Advanced Cardiac Life Support

G 2010

IRISH HEART
FOUNDATION
Fighting Heart Disease & Stroke

Produced by the Advanced Cardiac Life Support Council of the Irish Heart Foundation

March 2012

Introduction:

The Arrhythmia and ACLS Councils of the Irish Heart Foundation collaborated to produce these algorithms (1). They are designed to provide a simple and safe approach to the acute management of heart rhythm problems. They are directed at junior doctors who may have to deal with these at times complex problems whilst on call, when direction from more senior colleagues may not be immediately available. It is hoped that they will serve as an aid to deciding on a reasonable therapeutic strategy for managing these patients until more definitive therapy can be offered.

The revised algorithms are based on the American Heart Association ACLS Guidelines (Circulation.2010;122:18 (suppl 3)) which provide a more comprehensive and complete (but also necessarily more complex) outline of acute arrhythmia management. The number of drug choices given here has been deliberately kept to a minimum in order to avoid possible confusion and the hazards of polypharmacy when one drug is tried after another in resistant cases. Experienced physicians may feel that their drug of choice for the treatment of any one arrhythmia has been omitted but they can of course direct their junior staff to follow a different strategy wherever they deem that appropriate.

Finally, it must be emphasized that all of the drugs listed in these algorithms have the potential to do harm, so they should always be administered with care and caution. Whenever they are in doubt, junior doctors should seek assistance from their more experienced colleagues before committing themselves to a particular treatment choice. Patients should always be followed very closely with continuous cardiac and non invasive monitoring whenever antiarrhythmic drugs are administered acutely.

High quality basic life support, with minimal interruption and avoidance of hyperventilation are reinforced.

It should be remembered that guidelines are a compromise between available evidence, of which several levels exist, and complex dynamic clinical realities.
Expert consultation should be sought when reality questions the ability. Decisions regarding management will be based upon knowledge and experience.

