# Vancouver Coastal Health
# Trauma Program
# Clinical Practice Guidelines and Protocols
# 2005

# Index of Clinical Practice Guidelines and Protocols for Trauma

## Section A

## RESUSCITATION PROTOCOLS

The following Clinical Practice Guidelines (CPG) represent the collaborative work of the Regional Trauma Program in Vancouver Coastal Health Authority. The initial group of CPGs relate to resuscitation. Subsequent sections deal with injury specific practice guidelines and ICU/Special Care guidelines.

The first four resuscitation guidelines deal with the definition of the major trauma patient and how these criteria are used to define the need for Trauma Team Activation, Trauma Consultation and inter-facility transfer of trauma patients. These criteria are internationally recognized and are used by national and international bodies to identify those trauma patients at high risk for mortality or severe morbidity.

Subsequent algorithms deal with common problems during resuscitation of trauma patients, including management of airway, resuscitation from shock, massive transfusion, management of traumatic arrest and management of pain and trauma.

**Index to Resuscitation Protocols**

## DEFINITION OF THE MAJOR TRAUMA PATIENT

There are many injury severity classifications used to define the major trauma patient. Most are based on scoring methodologies requiring a thorough knowledge of all the patient's injuries. The Injury Severity Score (ISS) and the Anatomic Injury Scale (AIS) score on which it is based are two of these with an ISS of either $\geq$ 12 or $\geq$ 16 indicating major trauma. These scoring methods are not applicable in the field or during early ED triage when diagnostic information is limited. In these situations the following criteria are used to identify patients at high risk for traumatic death or serious morbidity. These criteria are the basis for field triage of trauma patients to trauma centres, interfacility transfer protocols for trauma, trauma team activation and consultation criteria, and the need for objective evaluation for intra-cavitary hemorrhage or spine injury.

**1. Physiologic Criteria (In presence of significant trauma)**

a. Respiratory rate <10 or > 29/min
b. Systolic blood pressure < 90
c. Glasgow Coma Scale $\leq$ 13

**2. Anatomic Criteria**

a. Penetrating injuries to head, neck, chest, abdomen, groin and extremities proximal to elbow and knee
b. Flail chest
c. Combination trauma with burns > 20% of BSA
d. Unstable pelvic fracture
e. Amputation proximal to wrist and ankle
f. Traumatic limb paralysis
g. $\geq$ 2 proximal long-bone fractures

**4. Mechanism**

a. Fall > 20 ft (6m)
b. Motor vehicle (driver, passenger)
    initial speed > 65 kph (40 mph)
    major auto deformity > 50 cm (20 in)
    intrusion into passenger compartment >30 cm (12 in)
    vehicle rollover
    ejection from vehicle
    extrication time > 20 min
    death same passenger compartment
c. Pedestrian struck
    with significant impact > 10 kph (5 mph)
    thrown > 10 ft or run over
d. Bicyclist struck
    with significant impact > 10 kph (5 mph)
e. Motorcyclist
    crash > 30 kph (20 mph)
    separation from motorcycle
f. Major industrial accident
g. Significant assault

# GUIDELINES FOR TRAUMA TEAM ACTIVATION (TTA)

Trauma Team Activation (TTA) protocols are devised to expedite the resuscitation, diagnostic evaluation, and definitive therapeutic intervention in major trauma patients at risk for mortality or significant morbidity. TTA is a system-wide activation alerting the trauma team, the OR and other areas to expedite and reduce preventable delays in care. Guidelines for initiating a TTA are similar across the entire VCH Trauma System and are based on the following criteria.

**1. Physiologic Criteria**

- a. Respiratory rate <10 or > 29/min
- b. Systolic blood pressure < 90*
- c. Glasgow Coma Scale ≤ 13

**2. Anatomic Criteria**

- a. Penetrating injuries to head, neck, chest, abdomen, groin and extremities proximal to elbow and knee*
- b. Flail chest
- c. Combination trauma with burns > 20% of BSA
- d. Unstable pelvic fracture
- e. Amputation proximal to wrist and ankle
- f. Traumatic limb paralysis
- g. Multiple proximal long-bone fractures (≥ 2)

**3. Other Considerations (Discretional)**

- a. Pregnant patient > 20 weeks with evidence of fetal distress and/or premature labour in the context of trauma with significant mechanism
- b. Other significant co-morbidity

Trauma Team Activation prior to patient arrival will be initiated whenever the prehospital report clearly indicates the presence of any of the above physiological or anatomical injury criteria, given a history of significant mechanism of injury. Alternatively, Trauma Team Activation will be initiated immediately following patient arrival in the Emergency Department when any of the above injury criteria are identified in the setting of a significant mechanism of injury.

Trauma Team members differ according to the institution. When the Trauma Team does not include a general surgeon, simultaneous general surgical consult should be obtained for patients presenting with criteria marked with * or as soon as operative intervention for cavitary hemorrhage is identified as a possibility.

Patients meeting mechanism criteria outlined in the definition of the major trauma patient should be considered for **Trauma Consultation** to rule out occult injury whether or not specific subspecialty injuries have been identified.

# CRITERIA FOR CONSIDERATION OF EMERGENCY TRANSFER OF TRAUMA PATIENTS TO A VCH TRAUMA CENTRE

The following criteria apply to trauma patients requiring interfacility transfer for life or limb threatening injuries. Patients uniquely served by the services available at VGH **(in bold)** will be guaranteed access to VGH in these circumstances. Patients with other life or limb threatening injuries will be guaranteed access to either VGH or LGH if they are referred from within the VCH region or if care cannot be provided in their own region.

HEAD INJURY
- Penetrating injury or open fracture
- Depressed skull fracture (>5mm), intracranial hematoma
- Glasgow Coma Scale (GCS) <14 or deterioration
- Lateralizing neurologic signs

SPINE INJURY:
- Spinal cord injury
- Major vertebral injury with instability

CHEST
- **Wide mediastinum or other signs of great vessel injury**
- Major chest wall injury (flail) or pulmonary contusion with hypoxia
- Cardiac injury or massive hemothorax requiring urgent thoracotomy
- Requirement for advanced ventilator support

ABDOMEN
- Major solid organ injury, **severe hepatic or bile duct injury**
- **Duodenal/pancreatic**/retroperitoneal injuries, damage control or open abdomen

PELVIS and EXTREMITY
- **Major pelvic fractures** (unstable, acetabulum, open fractures, & shock)
- Fracture / dislocation with ischemia
- Open or **complex long bone fractures**
- Multiple long bone fractures
- Amputation or near amputation with possibility for re-implantation.

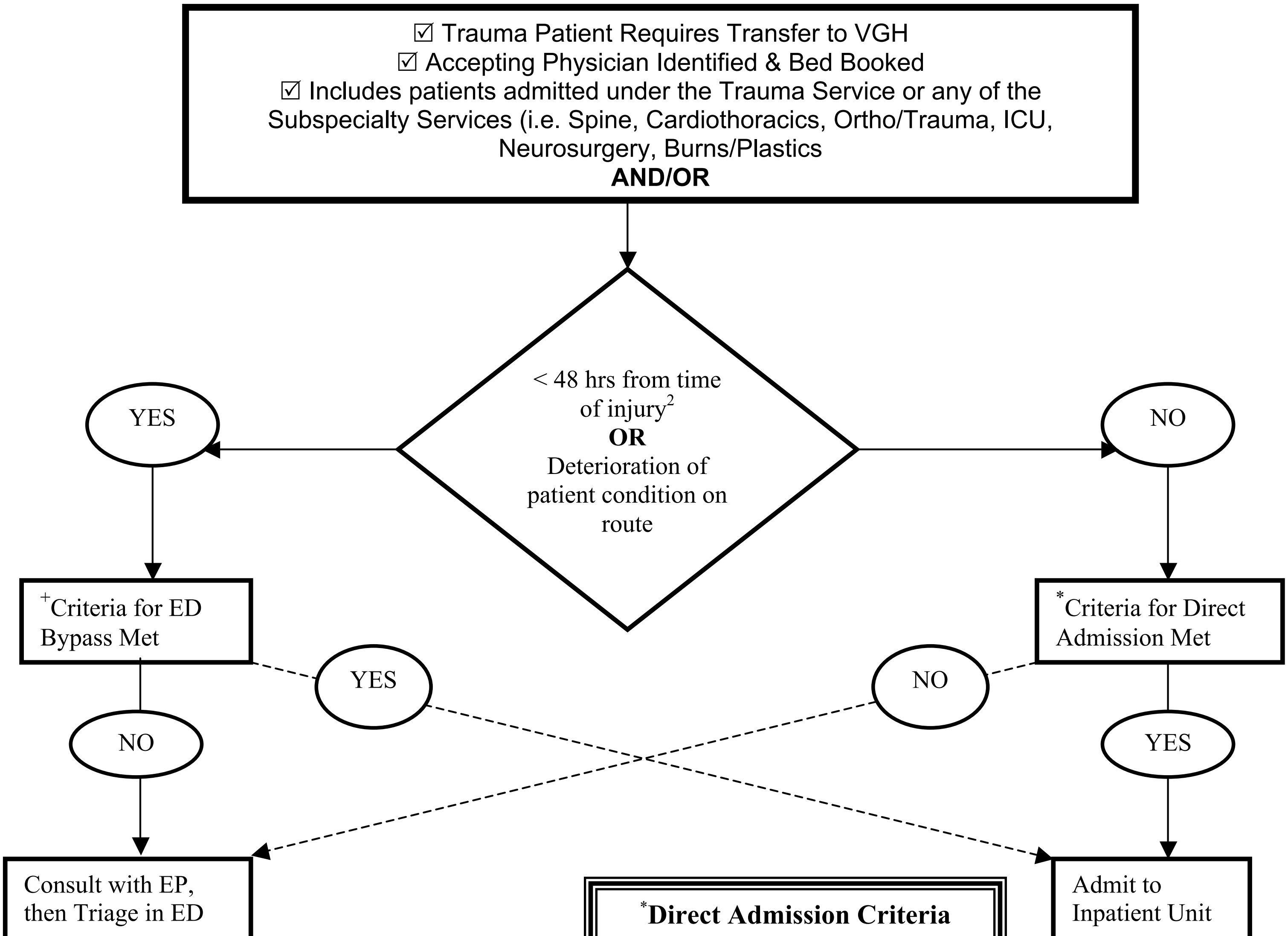
FACE
- **Major facial injuries with hemorrhage or airway compromise.**

BURNS
- **Body surface involvement > 20%**
- **Hand, face, perineal burns**
- **Burns with inhalation injury or other associated trauma.**

OTHER
- Multisystem trauma (ISS >16)
- Requirement for major resuscitative support
  - (Blood products, hypothermia rewarming, hyperbaric)
- Major complications (traumatic fistulae, severe sepsis, SIRS, MODS)

The process for trauma transfer is outlined in the following algorithm. It is highly recommended (and indeed mandated at VGH) that all trauma transfers be arranged through BC Bedline. If there are problems with transfers of major trauma patients meeting the above criteria ask to speak to the on call trauma surgeon at VGH or the VGH Trauma Manager.

## ADMISSION POLICY FOR INTERFACILITY TRAUMA TRANSFERS TO VGH




### + ED Bypass Criteria

☑ Single System Injury
☑ Low Risk Mechanism
☑ Does not meet TTA/TC criteria
☑ Reliable Diagnostic Work-Up Completed

### * Direct Admission Criteria

☑Authorized by Accepting Attending in Consultation with
- ☑ Unit Manager/Charge Nurse
- ☑ Admitting Department

☑Patient does not meet TTA or Unit Specific Exclusion Criteria
☑Thoraco-Abdominal Injuries Excluded or Fully Identified
☑Reliable Diagnostic Work-Up Completed

[1]TTA: Trauma Team Activation (See Page 18 In Trauma Program Manual)
TC: Trauma Consultation (See Page 30 in Trauma Program Manual)

[2]BCAS Paramedic Transfers: Patients who have significant clinical changes and/or become unstable during transfer will be transported directly to the ED with pre-hospital notification.

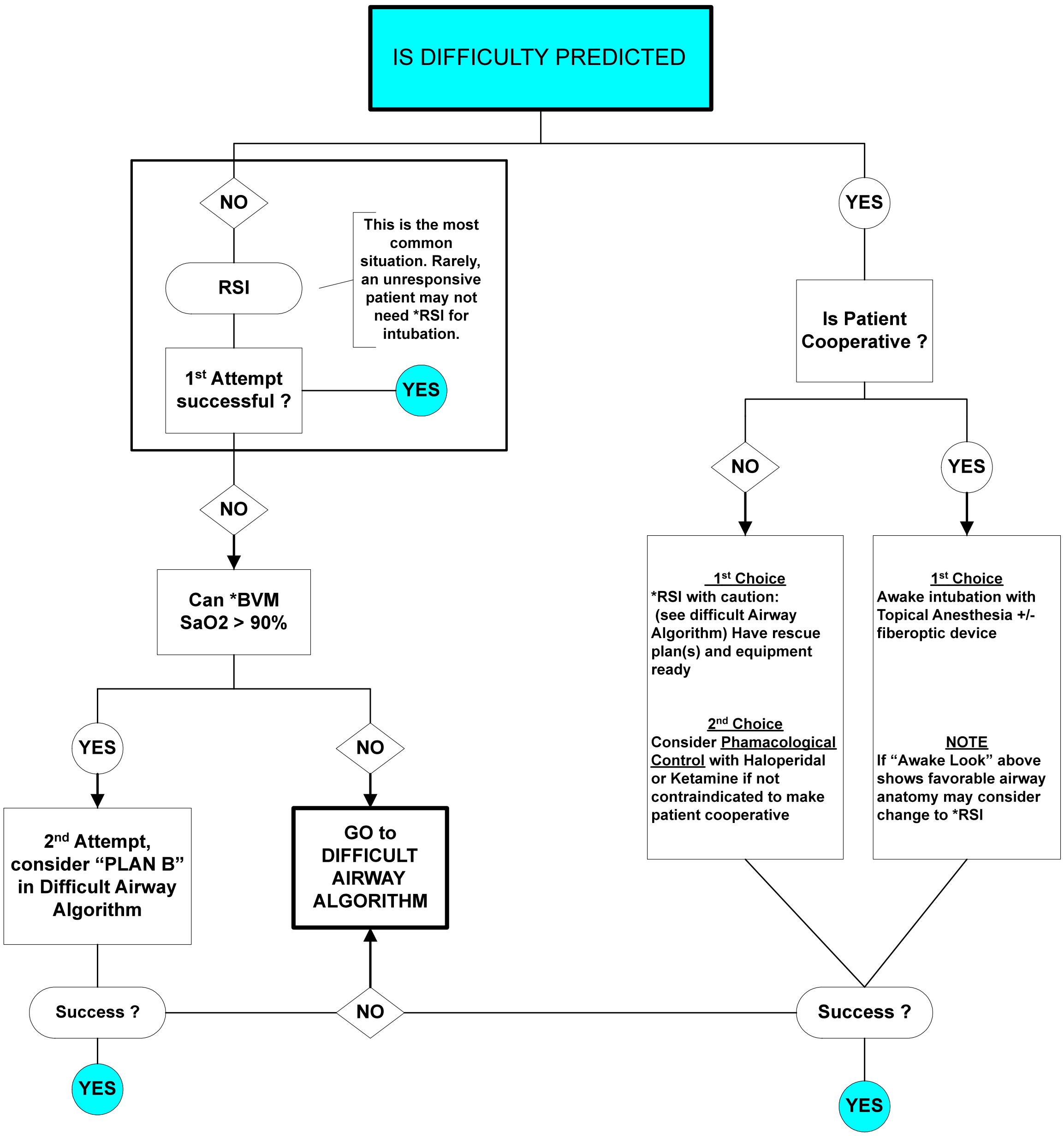
**Important Contact Numbers**

VGH ED: 875-4675
Trauma Hotline: 1-800-561-1133
BCAS Regional Dispatch: 708-7523
BCAS Provincial Dispatch: 1-800-561-8011

