

British Columbia & Yukon

2005 // ACLS Algorithms



Developed and Produced by:

Members of the "ACLS Working Group" of the BC ACLS Subcommittee of the Emergency Cardiac Care Committee

Project Facilitator: Chris Sims RN
Clinical Leader: Ross Berringer, MD

Sandy Barabe, RN
Tracy Barill, RN
Michael Dare, RN
Cameron Glass, ALS Paramedic
Allan Holmes, MD
Alec Ritchie, MD
Sherry Stackhouse, RN
Ron Straight, ALS Paramedic

Heart and Stroke Foundation of B.C. & Yukon
September 2006



**HEART &
STROKE**
FOUNDATION
OF BC & YUKON

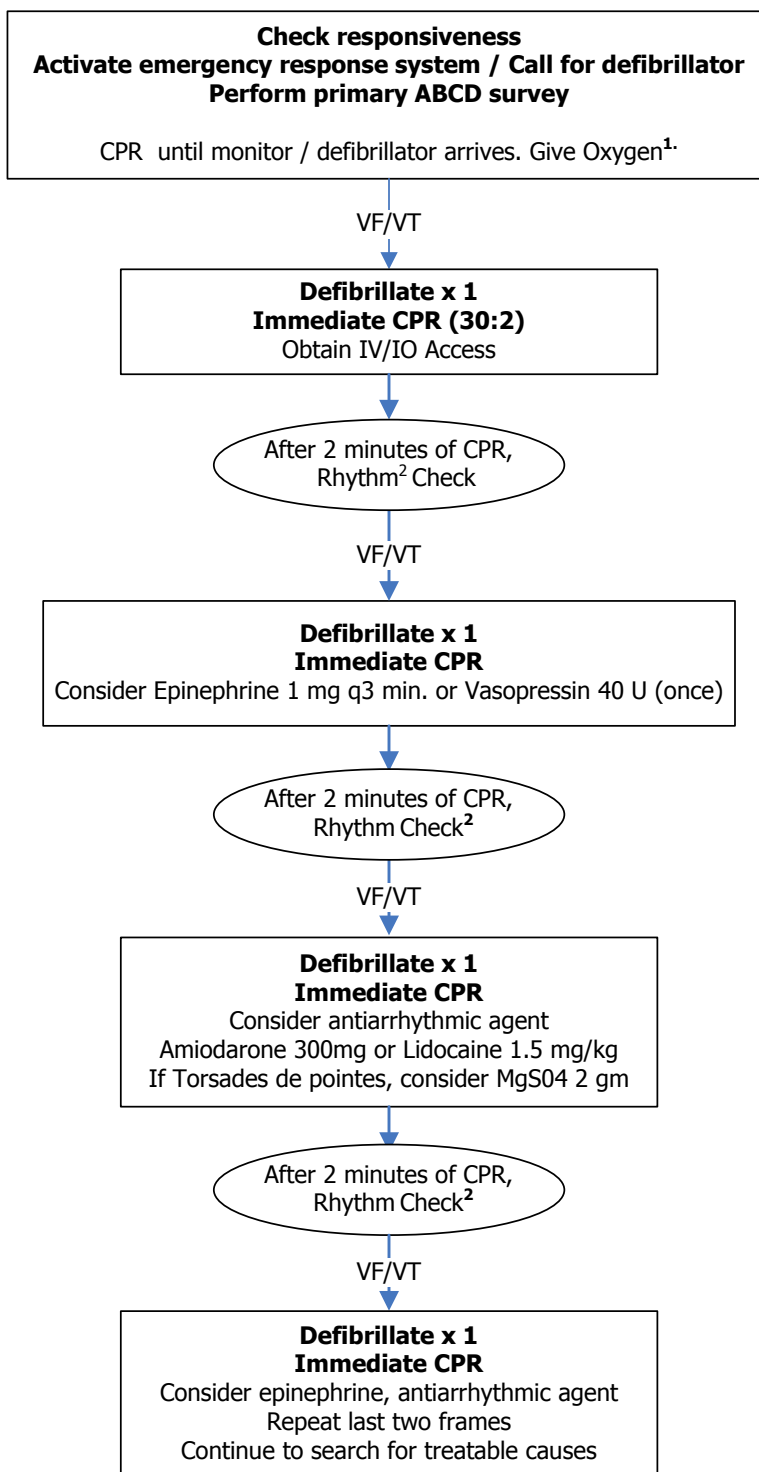
Finding answers. For life.