1. G 2005, Keelan T., Harte M., et al., Irish Heart Foundation Jul 2006.

T. Keelan, Cardiologist, Mater Misericordiae and Connolly Hospitals.
D. Barton, Vice Chairperson, ACLS Council, IHF

23:03:12

IRISH HEART FOUNDATION

Colour code to boxes

Assessment

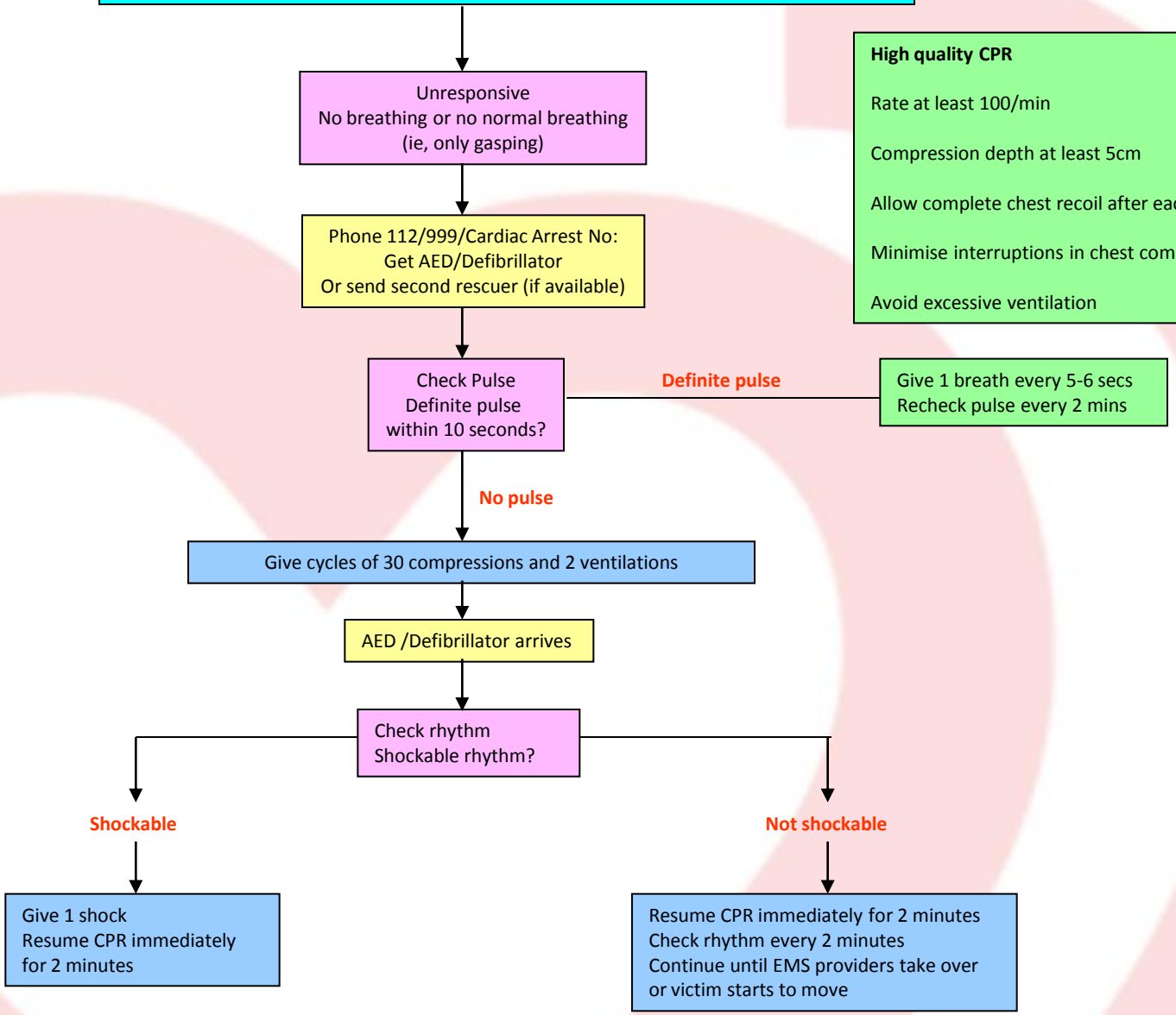
Reminder

Action

Treatment

IRISH HEART FOUNDATION

Adult BLS Healthcare Provider Algorithm



High quality CPR

Rate at least 100/min

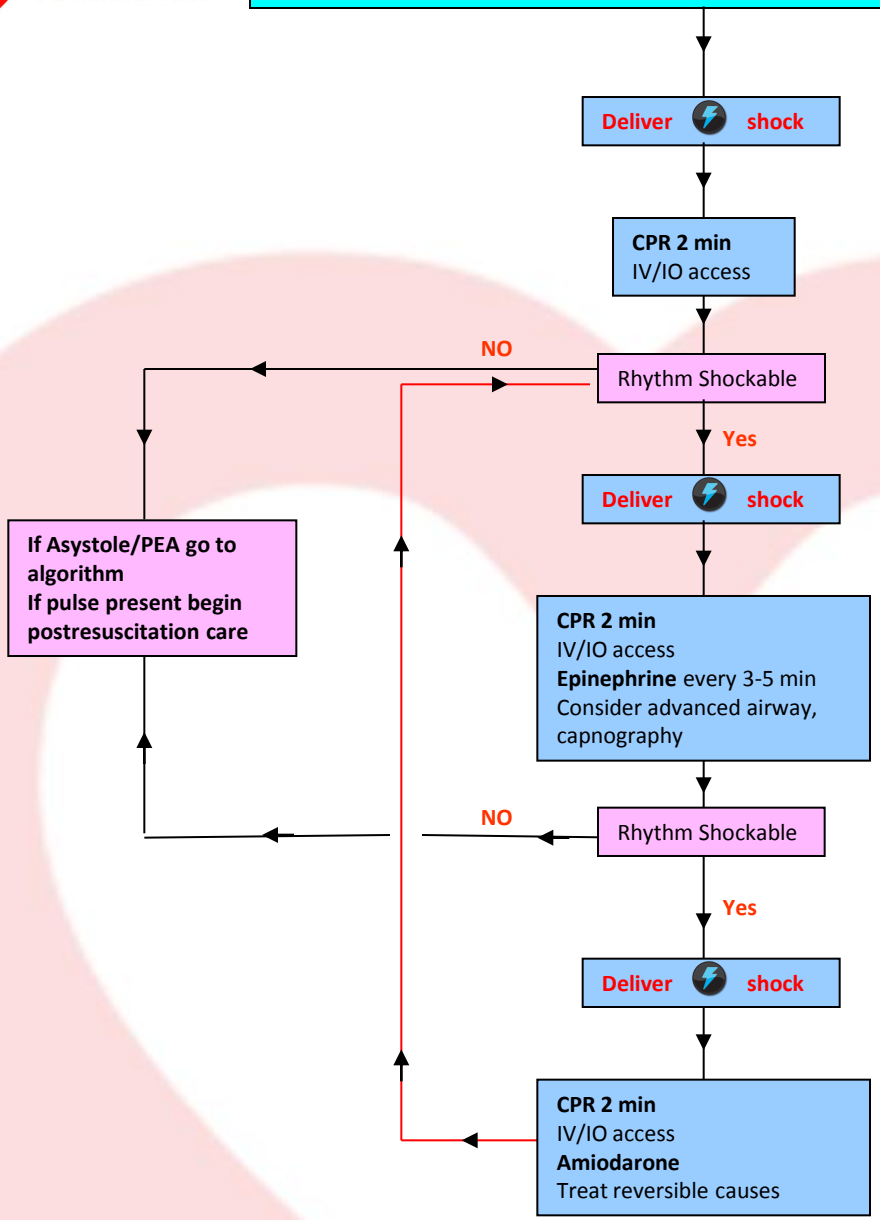
Compression depth at least 5cm

Allow complete chest recoil after each compression

Minimise interruptions in chest compressions

Avoid excessive ventilation

Ventricular Fibrillation / Ventricular Tachycardia



CPR Quality
Rate at least 100/min
Compression depth at least 5cm
Allow complete chest recoil after each compression
Minimise interruptions in chest compressions
Avoid excessive ventilation
Rotate compressors every 2 mins with rhythm checks
If no advanced airway, 30:2 compression ventilation
Quantitative waveform capnography
- If $Petco_2$ < 1.3kPa, attempt to improve CPR quality

Return of Spontaneous Circulation (ROSC)
Pulse
Blood pressure
Abrupt increase in $Petco_2$ (typically >= 5.3kPa)

Shock energy
Biphasic: Manufacturer recommendation (120-200 J); if unknown, use maximum available.
Second and subsequent doses should be equivalent, whilst higher doses may be considered.
Monophasic: 360 J

Drug Therapy:
Epinephrine IV/IO Dose: 1mg every 3-5mins
Vasopressin IV/IO Dose: 40 units can replace first or second dose of epinephrine
Amiodarone: First dose 300mg (5mg/kg) bolus. Dilute in 20ml 5% dextrose. Second dose 150mg.