# VCH Trauma Program: RSI Primer

| | | |
|---|---|---|
| **PREAMBLE** | Assumes clinician possesses the knowledge, skill, equipment, and resources to safely perform RSI. | |
| **PREPARE** | Patient | - IV (x2 = better)<br>- Monitors (ECG, BP, Sa02) |
| | Self | - Rehearse RSI + Difficult Airway |
| | Equipment | - RSI + Difficult Airway |
| | Medications | - Calculate doses |
| | Personnel | - Rehearse RSI + Difficult Airway with Team |
| **PREOXYGENATE** | Patient | - 100% O2 NRFM, x 5 minutes or 5 full VC breaths<br>(NRFM=non-rebreather face mask) |
| **PRETREATMENT**<br>**Historical and controversial; little or no evidence supporting the following:* | Atropine 0.02 mg/kg | - "blunts vagal tone in pediatric patients" |
| | Fentanyl 1-3 mcg/kg | - "blunts undesirable sympathetic and respiratory reflexes" |
| | Lidocaine 1-1.5 mg/kg | - "blunts undesirable respiratory reflexes and neuroprotective" |
| | Rocuronium 0.1 mg/kg | - "defasiculating/neuroprotective" |
| | Pancuronium 0.01 mg/kg | - "defasiculating/neuroprotective" |
| **PUT TO SLEEP**<br>**Know the effects, relative indications and contraindications of each drug. Decreased dosages are acceptable in obtunded patients and necessary in hypovolemic patients.* | Etomidate 0.3 mg/kg | - hemodynamically rel. neutral |
| | Ketamine 1.5 mg/kg | - sympathomimetic |
| | Midazolam 0.3 mg/kg | - will ↓ blood pressure, slower onset |
| | Propofol 1-3 mg/kg | - will ↓ blood pressure |
| | Thiopental 3-5 mg/kg | - will ↓ blood pressure |
| **PARALYSIS** *with* **PROTECTION** (controversial, but cricoid pressure may prevent passive aspiration) | | - non-depolarizing, onset 60-90 seconds, duration 45-60 minutes<br>- depolarizing, onset 45 seconds, duration 5-10 minutes |
| **PASS THE TUBE** | Intubate after paralysis onset | |
| **PROOF** | Ensure endotracheal (not esophageal) intubation, $CO_2$ detection is best | |

# VCH Trauma Program CPG's
# Endotracheal Intubation In Trauma




BVM = Bag, valve mask
MILS = manual in line stabilization
RSI = rapid sequence intubation

*Remember MILS C-spine

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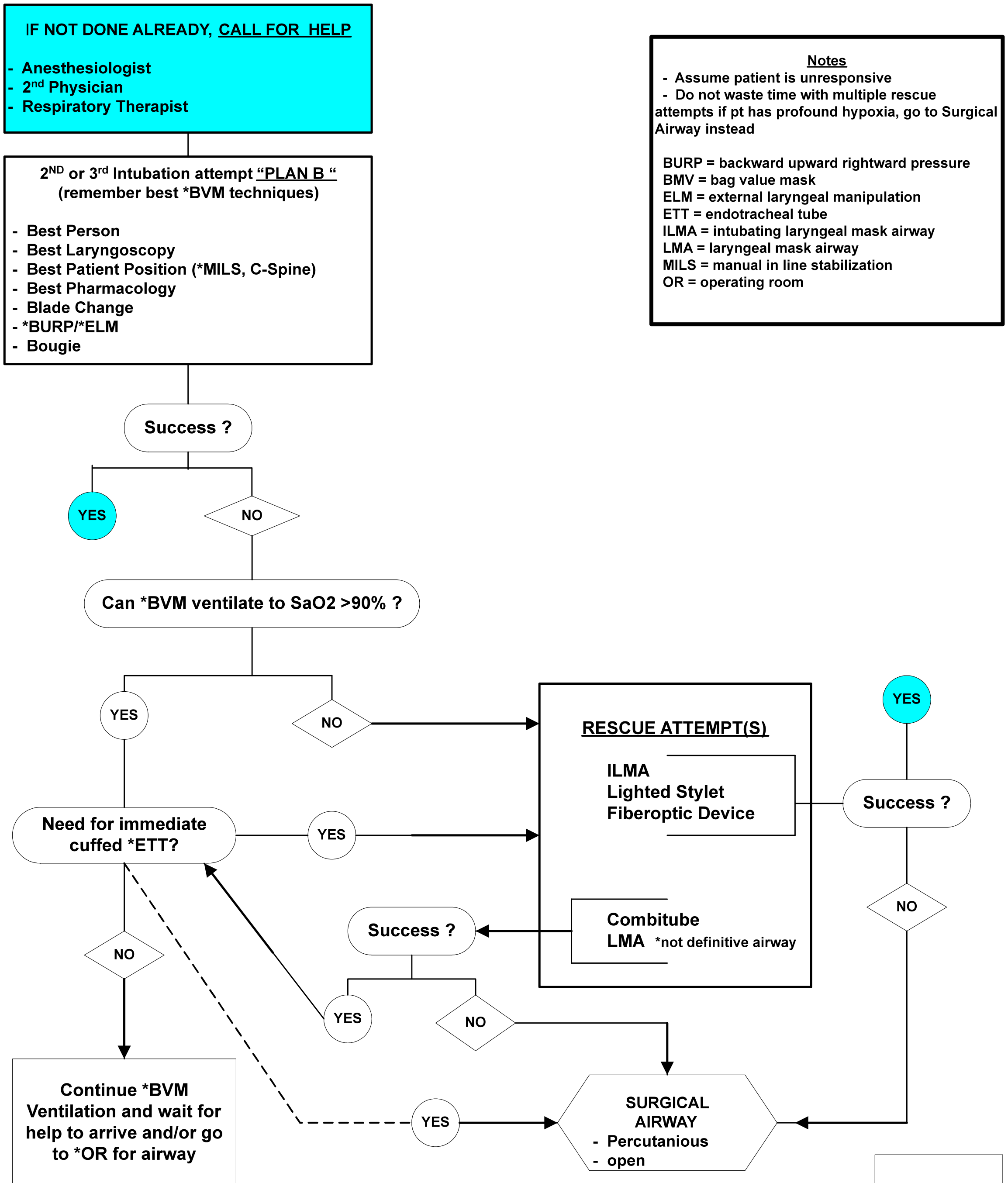
July 7 / 2005

# VCH Trauma Program CPG's
# Difficult Airway Algorithm




**Notes**

- Assume patient is unresponsive
- Do not waste time with multiple rescue attempts if pt has profound hypoxia, go to Surgical Airway instead

BURP = backward upward rightward pressure
BMV = bag value mask
ELM = external laryngeal manipulation
ETT = endotracheal tube
ILMA = intubating laryngeal mask airway
LMA = laryngeal mask airway
MILS = manual in line stabilization
OR = operating room

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# SHOCK AND RESUSCITATION

Patients presenting with major traumatic injury are at risk for shock. In most instances, shock will be due to hemorrhage and hypovolemia, although other causes of shock are occasionally seen in the trauma patient either due to co-morbidity, such as myocardial ischemia, or due to injury, such as neurogenic causes of shock arising from high C-Spine Injuries. Thoracic complications of cardiac tamponade or tension pneumothorax can also compromise cardiac function. Recognition of shock in the trauma setting is problematic in that the commonly measured vital signs are neither specific nor sensitive in identifying early shock. Trauma patients therefore are assumed to have early compensated shock irrespective of their vital signs and managed accordingly as per ATLS guidelines. All trauma patients at risk for major injuries should have 2 large bore peripheral IVs inserted and 2L of crystalloid hung running at a brisk rate until diagnostic workup has been initiated or the patient has declared themselves as completely stable.

Patients presenting with overt shock i.e. hypotension and/or tachycardia should initially be assumed to be suffering from hemorrhagic shock and resuscitated with volume, initially crystalloid followed quickly by packed red cells if there is no response. Patients requiring significant resuscitative volumes should have all their fluid passed through a rapid infuser to minimize the risk of hypothermia.

A diagnosis of hemorrhagic shock mandates a rapid and diligent search for the source of blood loss and early definitive intervention to stop the bleeding. For many patients, this will require transfer to the Operating Room, fixation or splinting of fractures or angiography to achieve hemostasis and hemodynamic stability. Adjuncts to the primary survey, including chest x-ray, pelvic x-ray, FAST in addition to a brief but thorough physical exam should identify all major sources of bleeding. In the absence of any major bleeding source, other causes of shock should be considered and appropriate diagnostic tests performed.

The degree of resuscitative intervention will dictate management strategies for a number of injuries including solid organ abdominal injury and pelvic fracture. Once a resuscitative threshold has been crossed, non-interventional strategies are no longer indicated and operative intervention or angiography will be required. For most patients, non-interventional strategies should be reconsidered once the patient has received 4 units of packed cells and 4-5 L of crystalloid or sooner if the patient is obviously not stabilizing.

Vancouver Coastal Health Authority is in the process of developing a Massive Transfusion Protocol for those patients requiring large volumes of blood and blood products. The attached massive Transfusion Protocol is a draft document, which is not for circulation or dissemination, but may be used as a guideline until ratified by relevant stakeholders.

# VCH Trauma Program CPG's
# SHOCK

**SHOCK**

**ABC's Volume resusitate per ATLS**

**Look for source of bleeding**

| | |
|---|---|
| **CXR:** | **( Hemothorax)** |
| **PXR:** | **( Pelvic # )** |
| **FAST/DPL:** | **( Hemoperitoneum)** |
| **Phys. Exam:** | **( Fractures/Bleeding)** |

**+**

**1. Stop bleeding (OR/Angio/# splint/fixation)**

**2. Continued resuscitation**

**3. ICU consult**

**-**

**Other Causes ?**

**1. Cardiogenic**

| | |
|---|---|
| **Tamponade :** | **JVD/HS muffled** |
| **Tension ptx :** | **JVD/tracheal shift** |
| **MI :** | **ECG changes)** |

**2. Vasogenic**

**Vagal HR**

**Neurogenic HR/paraplegia**

**+**

**RX accordingly**

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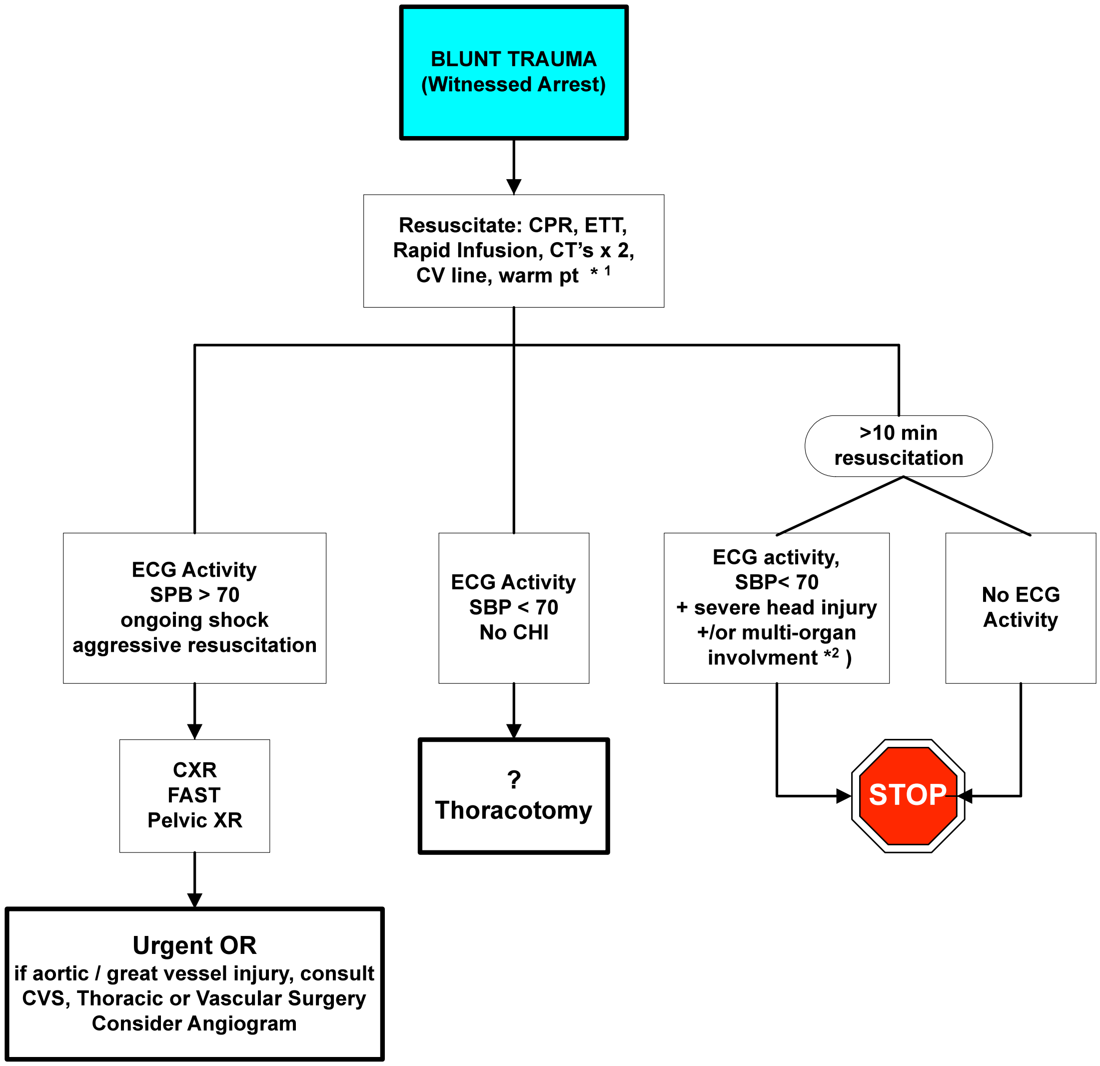
# TRAUMATIC ARREST PROTOCOLS

The following two Clinical Practice Guidelines address Witnessed Post-Traumatic Arrest for patients with Penetrating or Blunt trauma. The purpose of these guidelines is to minimize the unnecessary exposure to healthcare workers from performing futile resuscitative thoracotomies. Survival from blunt traumatic arrest is extremely rare and should be reserved for those patients whose vital signs are lost in the department, do not have significant head or multisystem trauma, and in whom resuscitative and definitive interventions can be performed quickly with rapid transfer of the patient to the OR.