Ventricular Fibrillation / Pulseless Ventricular Tachycardia



HEART &
STROKE
FOUNDATION
OF BC & YUKON

Finding answers. For life.



Essential Actions / Notes

- Push hard & fast (100/min), ensuring full chest recoil, and minimizing interruptions in chest compressions; change compressor every 2 minutes
- If unsure of initial biphasic energy, use 200J; monophasic energy is 360 J
- Avoid hyperventilation; perform asynchronous CPR ventilating 8-10 breaths/minute if advanced airway utilized
- Search for treatable causes (6H's & 6T's)
- If return of spontaneous circulation is achieved, recommend therapeutic hypothermia (see next algorithm)

1. Initial use of oropharyngeal airway and bag-valve-mask is acceptable with advanced airway (ETT tube, laryngeal mask airway, or combitube) deferred until a suitable time.

2. Rhythm checks should be brief with pulse checks performed if any changes in rhythm.

Treatable Causes

Hypovolemia	Tablets and Toxins
Hypoxia	Tamponade (cardiac)
H ⁺ Acidosis	Tension pneumothorax
Hyper/Hypokalemia	Thrombus – MI
Hypothermia	Thrombus – PE
Hypoglycemia	Trauma

Therapeutic Hypothermia for Survivors of Cardiac Arrest

A) Cardiac Arrest (Pre-hospital and ED)

- Resuscitate as per ACLS guidelines
- Remove clothing: expose patient to ambient air while maintaining privacy and dignity
- Pre-hospital: notification and transfer to receiving ED

Is there return of spontaneous circulation?

No

- Continue ACLS
- Search for reversible causes of cardiac arrest
- Consider termination of resuscitation

Yes

B) Survivor: Assess Eligibility for hypothermia

Inclusion Criteria

1. Primary cardiac arrhythmia*
2. Collapse to ACLS <15 min
3. Collapse to ROSC <60 min
4. Persistent Coma (GCS <10)
5. Adult Victim (>18)

Exclusion Criteria

1. Improving neurological status
2. Coma secondary to non-cardiac factors
3. Arrest secondary to non-cardiac factors
4. Persistent hypoxia: O2 sat <85% for >15 min
5. Hemodynamic Instability despite vasopressors
SBP < 90 mmHg for > 30 min
MAP < 60 mmHg for > 30 min
6. Coagulopathy
7. History of terminal Illness

* Best evidence of benefit is in survivors of VF/VT cardiac arrest. There is theoretical benefit in survivors of other primary cardiac arrest rhythms (Non VF/VT rhythms) if they meet other eligibility criteria. The decision to initiate hypothermia in the non-VF/VT patient should be made in consultation with receiving ED or ICU.

Not eligible

Continue standard care

Eligible for Hypothermia

I Baseline Neurological Exam

1. Pupillary reaction
2. Corneal reflex
3. Oculo-cephalic (Doll's Eye) reflex
4. Motor response to noxious stimuli
5. Glasgow Coma Scale

II Sedative and Paralysis Options

Sedative Options

- Midazolam Infusion: 0.04-0.2 mg/kg/hr
- Propofol Infusion: 1-5 mg/kg/hr
- Fentanyl Infusion: 0.7-10 ug/kg/hr

Paralytic Agent Options

- Vecuronium
 - Bolus: 0.08 mg/kg
 - Infusion: 50-70 ug/kg/hr
- Atracurium
 - Bolus: 0.5 mg/kg
 - Infusion: 0.6-1.2 mg/kg/hr
- Rocuronium 0.6-1 mg/kg q 1h
- Pancuronium 0.1mg/kg q 2h

C) Post- Arrest Care of the Cardiac Arrest Survivor (First 15 minutes)