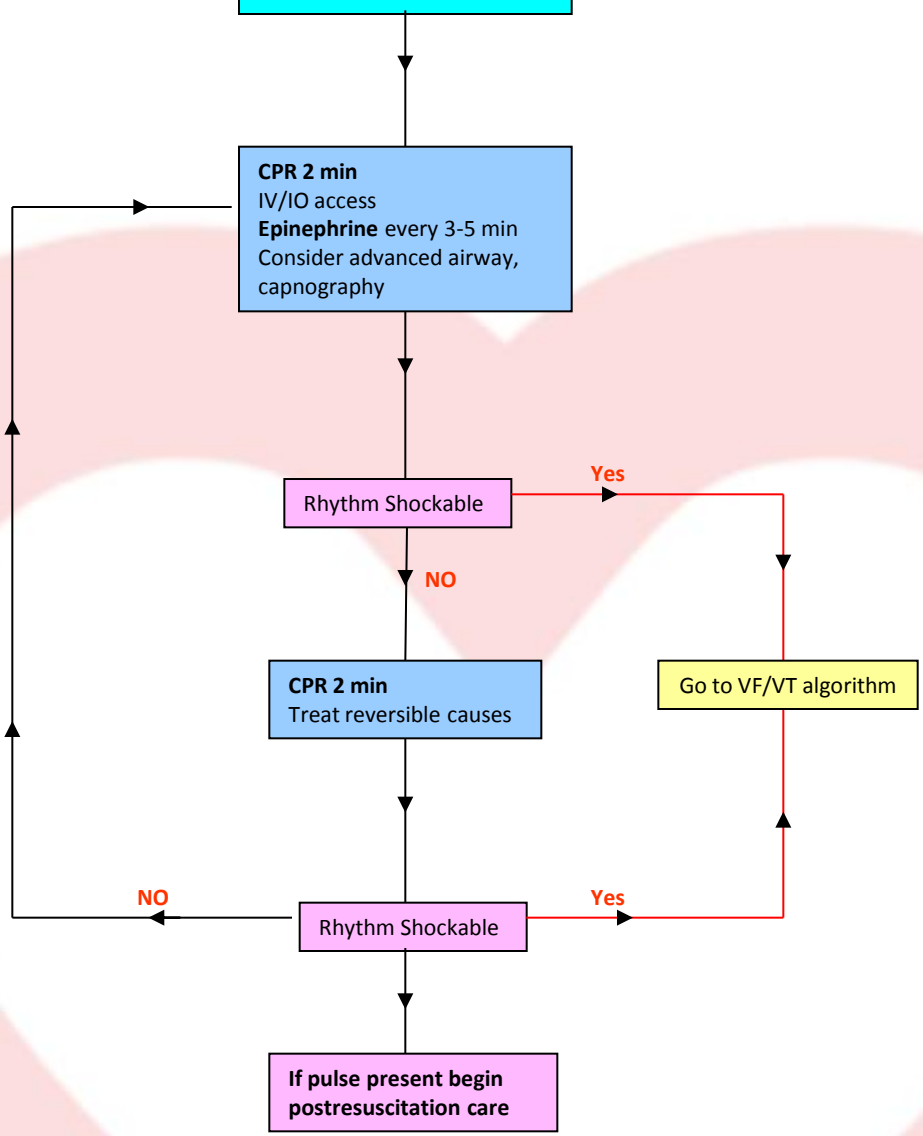
Advanced Airway
Supraglottic advanced airway or endotracheal intubation
Waveform capnography to confirm and monitor ET tube placement
8-10 breaths per minute with continuous chest compressions

Reversible causes

Hypovolaemia	**T**ension pneumothorax
Hypoxia	**T**amponade cardiac
Hydrogen ion ↓Ph	**T**oxins
Hypo/perkalaemia	**T**hrombosis Cor/Pulm
Hypothermia	**T**rauma hypovolaemia
Hypoglycaemia	increased ICP

IRISH HEART FOUNDATION

Asystole/PEA



CPR Quality
Rate at least 100/min
Compression depth at least 5cm
Allow complete chest recoil after each compression
Minimise interruptions in chest compressions
Avoid excessive ventilation
Rotate compressors every 2 mins with rhythm checks
If no advanced airway, 30:2 compression ventilation
Quantitative waveform capnography
- If $Petco_2$ < 1.3kPa, attempt to improve CPR quality

Return of Spontaneous Circulation (ROSC)
Pulse
Blood pressure
Abrupt increase in $Petco_2$ (typically >= 5.3kPa)

Shock energy
Biphasic: Manufacturer recommendation (120-200 J); if unknown, use maximum available.
Second and subsequent doses should be equivalent, whilst higher doses may be considered.
Monophasic: 360 J

Drug Therapy:
Epinephrine IV/IO Dose: 1mg every 3-5mins
Vasopressin IV/IO Dose: 40 units can replace first or second dose of epinephrine
Amiodarone: First dose 300mg (5mg/kg) bolus. Dilute in 20ml 5% dextrose. Second dose 150mg.