# MANAGEMENT OF PAIN IN TRAUMA

Most patients presenting to the Emergency Room with traumatic injury may receive early analgesia as long as this is appropriately titrated and administered with caution in the setting of either overt or potential hemodynamic compromise. Procedural analgesia should be used for painful resuscitative procedures including chest tubes and possibly wound exploration and diagnostic peritoneal lavage as long as vital signs are normal and stable.

# VCH Trauma Program CPG's Witnessed Traumatic Cardiopulmonary Arrest in ED Blunt Trauma




*1 All patients with T < 32 C, re-warm before stopping resuscitation
*2 For severe head injury and multiple organ involvement, there is a < 1% survival rate

CONSIDER ED THORACOTOMY ????

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# MULTISYSTEM TRAUMA IN BURN PATIENTS

All patients with traumatic injuries, in addition to burns should have a Trauma Team Consult. If the patient meets activation criteria, the Trauma Team should be activated. The Burns/Plastics Team should be consulted immediately. Patient care will be a joint process with Burns/Plastics, the Trauma Team and consulted services.

Initial Management: **Follow ATLS Protocol (ABCs)**

Airway should be appropriately managed – Intubation and Escharotomies as required. Resuscitation requirements begin at the time of the burn. The Parkland Formula is used for this and is as follows:

4ml RL/Kg/%BSA for the first 24hrs (1/2 in the first 8 hours)
Calculate BSA – Rule of 9 (This is modified for the Paediatric Population).
Monitor Urine Output – 30-50ml/hr
May require additional fluid and blood depending upon nature of associated trauma.

Baseline studies include – CXR, PXR, Lateral C-Spine, FAST

Baseline Blood work – Trauma Panel, ABG's, Carboxyhemoglobin levels

Special Circumstances – Electrical, Chemical and Cold Injuries may require additional monitoring e.g., EKG

If patient is not in a Trauma/Burn Centre, need to consider transfer as per Table 9-2 pg. 84 – Plastics Manual (see table)

All Physicians caring for and managing Burn patients should consider taking the ABLS course.

**BURNS THAT DICTATE PATIENT ADMISSION TO A HOSPITAL OR BURN CENTER**

2º and 3º burns greater than 10% of BSA in patients <10 or > 50 years old
2º and 3º burns greater than 20% BSA in any age group
2º and 3º burns posing a serious threat of functional or cosmetic impairment, e.g., the face, hands, feet, genitalia, perineum, and about major joints
3º burns greater than 5% BSA in any age
Electrical burns including lightning
Chemical burns posing a serious threat of functional or cosmetic impairment
Inhalation injury
Burns associated with major trauma

Table 9-2*[1]

*1 Brown ASB, Glickman L, Mattews M, Slezak S. "Essentials for Students," Plastics and Reconstructive Surgery , 5th Ed, 1998

# Section B

## INJURY SPECIFIC PROTOCOLS

The following CPGs relate to the management of specific injuries. While it is recognized that other approaches to management of these conditions may be appropriate, the following represent consensus opinion of the VCH Regional Trauma Advisory Committee and, as far as possible, are evidence based as well as reflective of current practice of VGH Trauma Services. When resources or commitment are inadequate to provide level of care consistent with these guidelines, it is recommended that patients be considered for transfer to a higher level of care.

**Index to Injury Specific Protocols:**

# CRANIO CERVICAL INJURY IN BLUNT FORCE TRAUMA

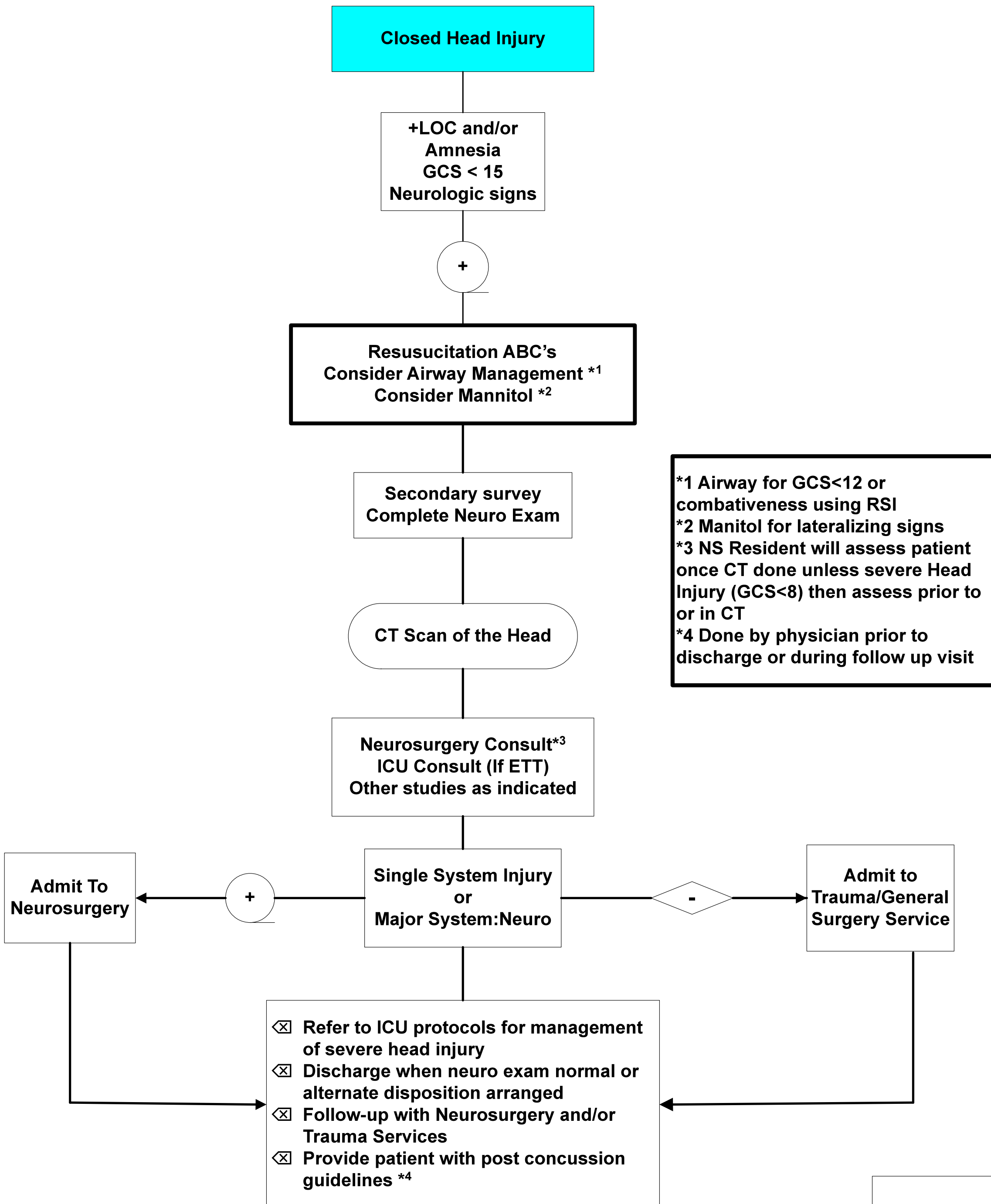
## 1. Head Injury

Rapid neurologic assessment and early CT head evaluation remain the cornerstones of evaluating patients with closed head injury. Patients with low or decreasing level of consciousness should be considered for emergency airway prior to CT. Patients exhibiting lateralizing signs such as anisocoria or unilateral motor signs should receive Mannitol IV prior to transfer to CT. Neurosurgical consult is recommended for all patients with significant head injury and certainly all patients with positive findings on head CT. Timing of the consult depends on the severity of the injury, but patients with severely depressed level of consciousness (GCS less than 8) or lateralizing signs should be seen as soon as possible by the Neurosurgery Service. Patients requiring intubation should be referred to ICU as soon as possible so assessment and bed preparation can be expedited. Patients with competing injuries will require additional diagnostic tests and patients who are hemodynamically unstable and require urgent operative exploration may require deferment of their head CT until surgery has been completed. Patients with single system neurotrauma or multi-system trauma, in which their neurologic component is the most relevant injury, should be admitted to the Neurosurgical Service. Other patients with Multi-system trauma, including head injury, should be admitted to General Surgical / Trauma Service.

## 2. C-spine

Any patient with a mechanism of injury consistent with major trauma criteria should be evaluated for a c-spine injury and be placed in c-spine precautions, including a rigid collar and firm surface, until evaluation has been completed. Patients with abnormal GCS undergoing head CT should obtain CT c-spine +/- CTA of the neck and be managed according to the Cervical Spine Clearance in the Obtunded Patient Protocol. Patients with a normal GCS should be evaluated by careful physical examination of the neck followed by 3-view plain x-ray of the c-spine, including a lateral film down to T1, AP view and an odontioid view. Patients with a negative physical exam and negative plain films can be cleared as long as they are fully awake and cooperative. Patients with a positive physical exam or positive findings on x-ray should undergo CT evaluation of the c-spine and depending on the findings, possible flexion-extension views. If further studies are negative, the c-spine can be cleared. Patients with positive radiological findings should be maintained in c-spine precautions and Spine Consult or Referral obtained. In the obtunded patient in whom a cooperative physical exam is unobtainable, concerns remain around the possibility of ligamentous injury in the absence of radiographically evident bony injury. These patients should be considered for passive flexion-extension views either by fluoroscopy or static films if any concern remains around the ligamentous.

## VCH Trauma Program CPG's
## Initial Management of Closed Head Injury

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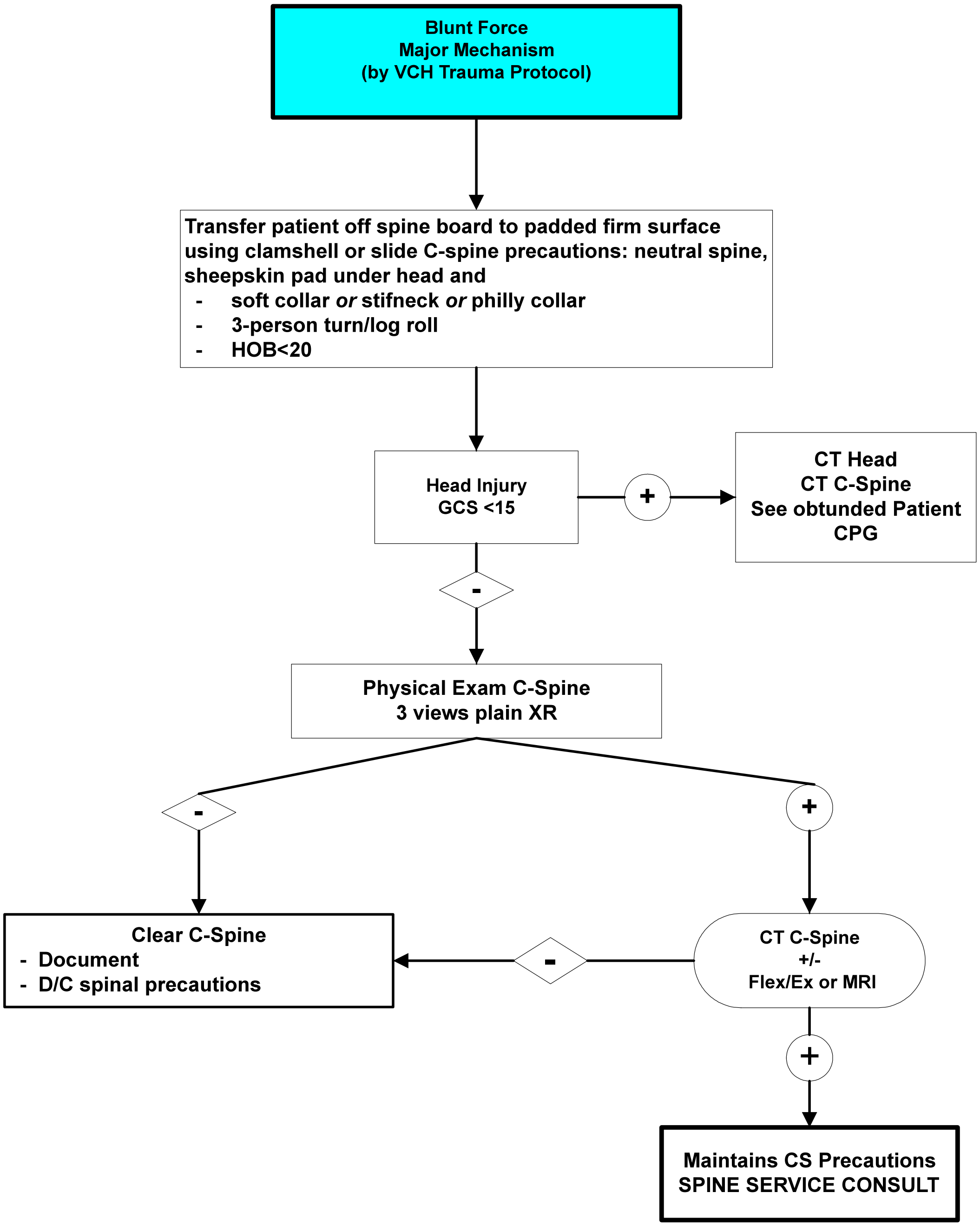
# VCH Trauma Program CPG's
# Blunt Force
# Cervical Spine

