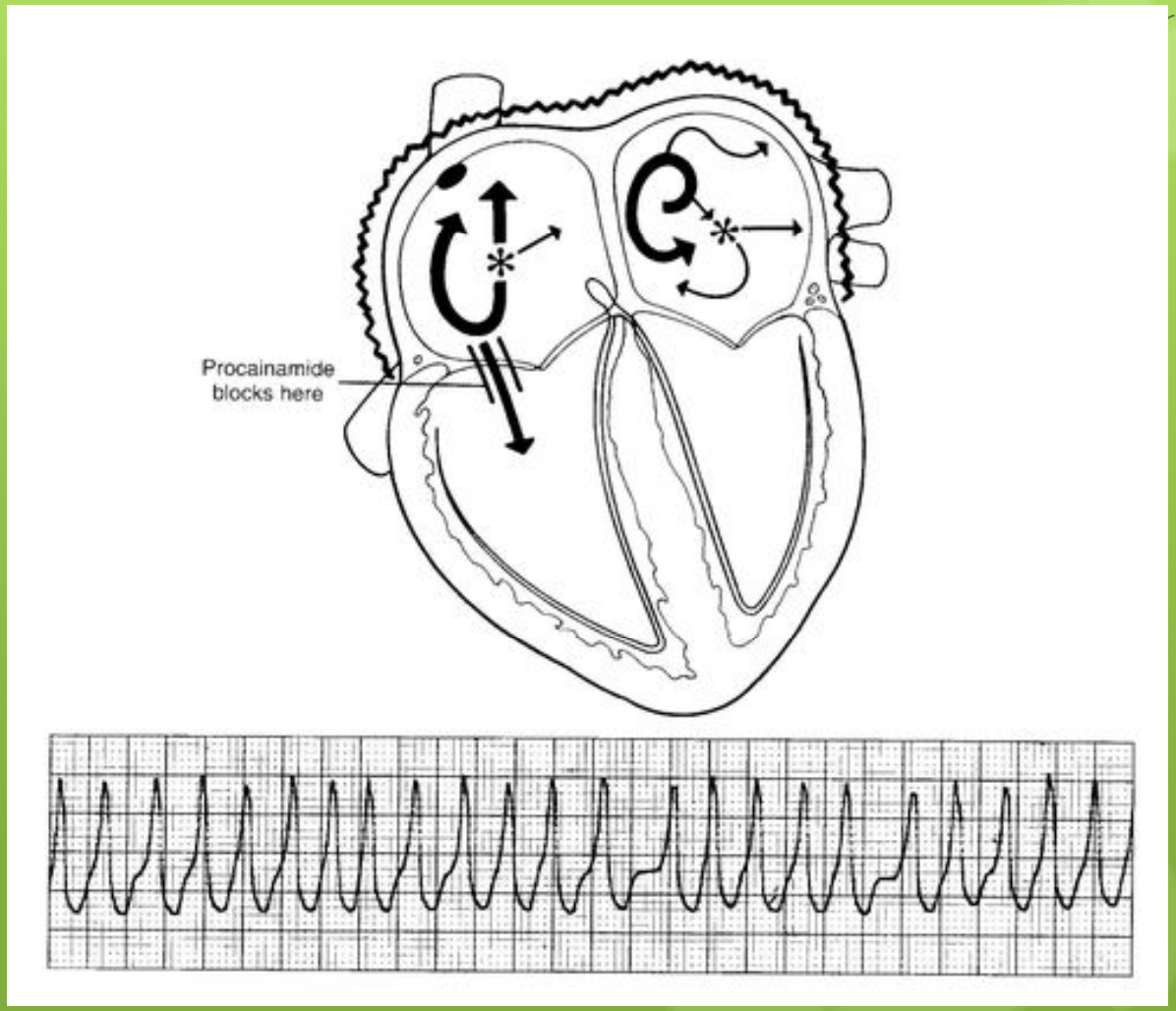
ATRIAL FIBRILLATION WITH WPW



ATRIAL FIBRILLATION WITH WPW

- WHO GETS IT?: Patients with Wolff-Parkinson-White pattern with bypass tracts conducting very well in antegrade direction.
- WPW has 3% rate of sudden death, atrial fibrillation more common than general population.
- Avoid digoxin, verapamil.