Advanced Airway
Supraglottic advanced airway or endotracheal intubation
Waveform capnography to confirm and monitor ET tube placement
8-10 breaths per minute with continuous chest compressions

Reversible causes

Hypovolaemia	**T**ension pneumothorax
Hypoxia	**T**amponade cardiac
Hydrogen ion ↓Ph	**T**oxins
Hypo/perkalaemia	**T**hrombosis Cor/Pulm
Hypothermia	**T**rauma hypovolaemia
Hypoglycaemia	increased ICP

IRISH HEART FOUNDATION

Tachycardia Overview Algorithm

Assess appropriateness for clinical condition.
Heart rate typically >150/min if tachyarrhythmia

Identify and treat underlying cause
Maintain patent airway;
assist breathing as necessary
Oxygen (if hypoxaemic) titrate to SpO2 >94%
Attach monitors; cardiac, BP, O_2 sats
IV access
12 lead ECG

Persistent tachyarrhythmia causing:
Hypotension?
Acutely altered mental status?
Signs of shock?
Ischaemic chest discomfort?
Acute heart failure?

Stable

Unstable

Synchronised cardioversion
- Consider sedation if patient is conscious
- Consider adenosine if narrow complex
- Consider expert consultation

Seek expert help

Establish IV access
Obtain 12 lead ECG
Is QRS narrow (<0.12sec) ?

Narrow QRS
Is rhythm Regular ?

Regular

Primary Dx:
SVT

Differential Dx:
Sinus Tachycardia
A.flutter 2:1 block

Irregular

Primary Dx:
A.Fib/Flutter

Differential Dx:
Multifocal Atrial Tachycardia

Wide QRS
Is rhythm regular?

Regular

Primary Dx:
Monomorphic VT

Differential Dx:
SVT c aberrancy
A.flutter c aberrancy

Irregular

Primary Dx:
Polymorphic VT

Differential Dx:
A.fib c aberrancy

A.Fib/Flutter + WPW

Dose details:

Synchronised cardioversion
Initial recommended doses:
Narrow regular: 50-100J
Narrow irregular: 120-200 J biphasic
or 200 J monophasic
Wide regular: 100 J
Wide irregular: defibrillation dose (**synch off**)

Adenosine IV dose:
First dose: 6mg rapid IV push; follow with NS flush
Second dose: 12mg if required

Antiarrhythmic Infusions for Wide QRS Tachycardia:

Amiodarone IV dose:
Dilute in 5% dextrose.
For VT/life threatening rhythms:
First dose 150mg over 10 minutes
Repeat as needed if VT recurs
Follow by maintenance infusion of 1mg/min for first 6 hours
For Atrial Fibrillation conversion:
150mg – 300mg (5mg/kg) over 20mins – 2hrs
Follow by maintenance infusion of 900mg over 24hrs

IRISH HEART FOUNDATION

Tachycardia Unstable Algorithm

Assess appropriateness for clinical condition.
Heart rate typically >150/min if tachyarrhythmia

Have available at the bedside
- O_2 sat monitor
- IV line
- Suction device
- Intubation equipment
- $EtCO_2$ monitor

Seek expert help

Premedicate whenever possible[1]

Synchronised DC Cardioversion [2,3,4]
- SVT
- Atrial fibrillation
- Atrial flutter
- Ventricular tachycardia

Persistent tachyarrhythmia causing:
Hypotension?
Acutely altered mental status?
Signs of shock?
Ischaemic chest discomfort?
Acute heart failure?
or
Unresponsive to first line therapy

Dose details:

Synchronised cardioversion
Initial recommended doses:
Narrow regular: 50-100J
Narrow irregular: 120-200 J biphasic
or 200 J monophasic
Wide regular: 100 J
Wide irregular: defibrillation dose
(**synch off**)

Notes:
1. Effective regimens have included a sedative (e.g. diazepam, midazolam) with or without an analgesic agent (e.g. fentanyl, morphine). Many experts recommend anaesthesia if service is readily available.
2. Always resynchronise after each cardioversion.
3. If delays in synchronisation occur and clinical condition is critical, go immediately to unsynchronised shocks.
4. Paroxysmal supraventricular tachycardia and atrial flutter may respond to lower energy levels, whilst atrial fibrillation may require higher energy levels