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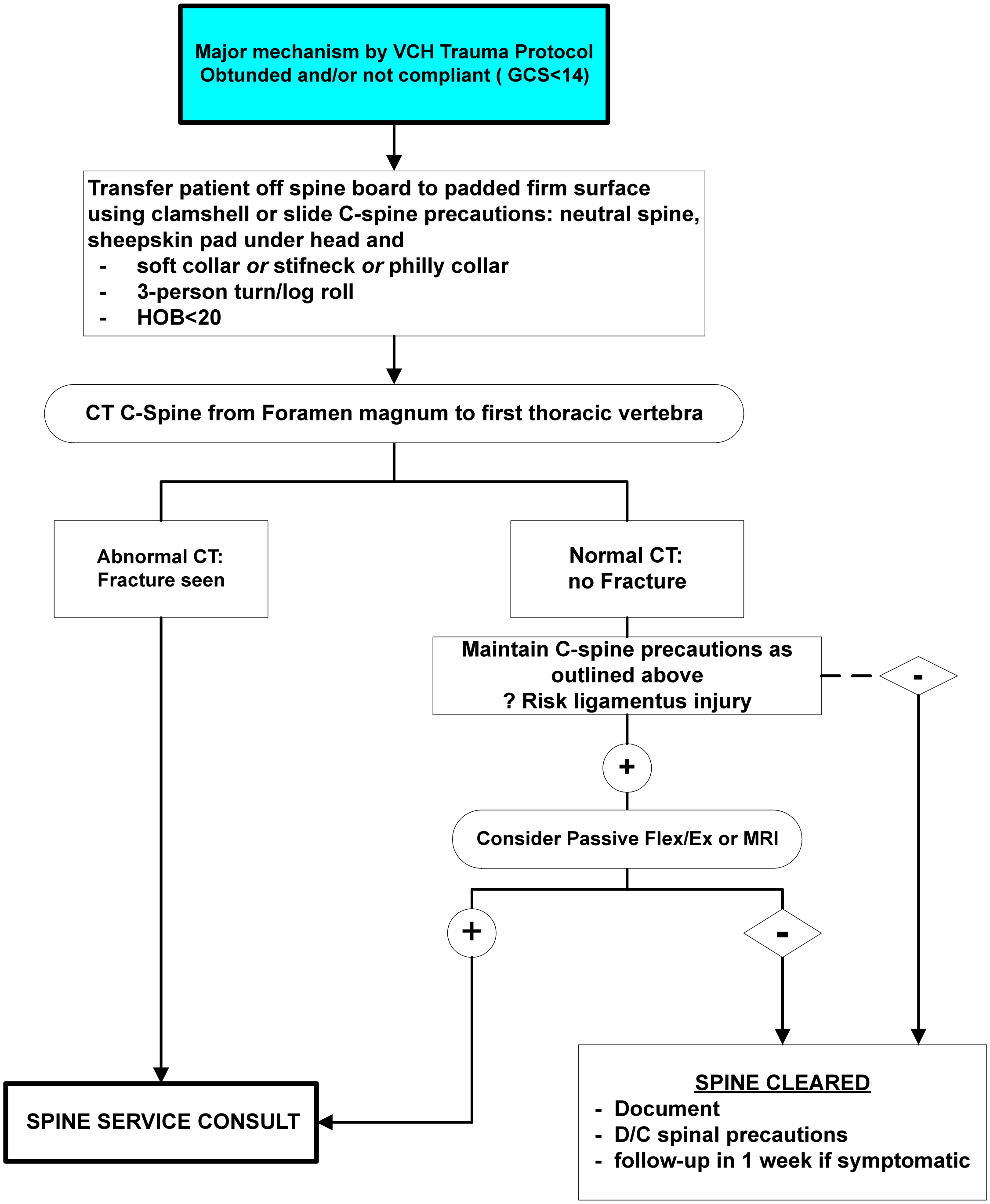
# VCH Trauma Program CPG's
# Cervical Spine Clearance (CSC)
# Obtunded Patient

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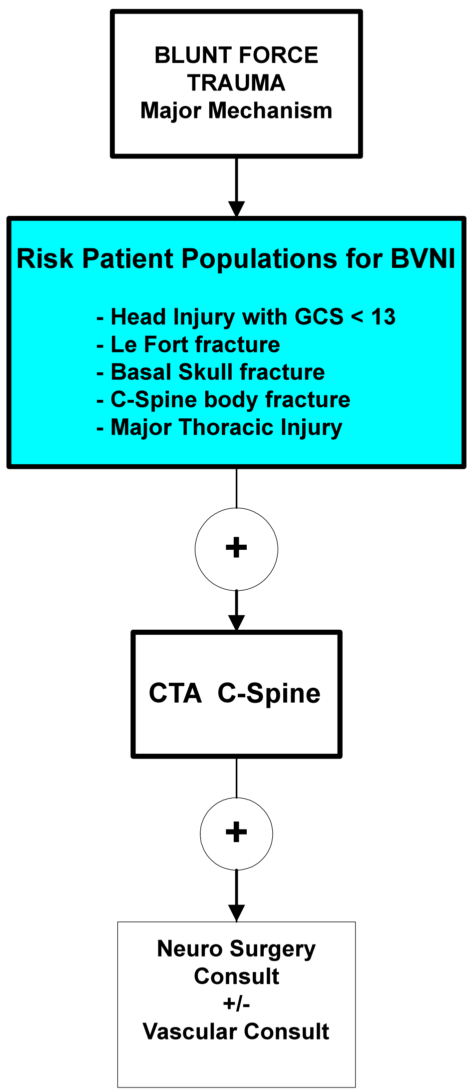
## 3. Blunt Neck Vascular Injury (BVNI)

Recent literature reviews and a review of our own experience has demonstrated that blunt vascular neck injury is uncommon, however, often presents occult without evidence of neurological impairment until devastating neurologic complication develops some time after admission. Without a screening protocol in place, the incidence of BVNI is thought to be around 0.1% of blunt trauma admissions in institutions with liberal screening that incidence increases to 1%. Various groups including ourselves have attempted to identify the population at risk for developing this injury and its complications in order to target a screening population. The following recommendations are based on this work and review of the literature.

### Screening for Blunt Vascular Neck Injury (BVNI) In Blunt Force Trauma

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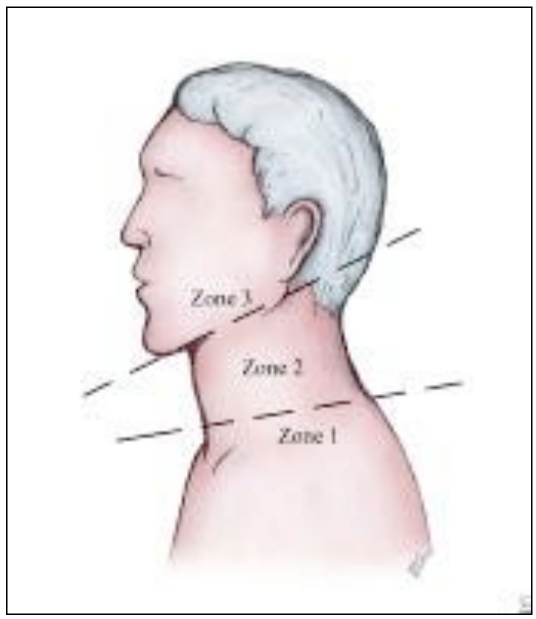
# PENETRATING NECK INJURY

Considerable controversy surrounds appropriate management of Penetrating Neck Injuries (PNI). The diagnosis is established once wound inspection demonstrates that the wound passes deep to platysma or deep to the superficial structures of the face. The immediately life threatening complications from PNI are airway compromise and hemorrhage. These should be anticipated and managed accordingly. No patient should leave the department unsupervised without airway secured or completion of diagnostic evaluation. Most patients with a significant penetrating injury to the neck should be considered for intubation prior to transfer to the Operating Room or diagnostic suite.

Management of PNI depends on status of patient on zone of injury in the neck (Figure). Patients presenting with significant bleeding or in shock will usually require expedited transfer to the Operating Room for definitive management of injuries irrespective of zone of injury. This can be problematic for Zone 1 injuries in terms knowing which incision to make. It is usually straightforward in Zone 2 injuries and is again problematic in Zone 3 injuries where access to great vessels is difficult. Zone 3 patients may be considered for angiographic intervention and stent placement if the appropriate consultations and resources support that plan.

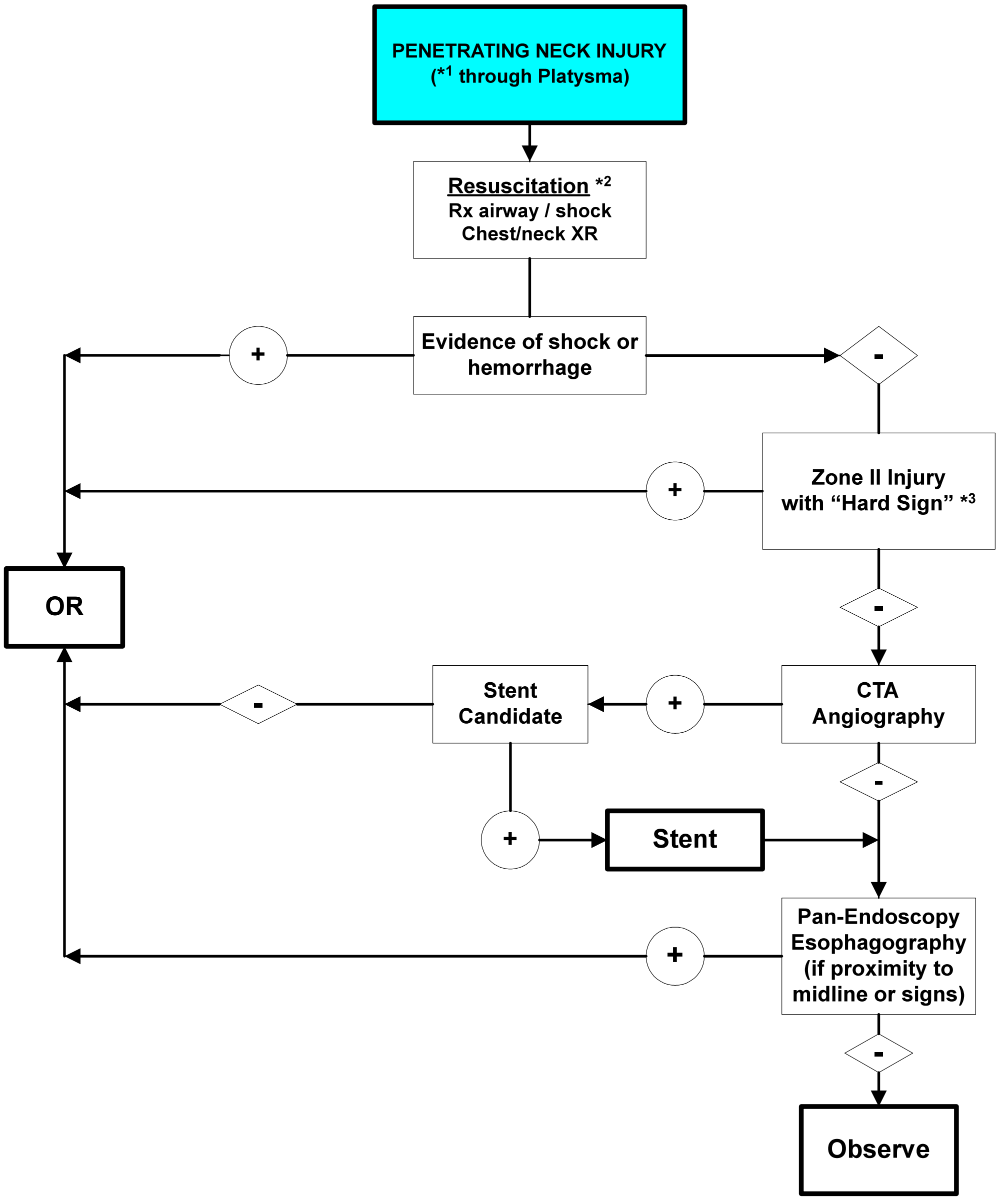
**Zones of the Neck**

1. Base of skull to angle of mandible
2. Between angle of mandible and cricoid
3. Below level of cricoid




Patients without evidence of hemorrhagic shock can be managed selectively. The basis of selective management is again controversial with recommendations ranging from simple observation all the way through to 4-vessel angiography with pan-endoscopy and esophagography. It is clear that any physical sign consistent with a vascular injury or an injury the aerophagic tract needs to be aggressively investigated or explored. Current recommendation of this program is all patients should be radiologically investigated with a CT angiogram to determine the presence or absence of vascular injury and proximity of the tract to the midline structures. If the CT suggests that the trachea or esophagus are at risk, then pan-endoscopy and esophagography are indicated.

# VCH Trauma Program CPG's
# Penetrating Neck Injury




*1 "Neck" extends from base of skull to Thoracic inlet. Face wound = potential zone I injury

* 2 Secure airway early of any doubt and before any diagnostic road trip ( e.g. Angio )

*3 e.g. expanding hematoma, active bleeding, bruit, air from wound, dysphasia, dystonia, hemoptisis

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# BLUNT THORACIC INJURY

Blunt thoracic injury covers a spectrum of injury from simple isolated rib fracture all the way through to aortic disruption or ventricular rupture. The following algorithms address specific clinical scenarios associated with blunt thoracic injury.

## BTI #1 – Widened Mediastinum

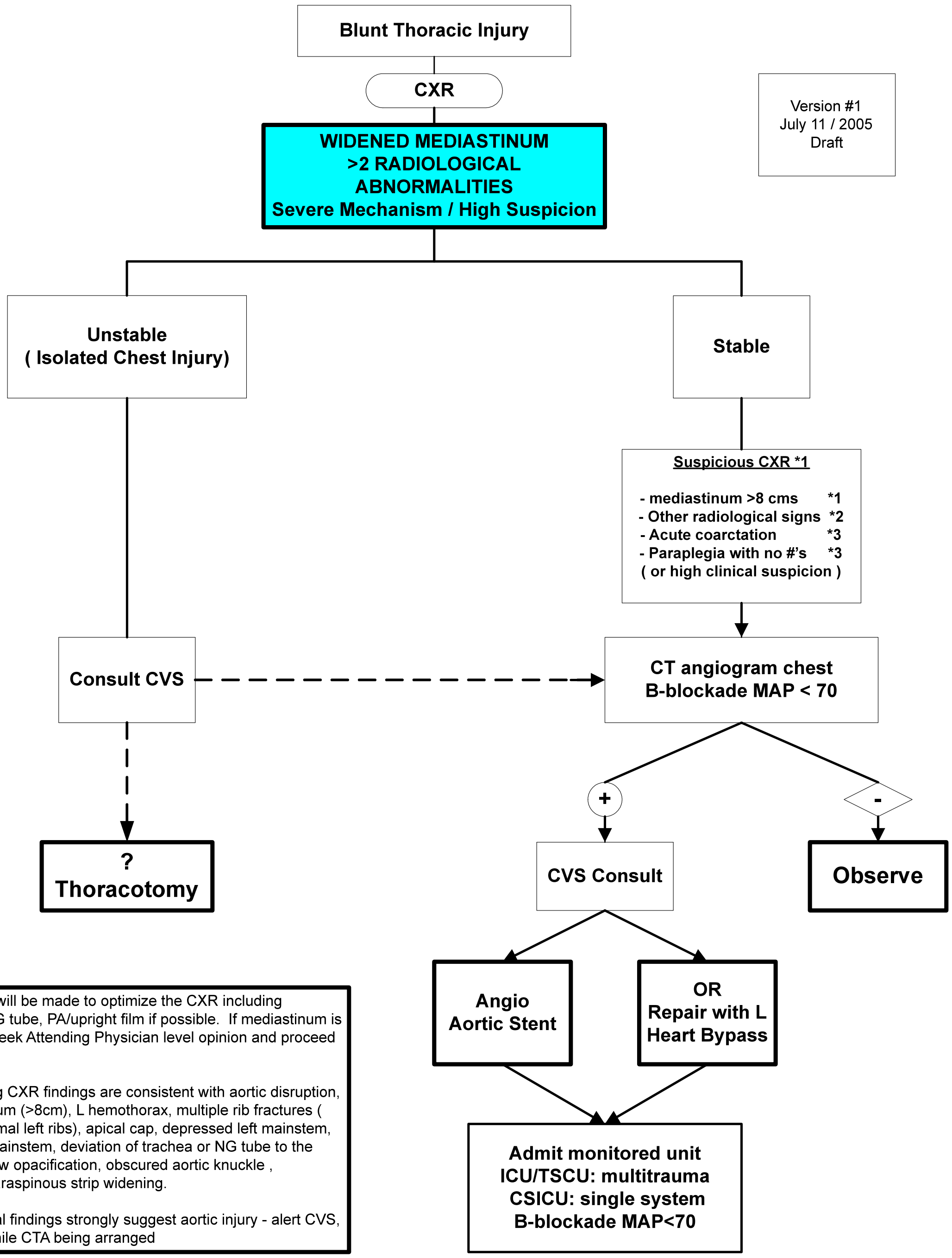
CT Angiogram is now used as the primary screening modality for patients considered at risk for any contained disruption of the thoracic aorta. Patients are usually selected on the basis of an abnormal chest x-ray demonstating a widened mediastinum or other radiologic abnormalities consistent with this diagnosis as described on the following algorithm. However, the presence of a normal chest x-ray in patients with high risk mechanisms or in whom there is high clinical suspicion of this injury should not preclude obtaining a CT Chest to rule-out the diagnosis. Management of this condition is also in evolution with a large number of patients now being managed with angiographically placed aortic stents. Those patients going to the Operating Room should be managed with a left heart bypass to minimize the risk of spinal cord ischemia or paraplegia.