- Stabilize cardio-respiratory system
- Goal MAP > 75 mmHg (vasopressor use recommended if required)
- Goal oxygen saturation > 98%
- Baseline neurological exam (see I)
- Baseline vital signs and temperature
- Communicate induction of hypothermia with accepting ED/ ICU
- Sedation and Paralysis (see II)

D) Initiate Therapeutic Hypothermia

III Cooling Options: Target Temperature 32-34° C within 2-6 hours

- Expose patient to ambient air
- Ice packs to head, axillae, and groin
- Wet sheet and fan
- Cold saline infusion (30 ml/kg of 4°C NS over 30-60 minutes)
- Cooling Blanket

Asystole / Pulseless Electrical Activity (PEA)



Check responsiveness
Activate emergency response system / Call for defibrillator
Perform primary ABCD survey

CPR until monitor / defibrillator arrives. Give Oxygen.¹

Non-Shockable Rhythm

Immediate CPR (30:2)
 Search for treatable causes
 Obtain IV/IO Access
 Epinephrine 1 mg q3 min. or Vasopressin 40 U (once)
 Consider Atropine 0.5 – 3 mg for bradycardia PEA or asystole

After 2 minutes of CPR,
 Rhythm Check²

Non-Shockable Rhythm

Immediate CPR
Search for Treatable Causes
 Consider Epinephrine 1 mg q3 minutes
 Repeat pulse and rhythm check every 2 minutes

Exhaust all treatable causes for narrow QRS complex PEA

Consider early termination of resuscitation attempt for agonal rhythm and asystole

Essential Actions / Notes

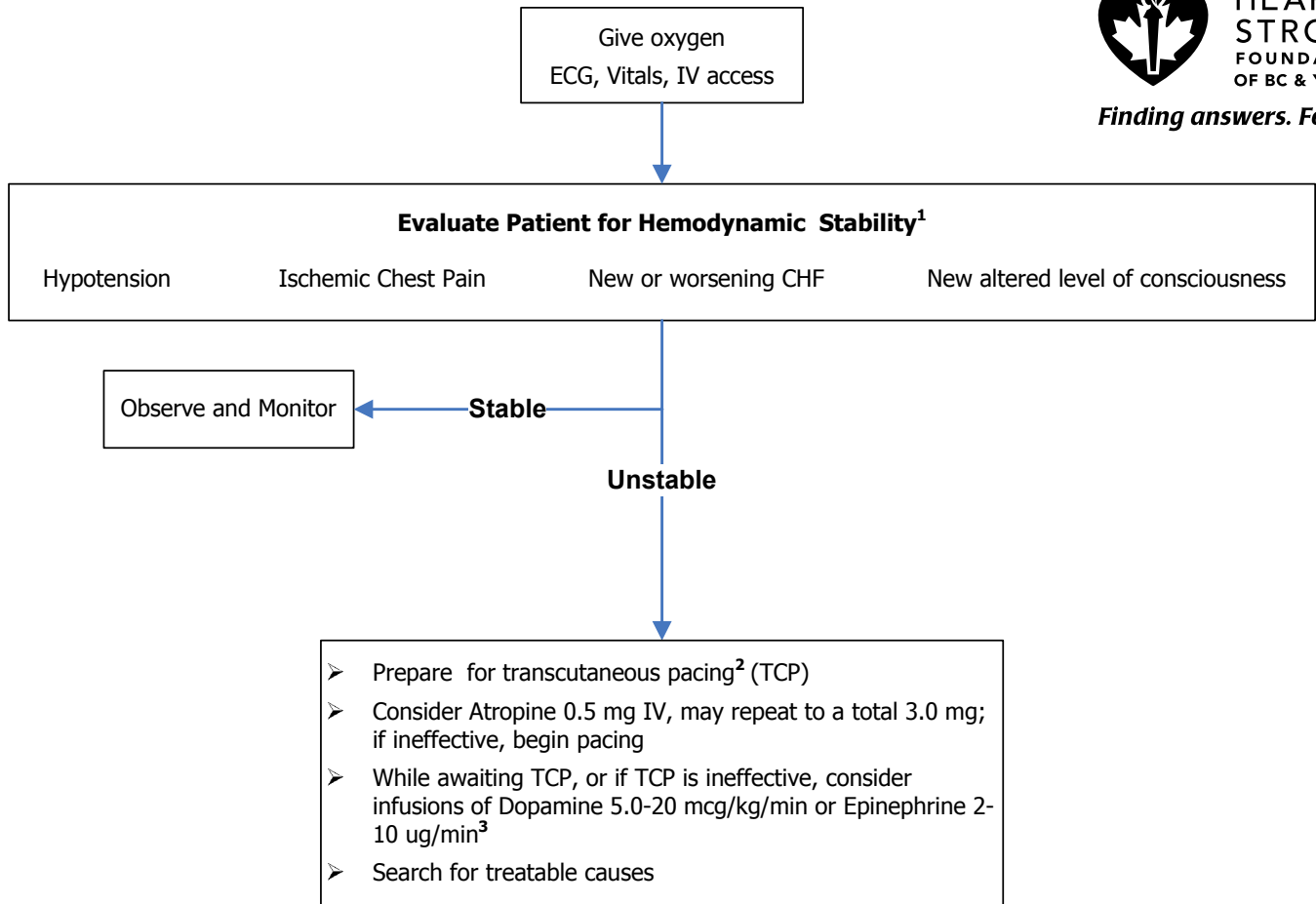
- Push hard & fast (100/min), ensuring full chest recoil, and minimizing interruptions in chest compressions; change compressor every 2 minutes
- Avoid hyperventilation; perform asynchronous CPR ventilating 8-10 breaths/minute if advanced airway utilized
- If treatable causes are identified, narrow QRS complex PEA is associated with much higher resuscitation rates than either asystole or wide QRS complex PEA
- Search for treatable causes (6H's & 6T's)
- If return of spontaneous circulation is achieved, consider therapeutic hypothermia (see attached algorithm)