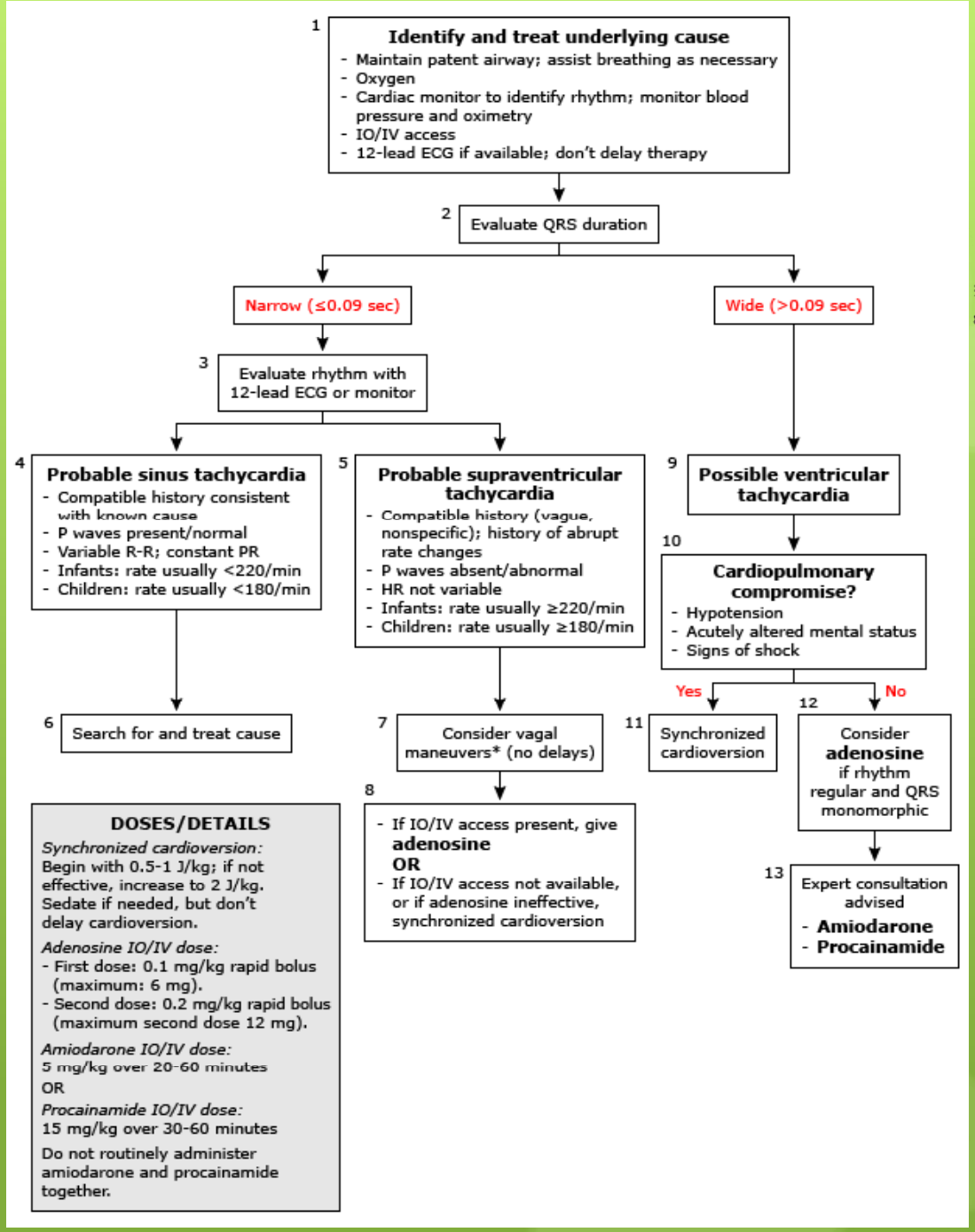
ATRIAL FIBRILLATION AND WPW



THE UGLY

- These rhythms are ugly with wide QRS complex, often irregular.
- Cardiopulmonary resuscitation first.
- Ventricular tachycardia, ventricular fibrillation, atrial fibrillation with WPW: defibrillation, epinephrine, amiodarone.
- Torsades de pointes: beta-blocker for congenital long QT; tranvenous pacing, IV magnesium for acquired.

PALS:


1
Identify and treat underlying cause
- Maintain patent airway; assist breathing as necessary
- Oxygen
- Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
- IO/IV access
- 12-lead ECG if available; don't delay therapy
2
Evaluate QRS duration
Narrow (≤0.09 sec)
Wide (>0.09 sec)
3
Evaluate rhythm with 12-lead ECG or monitor
4
Probable sinus tachycardia
- Compatible history consistent with known cause
- P waves present/normal
- Variable R-R; constant PR
- Infants: rate usually <220/min
- Children: rate usually <180/min
5
Probable supraventricular tachycardia
- Compatible history (vague, nonspecific); history of abrupt rate changes
- P waves absent/abnormal
- HR not variable
- Infants: rate usually ≥220/min
- Children: rate usually ≥180/min
9
Possible ventricular tachycardia
10
Cardiopulmonary compromise?
- Hypotension
- Acutely altered mental status
- Signs of shock
Yes
No
6
Search for and treat cause
7
Consider vagal maneuvers* (no delays)
8
- If IO/IV access present, give adenosine OR
- If IO/IV access not available, or if adenosine ineffective, synchronized cardioversion
11
Synchronized cardioversion
12
Consider adenosine if rhythm regular and QRS monomorphic
13
Expert consultation advised
- Amiodarone
- Procainamide
DOSES/DETAILS
Synchronized cardioversion:
Begin with 0.5-1 J/kg; if not effective, increase to 2 J/kg. Sedate if needed, but don't delay cardioversion.
Adenosine IO/IV dose:
- First dose: 0.1 mg/kg rapid bolus (maximum: 6 mg).
- Second dose: 0.2 mg/kg rapid bolus (maximum second dose 12 mg).
Amiodarone IO/IV dose:
5 mg/kg over 20-60 minutes
OR
Procainamide IO/IV dose:
15 mg/kg over 30-60 minutes
Do not routinely administer amiodarone and procainamide together.

SUMMARY

- Tachycardia is good, a benign adaptive finding in most cases in most children.
- Tachycardia with persistent high pulse rates and reduced perfusion require an urgent approach.
- ECG monitoring will reveal the bad and the ugly rhythms requiring emergent intervention.

REFERENCES

- Mazor S, Mazor R. Approach to the child with tachycardia. May 4, 2012. www.uptodate.com, accessed Apr 12, 2013.
- Freeman R, Kaufman H. Postural tachycardia syndrome. Feb 25, 2013. www.uptodate.com, accessed Apr 12, 2013.