Definitive care decisions are made in collaboration with CV Surgery and Angiography. In the unstable patient in whom the diagnosis is suspected, there is little to be gained by Emergency Room Thoracotomy, unless the diagnosis is in doubt. Urgent consultation with Cardiovascular Surgery should be obtained and direction as to whether the patient should proceed directly to the OR or proceed to CT, notwithstanding the hemodynamic issues and risks associated with doing this.

## BTI #2 – Blunt Cardiac Injury

This practice guideline addresses the need for observation and investigation of patients suspected blunt injury to the heart. The presence or absence of a so-called cardiac contusion is less relevant than detecting the complications of Blunt Cardiac Injury, which are rupture, ischemia from coronary artery injury, failure from dyskinesia and arrhythmia. The latter is by far the most common complication and can usually be predicted on the initial ECG or a brief period of Emergency Department monitoring. Some controversy surrounds the role of measuring Troponins in suspected Blunt Cardiac Injury with some authors suggesting that they are a marker for increased risk for subsequent dysrhythmias.

# VCH Trauma Program CPG's
# Blunt Thoracic Injury
# BTI # 1
# Widened Mediastinum

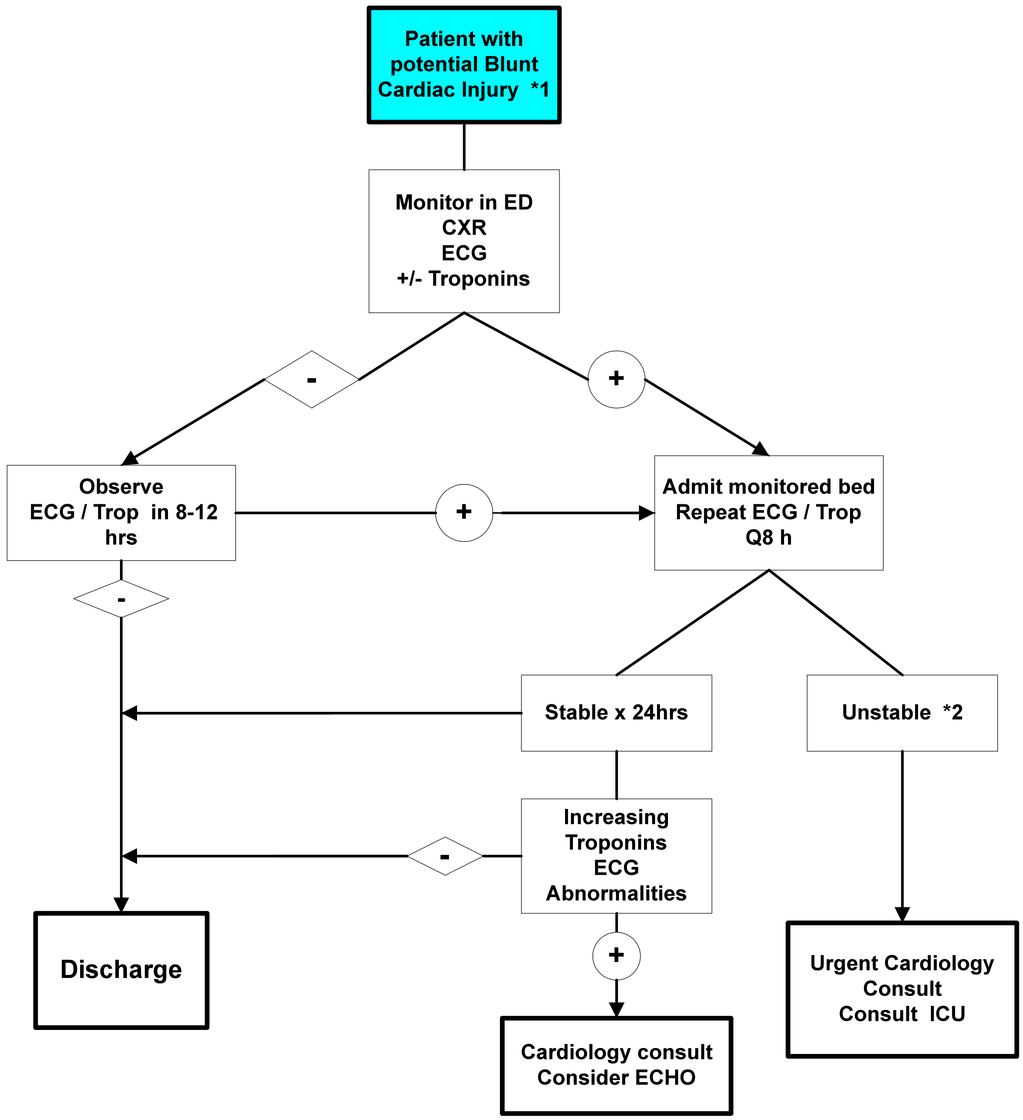



*1 Every effort will be made to optimize the CXR including placement of NG tube, PA/upright film if possible. If mediastinum is still wide, then seek Attending Physician level opinion and proceed with algorithm

*2 The following CXR findings are consistent with aortic disruption, wide mediastinium (>8cm), L hemothorax, multiple rib fractures ( especially proximal left ribs), apical cap, depressed left mainstem, elevated right mainstem, deviation of trachea or NG tube to the right. A-P window opacification, obscured aortic knuckle , paratracheal /paraspinous strip widening.

*3 These clinical findings strongly suggest aortic injury - alert CVS, OR, or Angio while CTA being arranged

# VCH Trauma Program CPG's
# Blunt Thoracic Injury
# BTI # 2
# Blunt Cardiac Injury




*1 Significant Mechanism MVC > 100 km hr, significant vehicle intrusion, steering wheel damage significant deceleration, fall > 15 ft with evidenced chest injury

*2 Evidence MI, Cardiogenic Shock, significant Arrythmia

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# HEMO-PNEUMOTHORAX

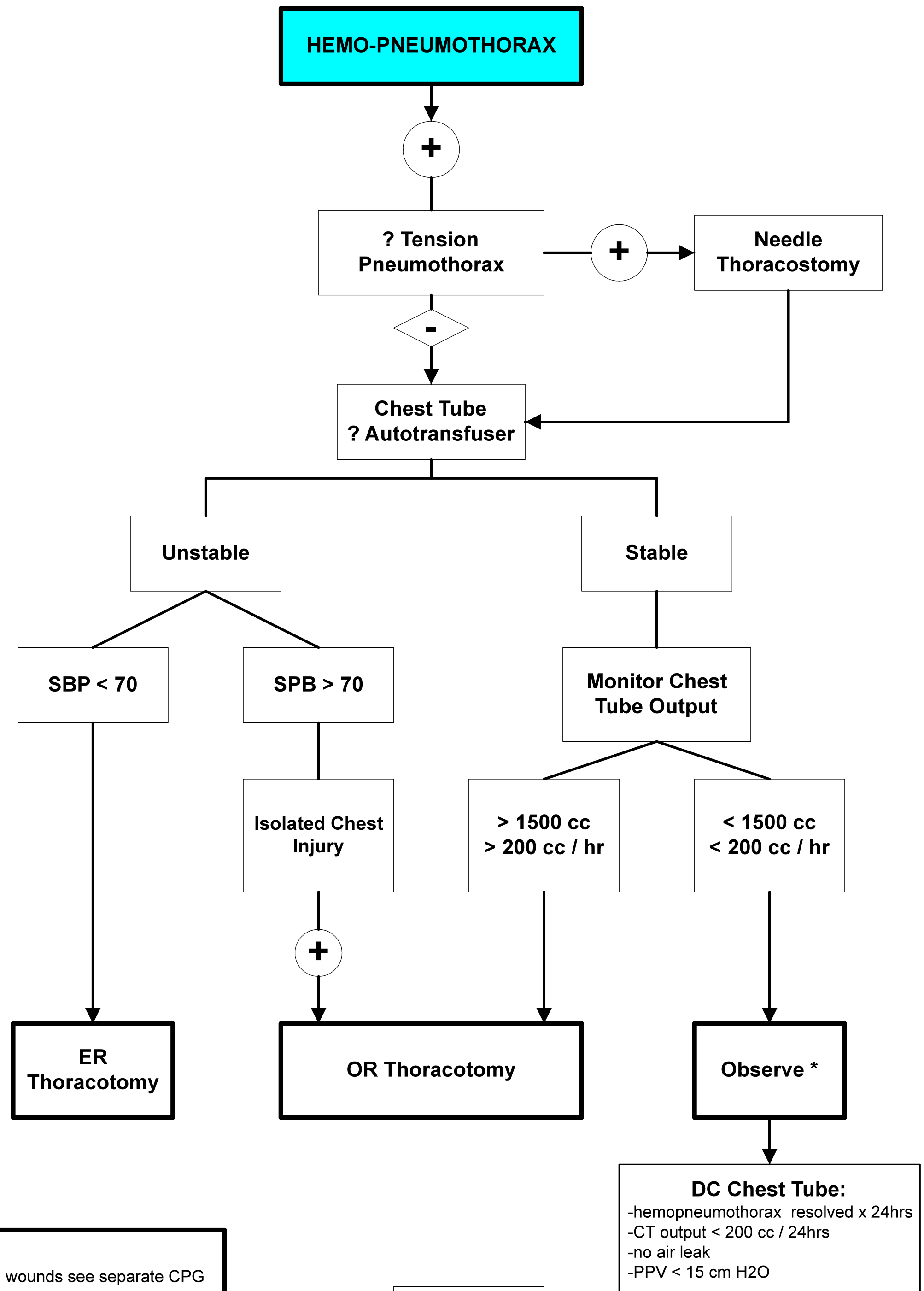
Patients with evidence of Hemopneumothorax on chest x-ray following blunt or penetrating trauma should be managed with tube thoracostomy unless there is evidence of tension, in which case, a large bore angio catheter should be inserted in the 2$^{nd}$ intercostal space mid-clavicular line or preferably in the 4$^{th}$ intercostal space just posterior to the anterior axillary line as per chest tube placement.

Tube thoracostomy should be in the 4$^{th}$ or 5$^{th}$ intercostal space laterally lying posteriorly to the anterior axillary line. In hemodynamically normal patients, this should be done under Procedural Sedation with generous amounts of local anaesthetic. Full sterile precautions should be observed unless crash tube thoracostomy is indicated. Patients with evidence of significant hemothorax on chest x-ray or physical exam should have the auto transfusion bag connected to the system prior to releasing the clamp on the chest tube.

Evidence of massive hemothorax defined as initial output greater than 1.5 to 2 litres of blood in the chest tube or ongoing bleeding of 200 cc/hr for 4 hours or longer mandates further intervention and usually an OR thoracotomy. Depending on the trauma surgeon involved, a thoracic surgery consult may be required.

Chest tubes are to be removed once there is radiologic evidence of resolution of the hemo- or pneumothorax for 24 hours or longer, output from the chest tube is less than 200 cc of serous or serosanguinous drainage per 24 hours, there is no air leak in the system, and that the patient is no longer on high levels of positive pressure ventilation ie. pressure support or PEEP greater than 7.5. Follow-up chest x-ray should be obtained 2-3 hours after removal of chest tube or sooner if there is a concern about recurrent pneumothorax.

# VCH Trauma Program CPG's
# Hemo-Pneumothorax




* For Mediastinal wounds see separate CPG

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# PENETRATING THORACIC INJURY (PTI)

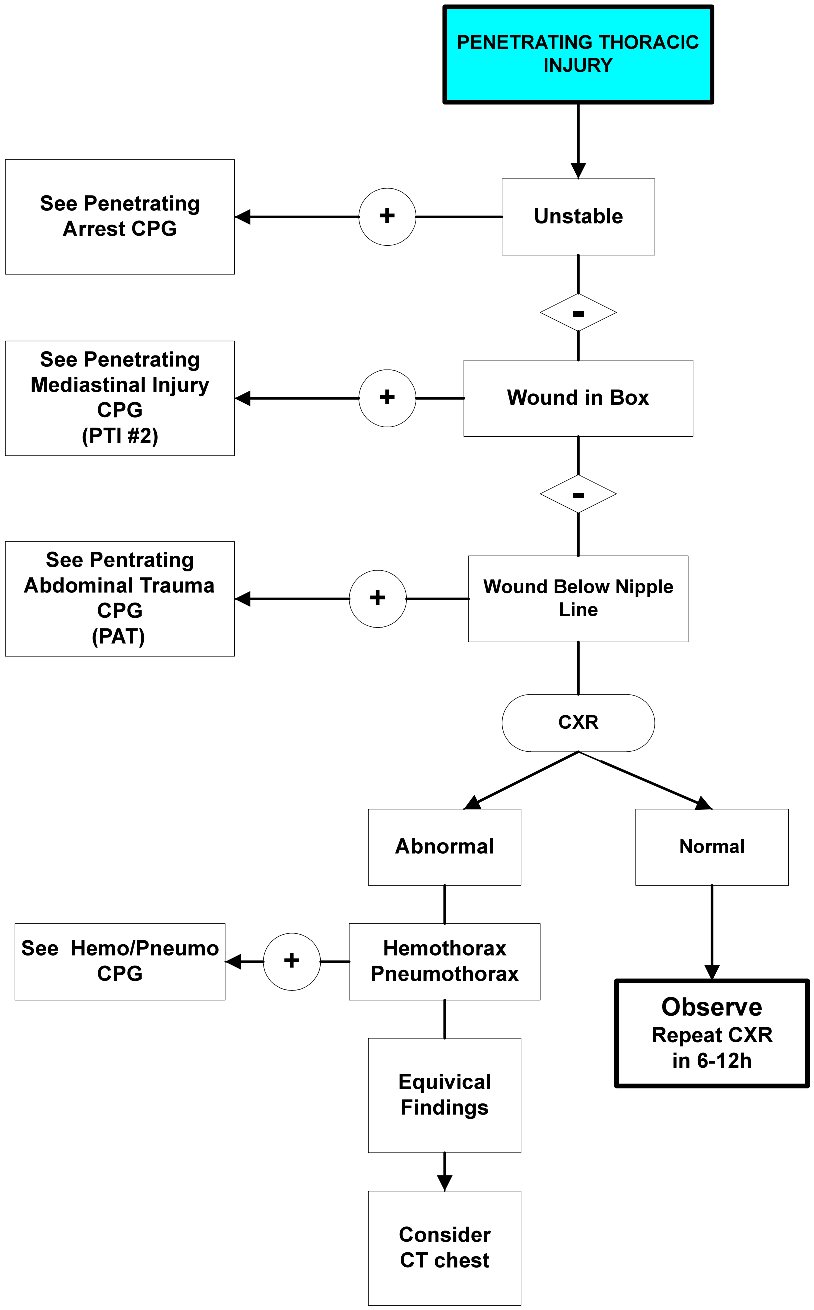
## PTI # 1: Penetrating Thoracic Injury

This algorithm describes the generic management of all penetrating injuries to the thoracic region. Patients who are unable to maintain a systolic blood pressure of 70 or better should be managed according to the Penetrating Traumatic Arrest CPG. Patients with wounds lying within the central thoracic region should be managed per the Penetrating Mediastinal Injury CPG. Any penetrating wound below the nipple line should be managed according to the Penetrating Abdominal Trauma CPG. Patients with evidence of Hemopneumothorax should be managed per the Hemopneumothorax CPG. Patients with unequivocally normal chest x-rays and with normal hemodynamics can be observed. Patients with equivocal findings should be considered for chest CT.