1. Initial use of oropharyngeal airway and bag-valve-mask is acceptable with advanced airway (ETT tube, laryngeal mask airway, or combitube) deferred until a suitable time.
2. Rhythm checks should be brief with pulse checks performed if any changes in rhythm.

Treatable Causes

Hypovolemia	Tablets and Toxins
Hypoxia	Tamponade (cardiac)
H+ Acidosis	Tension pneumothorax
Hyper/Hypokalemia	Thrombus – MI
Hypothermia	Thrombus – PE
Hypoglycemia	Trauma

Bradycardia



Essential Actions / Notes

- Maintain a patent airway, assisting breathing if necessary
 - Search for treatable causes (6H's & 6T's)
- Any one of these criteria make the patient unstable; heart rates greater than 50/minute rarely cause the patient to become hemodynamically unstable
 - Transcutaneous pacing is the treatment of choice (see box below)
 - Hemodynamically unstable patients may require rapid escalation of dose titration

TCP Procedure

Turn TCP on. Set demand rate to approximately 70-80/min. In the absence of consistent capture, quickly increase current (mA) until consistent capture is achieved. Verify mechanical capture (pulse) has been achieved.

Treatable Causes

Hypovolemia	Tablets and Toxins
Hypoxia	Tamponade (cardiac)
H ⁺ Acidosis	Tension pneumothorax
Hyper/Hypokalemia	Thrombus – MI
Hypothermia	Thrombus – PE
Hypoglycemia	Trauma

Tachycardia



**HEART &
STROKE**
FOUNDATION
OF BC & YUKON

Finding answers. For life.

Give oxygen
ECG, Vitals, IV access

Evaluate Patient for Hemodynamic Stability¹

Hypotension

Ischemic Chest Pain

New or worsening CHF

New altered level of consciousness

Unstable

Synchronized Cardioversion²

Consider sedation/analgesia
(100, 200, 300, 360J)

If hx indicates patient has chronic AF
then goal may become rate control
to stabilize

Stable

Go to Afib/Flutter Algorithm

Regular or
Irregular?

Irregular

Regular

QRS Narrow
or Wide?