IRISH HEART FOUNDATION

Bradycardia

Assess appropriateness for clinical condition.
Heart rate typically <50/min if bradyarrhythmia

Identify and treat underlying cause
Maintain patent airway;
assist breathing as necessary
Oxygen (if hypoxaemic) titrate to SpO2 >94%
Attach monitors; cardiac, BP, O_2 sats
IV access
12 lead ECG

Reversible causes

Hypovolaemia	**T**ension pneumothorax
Hypoxia	**T**amponade cardiac
Hydrogen ion ↓Ph	**T**oxins
Hypo/perkalaemia	**T**hrombosis Cor/Pulm
Hypothermia	**T**rauma hypovolaemia
Hypoglycaemia	increased ICP

Persistent bradyarrhythmia causing:
Hypotension
Acutely altered mental status
Signs of shock
Ischaemic chest discomfort
Acute heart failure

NO → Monitor and observe

YES

Atropine
If atropine ineffective:
Prepare for
Transcutaneous (TCP) or Transvenous Pacemaker
OR
Dopamine infusion:
OR
Epinephrine infusion:
OR
Isoprenaline infusion:

Drug dosage:

Atropine:	0.5mg IV. May repeat 3-5mins to total dose of 3mg
Dopamine infusion:	2-10mcg/kg/min or
Epinephrine infusion:	2-10mcg/min or
Isoprenaline infusion:	1-3mcg/min if available

Seek expert help

Atropine may rarely cause a further slowing of heart rate in patients with type 11 second degree AV block (2:1, 3:1 etc.)

IRISH HEART FOUNDATION

Tachycardia Stable Algorithm

Establish 12 lead ECG

Atrial Fibrillation/Flutter

S.V.T
Usually narrow complex but may be broad

Ventricular tachycardia

Vagal manoeuvres

***Adenosine** 6gms IV rapid push

***Adenosine** 12gms IV rapid push

***Adenosine 12gms IV rapid push**

See Atrial Fibrillation/Flutter Algorithm

See Ventricular Tachycardia Algorithm

Seek expert help

Narrow complex

Broad complex

‡ **ß Blocking** drug (if LV function normal) e.g. – **Metoprolol** 5mg slowly IV. May be repeated after 10-15 mins up to max 15mgs

OR

Consider Verapamil (if LV function normal) 2.5-5mgs slowly IV may be repeated after 15-30 mins (to total dose of 30mg) Monitor BP during administration

Consider Synchronised DC Cardioversion or Antiarrhythmic therapy
(see Unstable Tachycardia algorithm)

***Adenosine** is contraindicated in Asthmatics
Reduce dose to 3mg if: patient on dipyridamole or carbamazepine, administering through a central line, or post cardiac transplant patients

‡ **ß Blocking** drugs should be used with caution in patients with chronic obstructive pulmonary disease, or congestive heart failure

www.irishheart.ie

IRISH HEART FOUNDATION

Acute Management Ventricular Tachycardia Stable

Establish 12 lead ECG

Seek expert help

Monomorphic
Normal or impaired LV function
Amiodarone:
First dose 150mg over 10 minutes
Repeat as needed if VT recurs
Follow by maintenance infusion of 1mg/min for first 6 hours
Lignocaine:
Second line therapy due to lack of efficacy in clinical studies

Synchronised DC Cardioversion
(See Unstable tachycardia Algorithm)

Polymorphic
Check / correct electrolytes
Check if QT prolonging medications
Does patient have Congenital Long QT Syndrome (LQTS)? Consider ß blocker
If baseline QT prolonged (Torsade de Pointes) consider **Magnesium:**
1-2gms IV over 5-60 mins
For drug or bradycardia induced QT prolongation consider **Isoprenaline** or **Pacing** to increase heart rate
If baseline QT normal, ischaemia most probable cause consider **Amiodarone +/- ß blocker**

Unstable
Proceed to Defibrillation with procedural sedation/GA

IRISH HEART FOUNDATION

Acute Management of Atrial Fibrillation / Atrial Flutter

Seek expert help

Question:
Is LV function normal?
Is WPW present?
Is duration > or < 48hrs?
Is anticoagulation required?