## PTI # 2: Penetrating Mediastinal Injury

The following algorithm describes the management of patients with injures to the central chest, also described as being a "Wound within the box". The box is defined by the sternal notch superiorly, zyphoid inferiorly and the inter-nipple space laterally. Patients with central thoracic wounds who are hemodynamically unstable should be managed per the Penetrating Arrest CPG with ED thoracotomy. Hemodynamically stable patients should undergo imaging with a screening ultrasound and if stable, a CT chest. If either of these are positive, then formal echocardiography is recommended as long as the patient remains hemodynamically normal. A Cardiovascular Surgery consult should be obtained. Positive findings on ECHO should be managed per the patient's condition and recommendations from CVS surgery. Patient's with negative Echocardiography, but CT evidence of mediastinal penetration should be considered for esophagoscopy, bronchoscopy, and/or angiography and managed according to findings.

## VCH Trauma Program CPG's
## Penetrating Thoracic Injury
## PTI # 1

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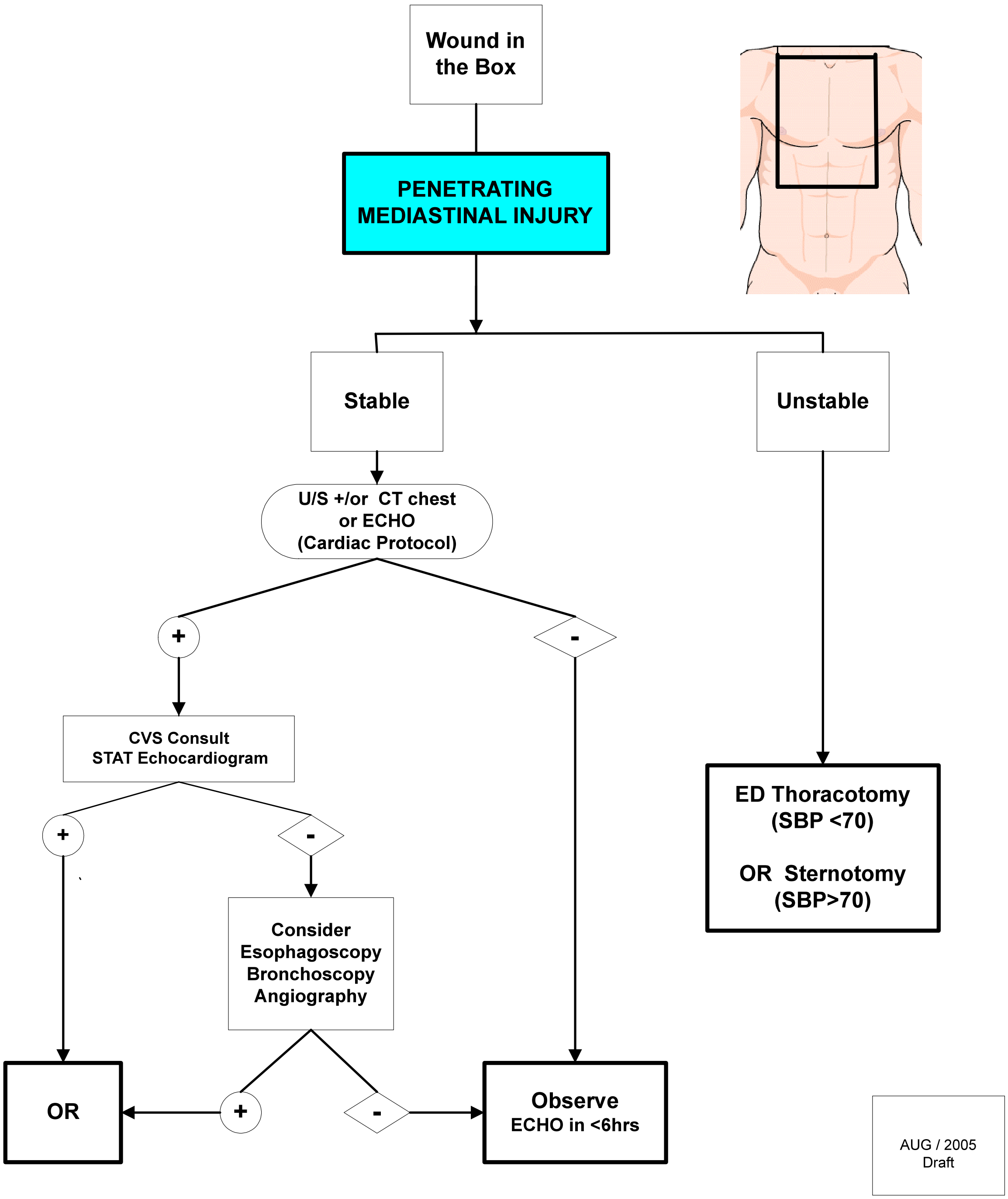
# VCH Trauma Program CPG's
# Penetrating Mediastinal Injury
# PTI # 2



# BLUNT ABDOMINAL TRAUMA (BAT)

## BAT #1: Blunt Abdominal Trauma

This algorithm provides an overview of the management of a patient suspected at risk for Blunt Abdominal Trauma (BAT). Management primarily depends on two parameters. The hemodynamic stability of the patient and the result of the Focused Abdominal Sonography for Trauma (FAST) exam. When FAST is not available then CT is appropriate for stable patients or DPL when patient is unstable.

Patients who are hemodynamically unstable with positive FAST should be taken directly to the OR. Patients who are unstable, but have a negative FAST exam should be screened for other causes of hemodynamic instability. If none are found, then the ultrasound should be repeated or DPL performed to fully exclude the possibility of hemoperitoneum. In Hemodyamically stable patients with a positive FAST, CT is then used to characterize the intrabdominal injury. Non-operative management is appropriate for Solid Organ Injury. If there is a suspicion of Hollow Viscus injury, then further investigation and/or laparotomy should be performed.

## BAT # 2: Hollow Viscus Injury

This algorithm describes the management of patients with suspected Hollow Viscus Injury. On the basis of abdominal CT, the finding of free fluid without solid organ injury or evidence of possible bowel or mesenteric injury, mandates further investigation to exclude injury to Hollow Viscus. Both DPL or laparoscopy have advantages over CT characterizing intraperitoneal injury and if these results are positive and/or equivocal, then laparotomy is mandated. Patients with gross findings on CT or on physical exam consistent with a Hollow Viscus injury should proceed directly to laparotomy without further investigation.

## BAT # 3: Isolated Splenic Injury

This algorithm outlines the current recommendations for management of Isolated Splenic Injury. CT evidence of active bleeding at the time of admission should mandate either operative intervention or alternatively angiographic intervention. Otherwise, the patient should be admitted to a monitored unit and undergo close observation per the algorithm for 72 hours. Follow-up CT is recommended at that time to identify lesions in the organ that may predict a high risk for subsequent delayed hemorrhage. If these lesions are identified, the patient should undergo angiographic embolization. Duplex ultrasonography is another option. CT negative patients or patients who have undergone successful angiography should then be admitted to the floor, mobilized and discharged when tolerating a DAT. Patients undergoing Splenectomy or at hight risk for needing a Splenectomy should be immunized against Hemophylus, Pneumococcus, and Meningococcus.

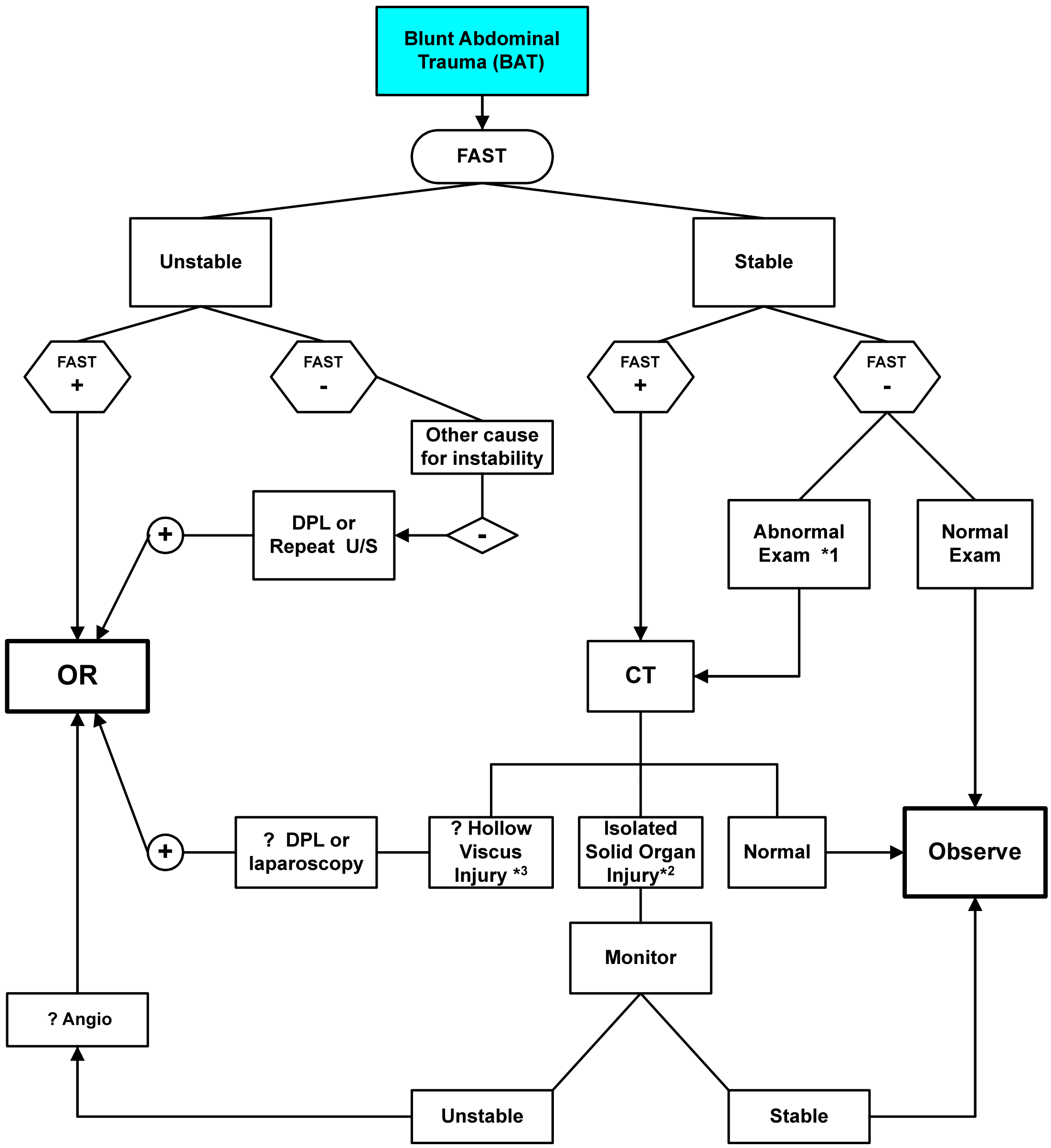
**BAT # 4: Isolated Liver Injury**

This algorithm describes a similar management of patients with Isolated Liver Injury. These patients are more at risk for significant hemoperitoneum and if there is a clinical suspicion for developing abdominal hypertension or abdominal compartment syndrome, then bladder pressure should be routinely monitored q12 hours. As with splenic injuries, patients should be admitted to a monitored unit and observed closely for 72 hours with follow-up CT or duplex ultrasonography at that time. Transfer to the floor is indicated in patients who have remained hemodynamically stable with a stable hemoglobin and a reassuring CT.

**BAT # 5: Blunt Renal Injury**

This algorithm describes the management of Blunt Renal Injury. Management depends on CT findings defining the grade of injury, but more importantly, whether there is evidence of active bleeding or urinary extravasation. Urology consultation should be obtained for all injuries, particularly the more serious ones where intervention will be required. The hemodynamically unstable patient with proven renal injury at presentation is usually managed operatively. Angiography is an option if available, and if the diagnosis is known unequivocally. Patients who develop hemodynamic instability, a drop in Hgb concentration or new bright red hematuria following admission, should be preferably investigated and managed angiographically since this will result in a higher rate of organ preservation. All patients who sustain renal injury should be followed long term to exclude the possibility of late onset hypertension.