QRS Narrow

QRS Wide³

12 Lead ECG
Clinical history
Vagal maneuvers⁴

Adenosine⁵
Beta Blockers⁶ *or*
Ca²⁺ Blockers⁷

12 Lead ECG
Clinical history
Old ECG⁸

Amiodarone 150 mg over
10 minutes *or*
Synchronized Cardioversion

Essential Actions / Notes

- Maintain a patent airway, assisting breathing if necessary
- Search for treatable causes (6H's & 6T's)
- 1. Any one of these criteria make the patient unstable; heart rates < 150/minute rarely cause the patient to become hemodynamically unstable
- 2. Biphasic or monophasic energy escalating energy settings
- 3. When in doubt, treat wide QRS complex tachycardia as VT; synchronized cardioversion is rarely a bad choice
- 4. Avoid carotid sinus massage in the elderly
- 5. Adenosine 6mg or 12mg. If atrial fib/flutter revealed, go to the atrial fib/flutter algorithm
- 6. i.e. Metoprolol 5 mg IV q 5 min to a total of 15 mg; relatively contraindicated in patients with CHF, COPD, asthma and with BP in the low range of normal
- 7. i.e. Diltiazam 15 mg IV; may repeat with 25 mg IV in 15 minutes if first dose is ineffective; decrease dose in small/elderly patients or with BP in the low range of normal
- 8. If previous ECG shows a BBB with QRS morphology identical to current QRS, then likely that ECG rhythm is supraventricular

Treatable Causes

Hypovolemia
Hypoxia
H+ Acidosis
Hyper/Hypokalemia
Hypothermia
Hypoglycemia

Tablets and Toxins
Tamponade (cardiac)
Tension pneumothorax
Thrombus – MI
Thrombus – PE
Trauma

Procedure for Synchronized Cardioversion

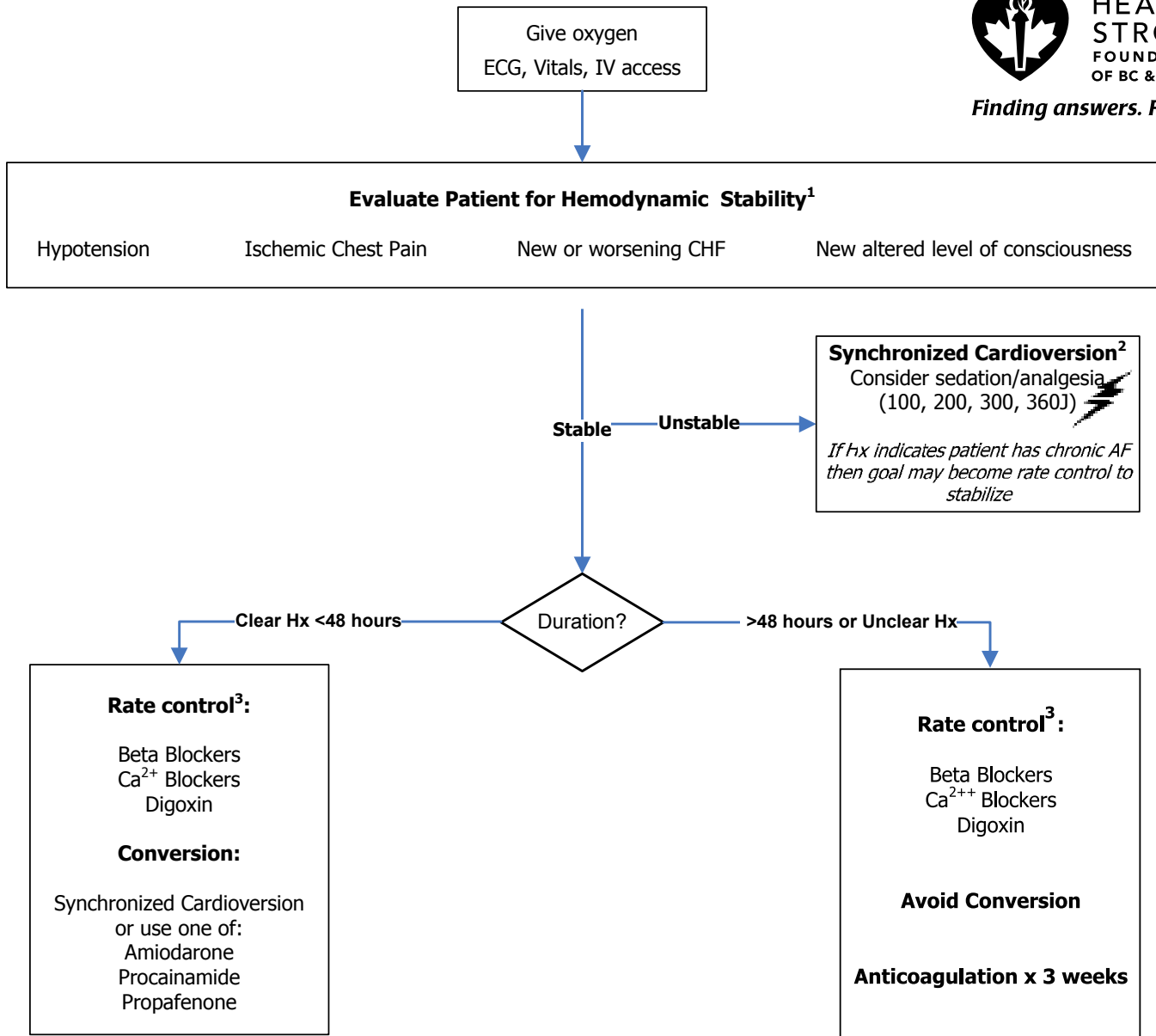
Consider sedation/analgesia. With monitor/defibrillator leads and adhesive electrodes attached appropriately to the patient, engage the synchronization mode by pressing the 'sync' button. Ensure that the R waves are marked. Select energy level. Make certain all personnel are free of contact with the patient and bed. After charging, discharge the energy using the 'Shock' button on the monitor/defibrillator if using electrode pads or both 'discharge' buttons on the paddles. If tachycardia persists, increase the joules and press the 'sync' button before each cardioversion attempt.