Stable

< 48 hrs duration
Control rate
Normal heart function:
ß Blocker e.g. **Metoprolol** 50mg BD PO +/- 5mg slowly IV
Or
Calcium channel blocker e.g.
Verapamil 80mg PO TDS +/- 2.5-5mg slowly IV
Impaired heart function:
Digoxin PO or 10mcg/kg IV
Or
Amiodarone PO or IV

Consider

Chemical Cardioversion
Convert rhythm
Amiodarone IV dose:
150mg – 300mg (5mg/kg) over 20 mins – 2hrs
Follow by maintenance infusion of 900mg over 24hrs
Alternative agents such as **Flecainide**, **Propafenone**, or **Procainamide** (with AV nodal blocking agents) may be used by experienced Physicians/Cardiologists

> 48 hrs or unknown duration
Control rate
Normal heart function:
ß Blocker e.g. **Metoprolol** 50mg BD PO +/- 5mg slowly IV
Or
Calcium channel blocker e.g.
Verapamil 80mg PO TDS +/- 2.5-5mg slowly IV
Impaired heart function:
Digoxin PO or 10mcg/kg IV

Unstable

Or

Synchronised DC Cardioversion
(see Unstable Tachycardia algorithm)

Anticoagulants: All patients with A.fib/flutter of >48hrs or unknown duration require anticoagulants for 4 weeks before elective cardioversion (either electrical or chemical). For emergency cardioversion, IV/SC Heparins may be considered

IRISH HEART FOUNDATION

Acute Management of Atrial Fibrillation/Atrial Flutter in patients with WPW

Present as irregular wide complex tachycardia (Pre-excitation Atrial Fibrillation)

Seek expert help

N.B. Adenosine, ß Blockers, Calcium channel blockers and Digoxin should not be given as they may cause a paradoxical increase in ventricular response

Rapidly conducting accessory pathway

Synchronised DC Cardioversion
(see Unstable Tachycardia algorithm)

Cardioversion not feasible/effective
Recurrent atrial fibrillation

Consider antiarrhythmic drug therapy with IV
- **Amiodarone**
  150mg – 300mg (5mg/kg) over 20 mins – 2hrs
  Follow by maintenance infusion of
  900mg over 24hrs

Alternative agents such as **Flecainide**, **Propafenone**, or **Procainamide** may be used by experienced Physicians/Cardiologists

- **Anticoagulants required if duration of arrhythmia > 48hrs or unknown**

Patients with WPW most commonly present with regular narrow complex Tachycardia and should be treated according to the SVT limb of Stable Tachycardia algorithm

IRISH HEART FOUNDATION

Suggested further reading

2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care.
Circulation 2010;122(suppl 3)
http://circ.ahajournals.org/content/vol122/18_suppl_3.toc

2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations
Circulation 2010;122(suppl 2)
http://www.ilcor.org/en/home/

Worksheets 2010
http://www.ilcor.org/en/consensus-2010/worksheets-2010/

IRISH HEART FOUNDATION

Amiodarone dosage

The dosage of amiodarone differs for life threatening and considered stable arrhythmias.

Life threatening arrhythmias:

First dose 150mg over 10 minutes
Repeat as needed if arrhythmia recurs
Follow by maintenance infusion of
1mg/min for first 6 hours

Ref 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care.
Circulation 2010;122;S748

Considered stable arrhythmias:

150mg – 300mg (5mg/kg) over 20 mins – 2hrs
Follow by maintenance (or repeat) infusion of
900mg (total of 1200mg or 15mg/kg) over 24hrs

Ref: Sanofi Winthrop Industrie, 1 Rue de la Vierge, BP599, 33440 Ambares, France.

IRISH HEART FOUNDATION

Acknowledgements

The authors wish to acknowledge the contribution of
Joe Galvin, Cardiologist, Mater Misericordiae University and Connolly Hospitals, Dublin, Ireland