# VCH Trauma Program CPG's
## Blunt Abdominal Trauma
## BAT # 1




* 1 Abnormal findings include tenderness, contusions (example: positive seatbelt sign), abnormal GCS or adjacent injuries i.e. rib #'s, pelvic #'s, spinal #'s

*2 See Splenic / Liver / Renal CPG's

*3 See Hollow Viscus Injury CPG's

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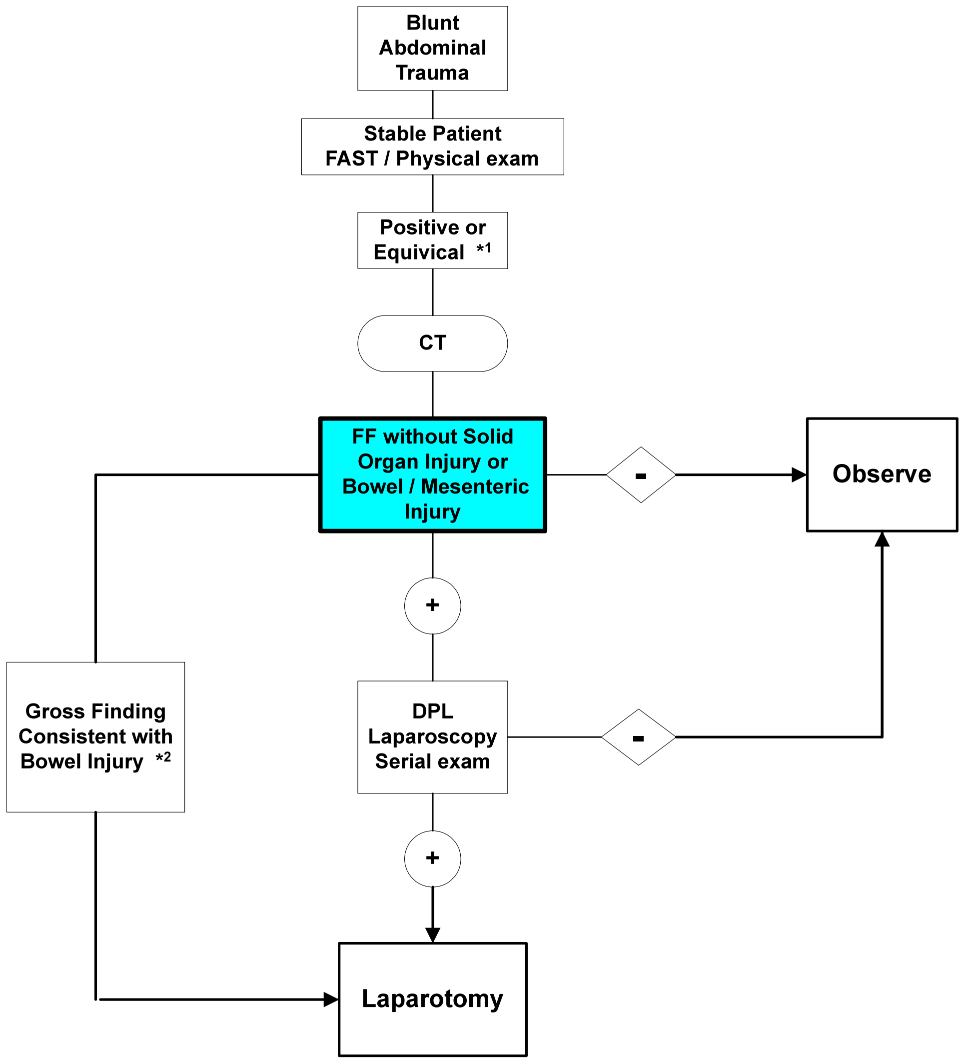
# VCH Trauma Program CPG's
# Blunt Abdominal Trauma (BAT # 2)
# Hollow Viscus Injury




*1 Diffuse abdominal tenderness, positive seatbelt sign, crush type injury ( handle-bar to abdomen) or Chance Fracture should all raise the suspicion of hollow viscus injury and mandate CT abdomen or exploration if evident peritonitis

*2 Large amounts of free fluid without solid organ injury or frank injury to bowel ( e.g.: free air, evident contrast leakage) +/- mesenteric hematoma mandates exploration

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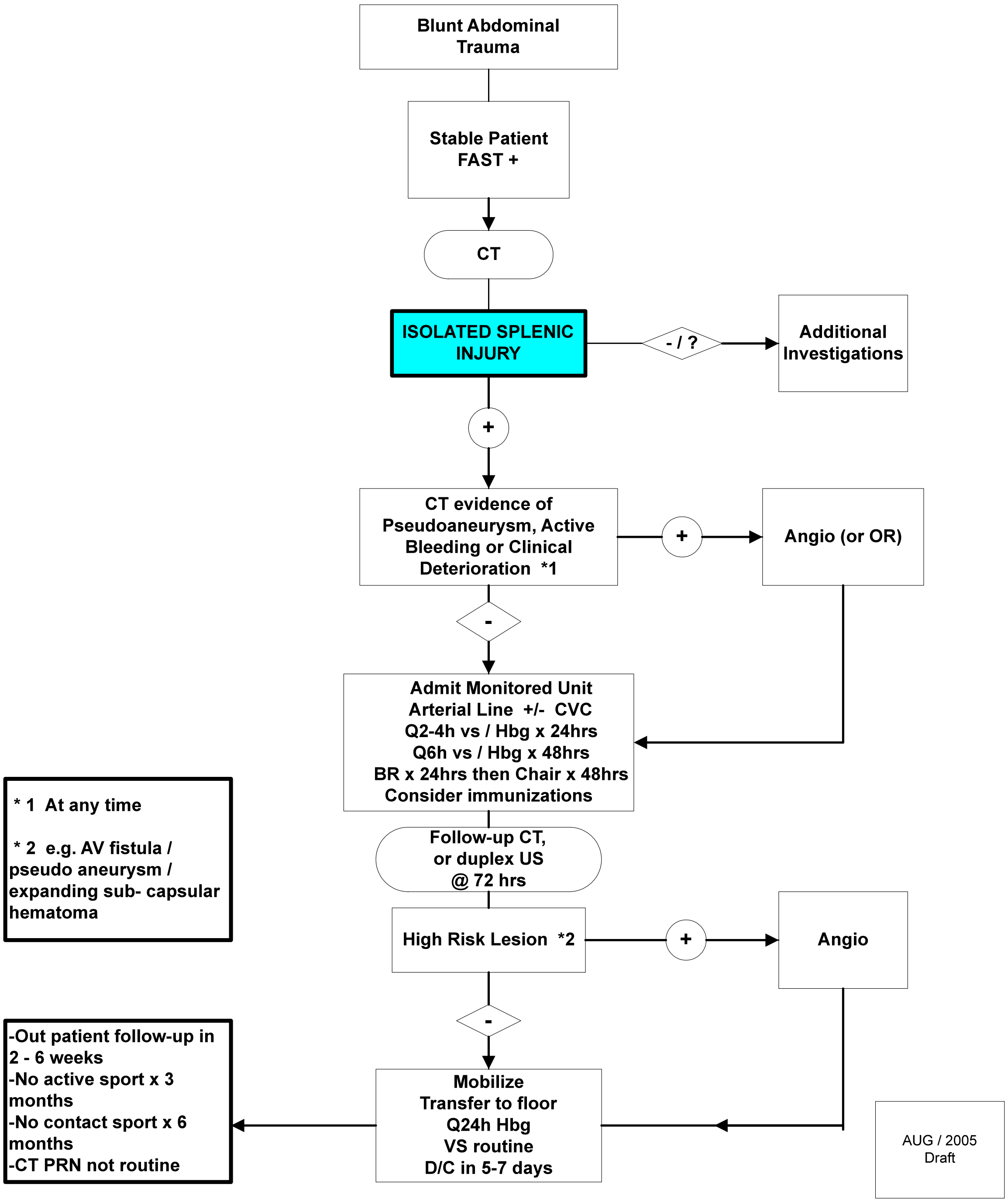
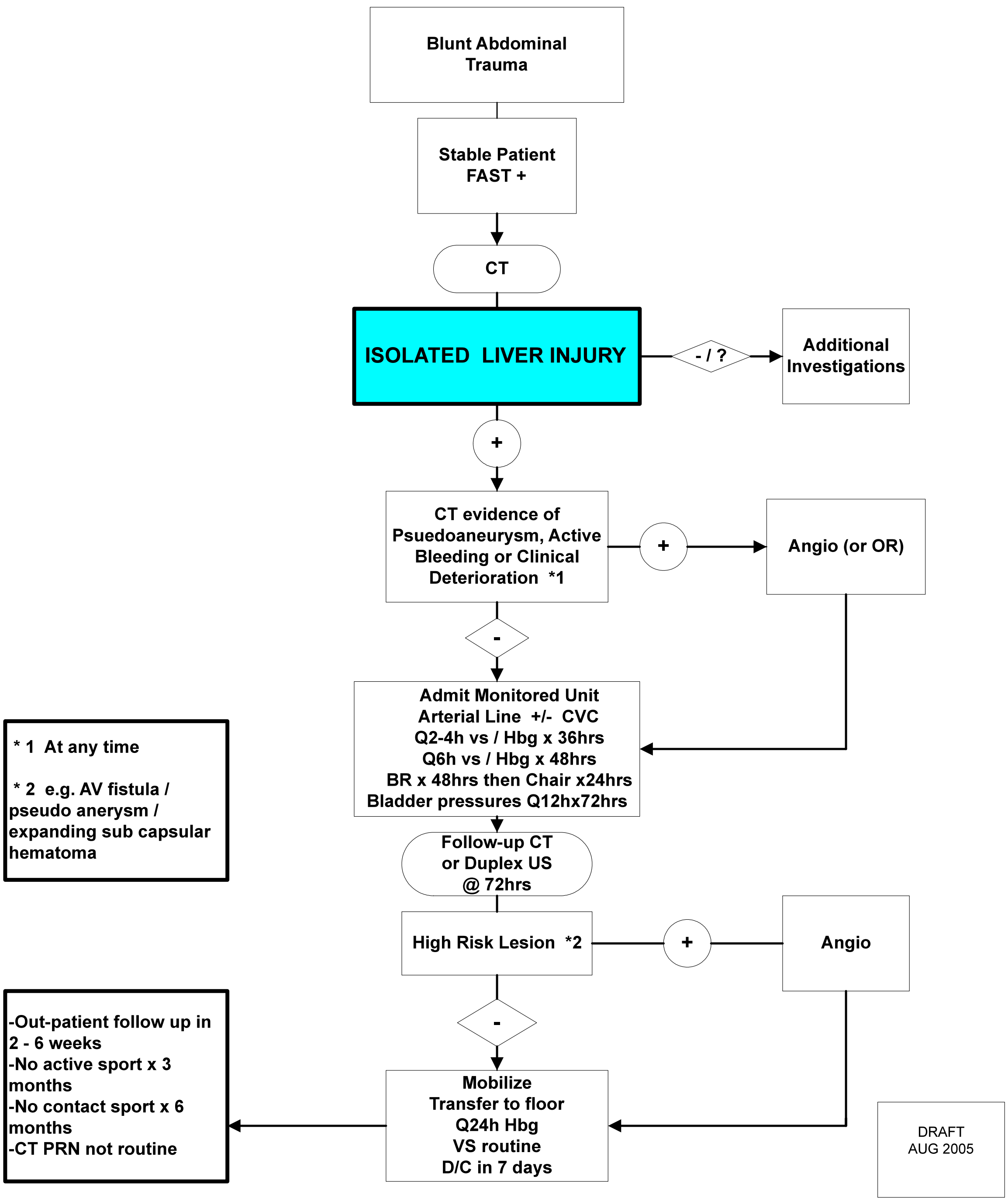
AUG / 2005

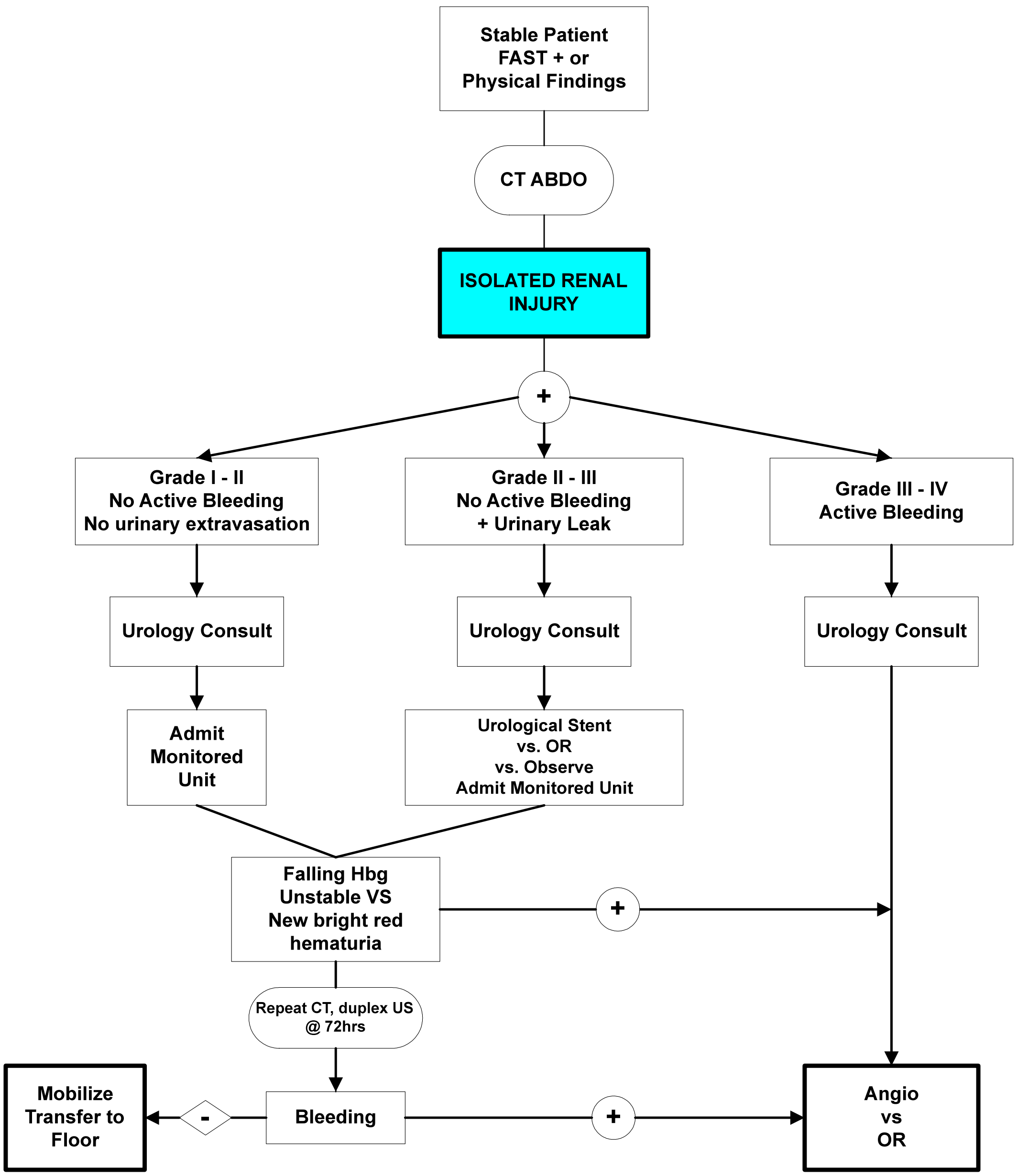
# VCH Trauma Program CPG's
# Blunt Abdominal Trauma
# BAT # 3
# Spleen Injury