Atrial Fibrillation / Flutter



HEART &
STROKE
FOUNDATION
OF BC & YUKON

Finding answers. For life.



Essential Actions / Notes

- Maintain a patent airway, assisting breathing if necessary
 - Search for treatable causes (6H's & 6T's)
1. Any one of these criteria make the patient unstable; heart rates less than 150/minute only rarely cause the patient to become hemodynamically unstable
 2. Biphasic or monophasic energy escalating energy settings
 3. If pre-excitation syndrome such as Wolff-Parkinson-White is suspected (i.e. wide QRS complex with rapid HR), expert consultation is advised; avoid the use of adenosine, beta blockers, calcium channel blockers or digoxin (abcd)

Treatable Causes

Hypovolemia	Tablets and Toxins
Hypoxia	Tamponade (cardiac)
H+ Acidosis	Tension pneumothorax
Hyper/Hypokalemia	Thrombus – MI
Hypothermia	Thrombus – PE
Hypoglycemia	Trauma

Acute Coronary Syndrome



HEART & STROKE
FOUNDATION
OF BC & YUKON

Finding answers. For life.

Signs and symptoms suggestive of ACS¹

Initial ED Assessment (<10 min)

- Vitals, O₂ Saturation, ECG monitor, IV
- 12-18 lead ECG
- Brief targeted Hx and physical (eligible for fibrinolytics)
- Bloodwork (CBC, electrolytes, coags, cardiac enzymes)
- Chest X-Ray (<30min)

Initial ED Treatment (MONA)²

- O₂ via NP 4 LPM (O₂ sat >90%)
- ASA 160-325mg PO, NG or rectal
- Nitroglycerin SL/Spray/IV/patch
- Morphine IV prn if pain not relieved by nitroglycerin

Review initial 12-18 lead ECG

ST Elevation or new or presumably new LBBB;
strongly suspicious for injury

ST-Elevation MI (STEMI)

Start adjunctive therapies as indicated
(assess for contraindications)
Do not delay reperfusion treatment
Beta blockers
Heparin³ (LMWH or UFH)
Clopidogrel
Consider Glycoprotein IIb/IIIa inhibitor if
immediate PCI

Onset of symptoms
<12hrs

Yes

Reperfusion Strategy

Fibrinolytics: door-to-needle <30 min
PCI: Door-to-balloon inflation goal 90 min

Additional Therapies

ACE inhibitors/angiotension receptor blocker
within 24 hrs of symptom onset
HMG CoA reductase inhibitor (Statin therapy)

ST depression or dynamic T-wave inversion;
strongly suspicious for ischemia

Unstable Angina / Non-ST-Elevation MI (UA / NSTEMI)

Start adjunctive therapies as indicated
(assess for contraindications)
Beta blockers
Heparin (LMWH or UFH)
Clopidogrel

Admit to monitored
bed
Assess risk status

High Risk Patient

- Refractory ischemic chest pain
- Recurrent / persistent ST deviation
- Positive cardiac markers (Tn or CKmb)
- VT
- Hemodynamic instability
- Signs of pump failure
- History of AMI, PCI, CABG

Consider early angiography to further
stratify high risk patients (for suitability for
revascularization with PCI or CABG)

Additional Therapies

ACE inhibitors/angiotension receptor blocker
HMG CoA reductase inhibitor
Glycoprotein IIb/IIIa inhibitor (in high risk
patients undergoing PCI)

Nondiagnostic ECG

Intermediate / Low-Risk UA

Troponin positive or
develops high risk
criteria

Yes

No

Consider serial cardiac enzymes, serial
ECG's, cardiac imaging studies, stress test,
ED monitored bed or CCU admission

Troponin positive or
develops high risk
criteria

Yes

No

Consider discharge and follow-up

Notes

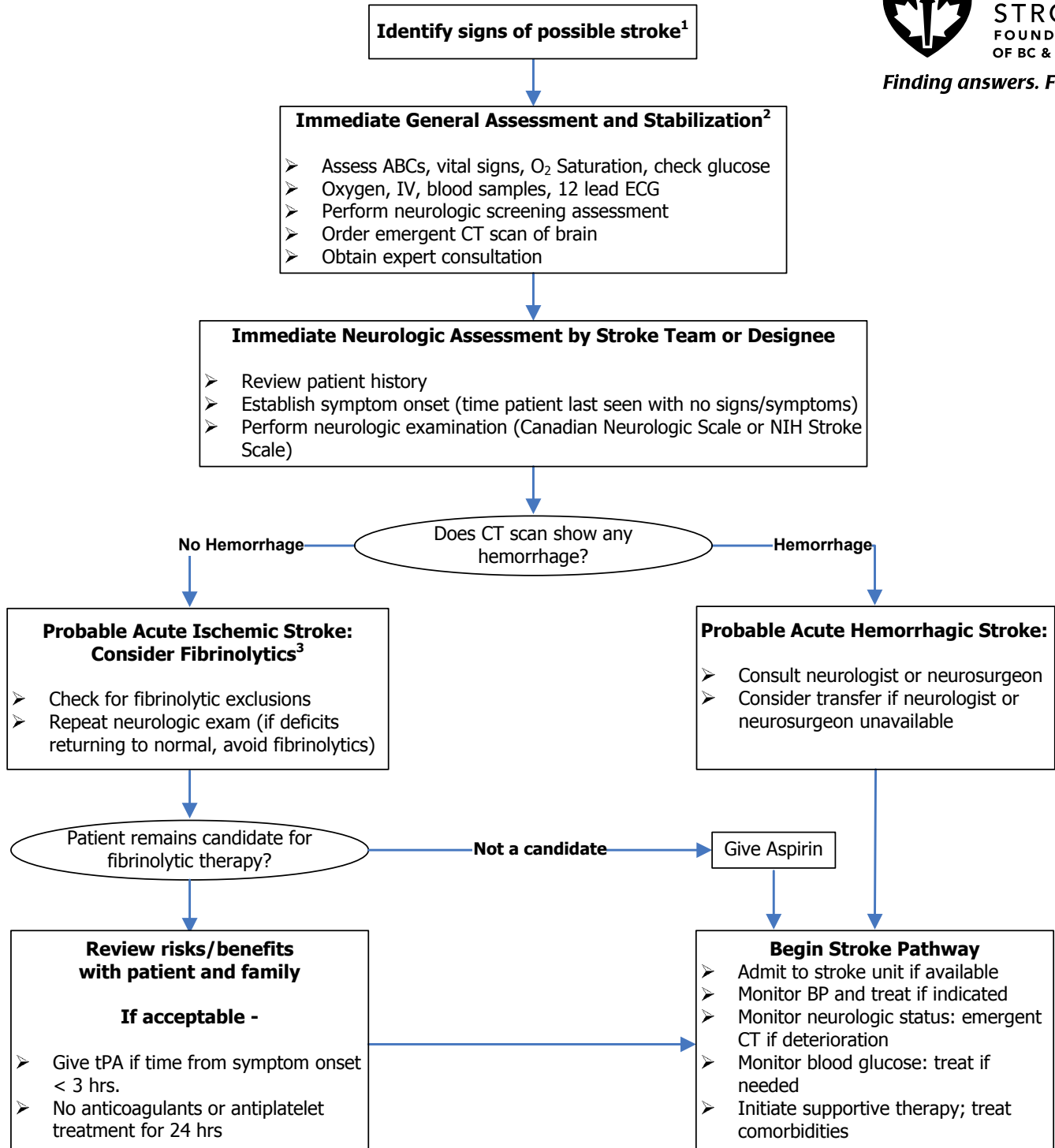
1. Signs and symptoms include chest discomfort, shortness of breath, diaphoresis, indigestion, fatigue, and various sites of referred pain; note that patients, especially women, diabetics and the elderly may present with atypical symptoms.
2. Be cautious in the use of nitrates and morphine for patients experiencing a right ventricular AMI
3. UFH is recommended for pts aged ≥75

Stroke



**HEART &
STROKE**
FOUNDATION
OF BC & YUKON

Finding answers. For life.



Notes

1. Signs and symptoms of a stroke include one or more of the following: sudden unilateral weakness or numbness to face, arm or leg; sudden disturbances in vision, gait; sudden severe headache of unknown cause. Rule out other causes of observed signs such as seizure activity and hypoglycemia.
2. Ensure a patent airway. Give oxygen. Assist breathing using an advanced airway if necessary.
3. Refer to fibrinolytic checklist for inclusion and exclusion criteria.

ACLS Drugs

DRUG	DOSAGE (all doses intravenous unless noted otherwise)
Adenosine	6 mg as initial dose IV push as rapidly as possible, if not successful, 12 mg IV push
Adrenaline/Epinephrine	<ul style="list-style-type: none"> • 1 mg boluses (to a pulseless patient) every 3 minutes • as an infusion for bradycardia: 2-10 ug/minute
Amiodarone	<ul style="list-style-type: none"> • in V. Fib: bolus 300 mg, followed by 150 mg 5 – 10 minutes later. • in perfusing rhythms: 150 mg over 10 minutes followed by 1 mg/min over 6 hours, then 0.5 mg/min over 18 hours. • maximum: 2.2 gm in 24 hours
Atropine	<ul style="list-style-type: none"> • maximum: 0.04 mg/kg • in Asystole: single dose of 3 mg • in Bradycardia: 0.5 – 1.0 mg every 5 minutes
Digoxin	0.5 mg bolused, followed by 0.25 mg every 2 – 3 hours to a maximum of 1 mg
Diltiazem	15-25 mg over 1 – 2 minutes (0.25 mg/kg)
Dopamine	5-20 ug/kg/min
Lidocaine	<ul style="list-style-type: none"> • in V.Fib: 1.5 mg/kg boluses to a maximum of 3 mg/kg • in perfusing rhythms: 1 mg/kg every 5 minutes to a maximum of 3 mg/kg
Magnesium Sulphate	2 g as a bolus
Metoprolol	5 – 10 mg over 5 minutes (may be repeated)
Procainamide	in perfusing rhythms (A. Fib, wide complex): 17 mg/kg at 20 mg/min
Propafenone	300 – 600 mg PO
Sodium Bicarbonate	<ul style="list-style-type: none"> • 1 – 2 meq/kg • average adult is 2 – 3 amps (each ampule has 44 meq)
Vasopressin	40 units IV push as a single dose on in V.Fib/pulseless V.Tach
Verapamil	2.5 – 5 mg over 2 – 3 minutes