# VCH Trauma Program CPG's
# Blunt Abdominal Trauma
# BAT # 4
# Liver Injury



**VCH Trauma Program CPG's**
**Blunt Abdominal Trauma**
**BAT # 5**
**Renal Injury**

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# PENETRATING ABDOMINAL TRAUMA (PAT)

## PAT # 1: Penetrating Abdominal Trauma

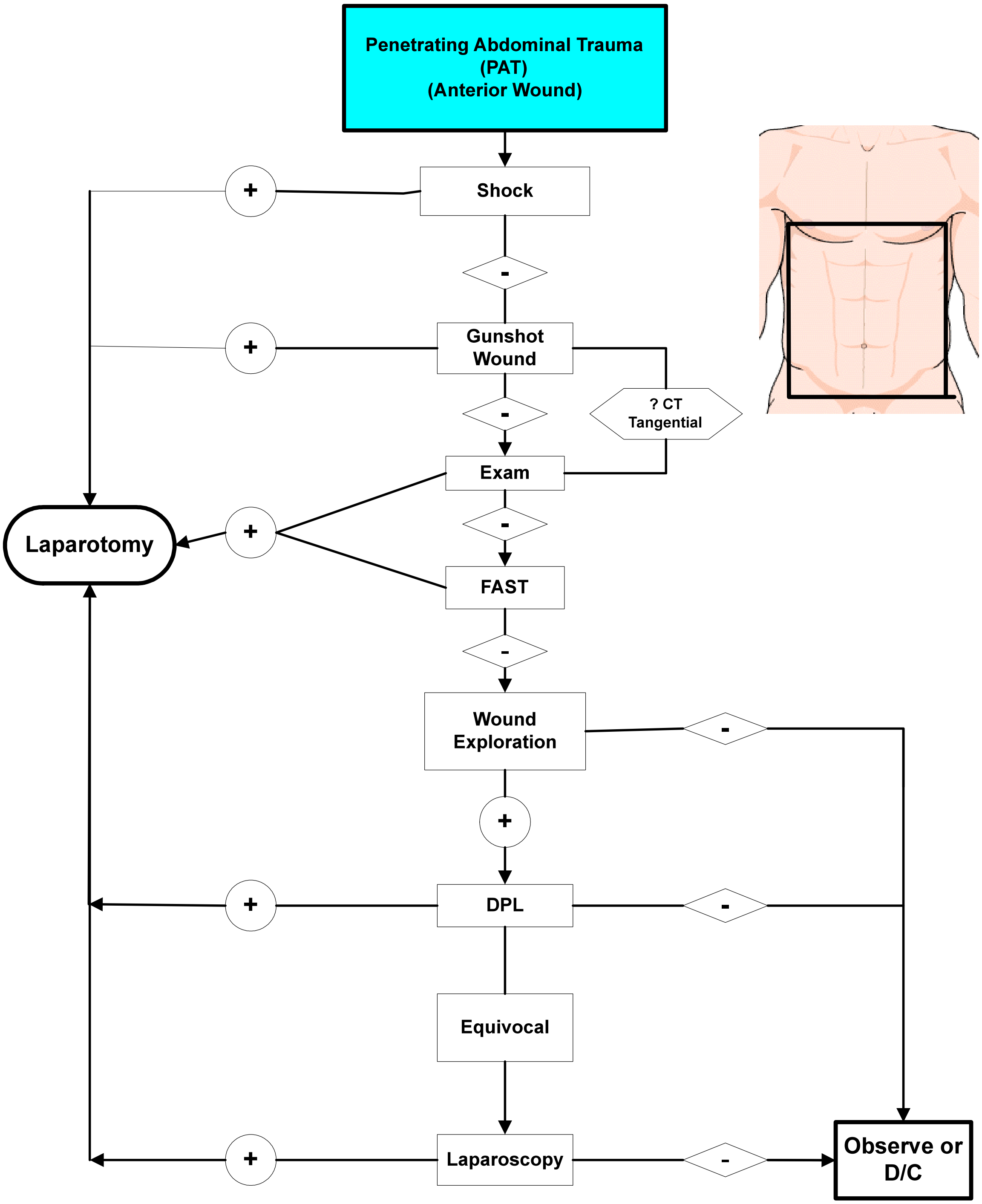
This CPG describes management of wounds in the anterior thoracolumbar region between the nipple lines down to the pubic symphysis and out to the anterior axillary lines bilaterally. Patients presenting in shock, with gunshot wounds, or with unequivocally positive physical exam (PE) such as evisceration, massive bleeding and peritonitis should undergo laparotomy without further investigation. One caveat to this would be a suspicion of a tangential gunshot and or stab wound in a hemodynamically stable patient in whom CT investigation may provide evidence of non-involvement of the peritoneal cavity.

The stable patient should undergo FAST examination (if available) and if this is positive for free fluid, laparotomy is indicated. A negative FAST does not rule out intraperitoneal injury and these patients should undergo local wound exploration (LWE). Those with superficial wounds only should be observed or discharged. If the injury penetrates deeply through the anterior fascia, further intervention is indicated. However, there is considerable controversy over the management of patients who are hemodynamically normal with otherwise unremarkable abdominal physical exams with isolated stab wounds. At a minimum, these patients should be observed and serially examined for evidence of developing peritonitis. Current majority recommendation is to proceed with further investigation with either a DPL in the ED or laparoscopy in the OR. Positive findings of peritoneal penetration with blood in the abdomen mandates formal laparotomy.

## PAT # 2: Penetrating Abdominal Trauma

This CPG describes the management of patients with penetrating wounds to the flank or posterior abdomen defined as the space between the tip of the scapula and the inferior gluteal crease to the anterior axillary lines bilaterally. Patients presenting with obvious hemodynamic instability with gunshot wounds or with positive physical exam should undergo immediate laparotomy. Other patients should undergo FAST to exclude hemoperitoneum. If this is negative, then a triple contrast CT is recommended. For wounds in the pelvic region, proctosigmoidoscopy should be an additional investigation. Positive findings should mandate laparotomy.

# VCH Trauma Program CPGs
# Penetrating Abdominal Trauma (Anterior Wounds)
# PAT # 1




Version #1
Aug 2005
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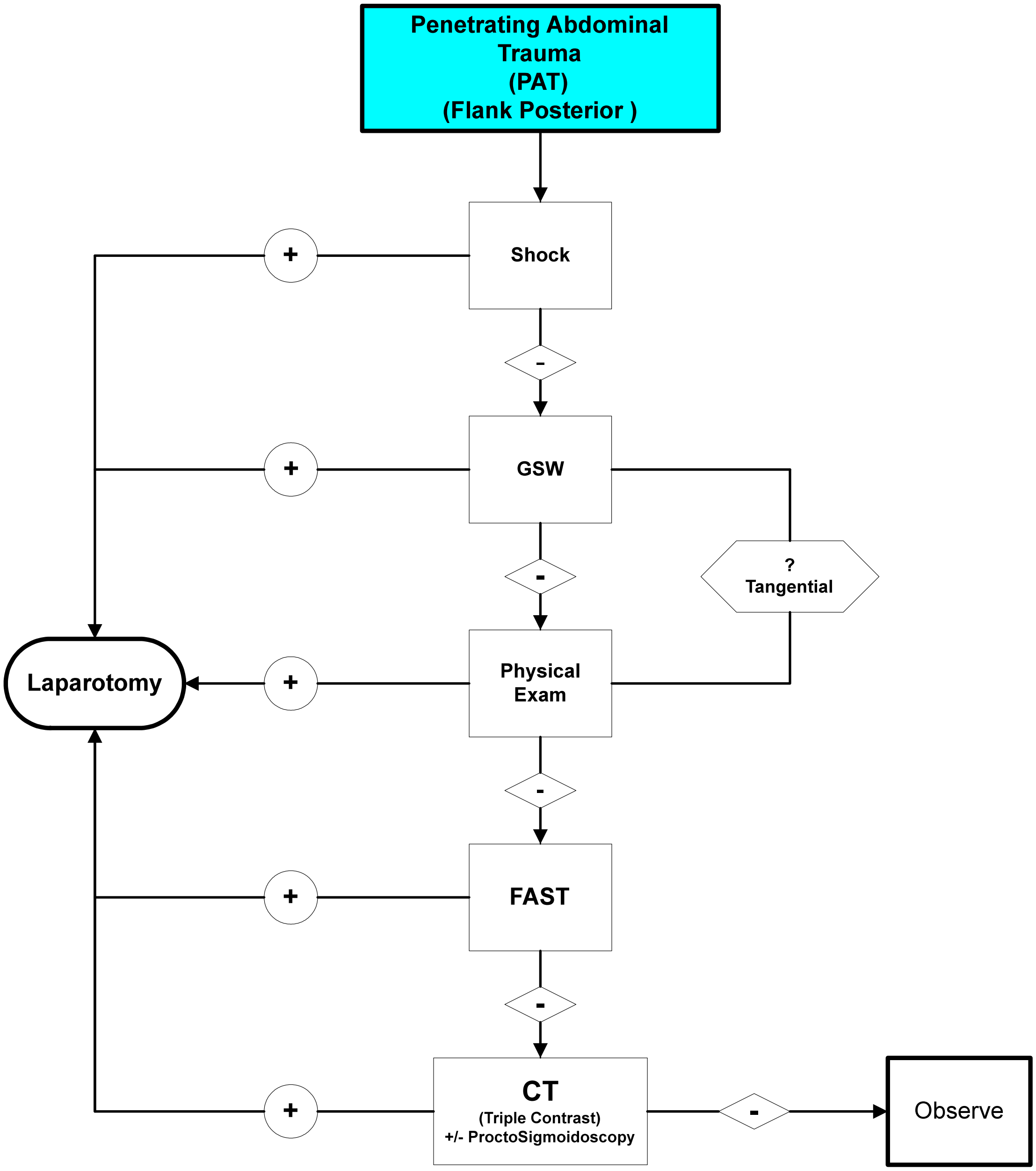
## VCH Trauma Program CPG's
## Penetrating Abdominal Trauma ( Flank Posterior )
## PAT # 2

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AUG / 2005

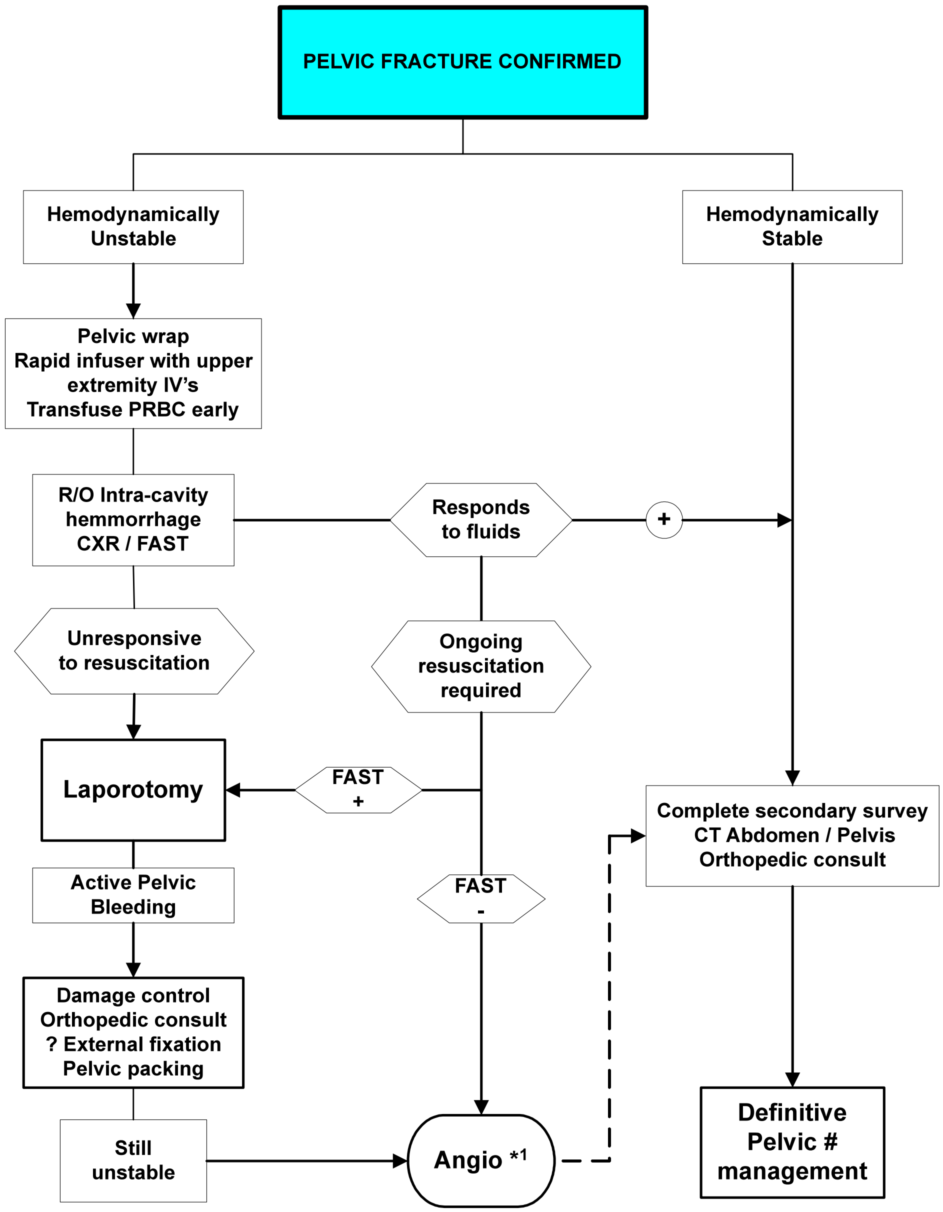
# PELVIC FRACTURE

Major pelvic injuries may result in life threatening vascular injuries as well as urological injuries. Patients who are hemodynamically normal can be fully investigated with the Orthopedic injury plus or minus urological injury addressed definitively.
Unstable patients require aggressive resuscitation with a pelvic binder, crystalloid and early use of packed red blood cells (prbc), with all fluids passed through a warmer/ rapid infuser. A rapid, diligent search for other sources of hemorrhage should be made with CXR, Pelvic XR, and a FAST or DPL.

Patients who do not respond to an initial resuscitation of 4-5L crystalloid with 3-4u packed red blood cells (prbc) should be transferred to the OR for damage control laparotomy with pelvic packing (if there is evident pelvic hemorrhage) and Bogotá bag closure before proceeding to angiography for embolization as required.
Patients who can be stabilized with fluids and packed red blood cells (prbc), but have ongoing resuscitation needs, should be taken to angiography (if the FAST/DPL is negative or minimally positive), or to the OR (if the FAST/DPL is grossly positive) followed by angio if necessary. Complete definitive diagnostic work up and care may have to await a period of stabilization in ICU.

Those patients who can be fully stabilized with modest resuscitative support can complete a full diagnostic evaluation and proceed to definitive care of their injuries.

# VCH Trauma Program CPG's
## Pelvic Fracture




*1. If Angiographer feels initial CT would help localization prior to angio, then do CT first if patients condition allows. Definitive management can follow angio once patient has been stabilized

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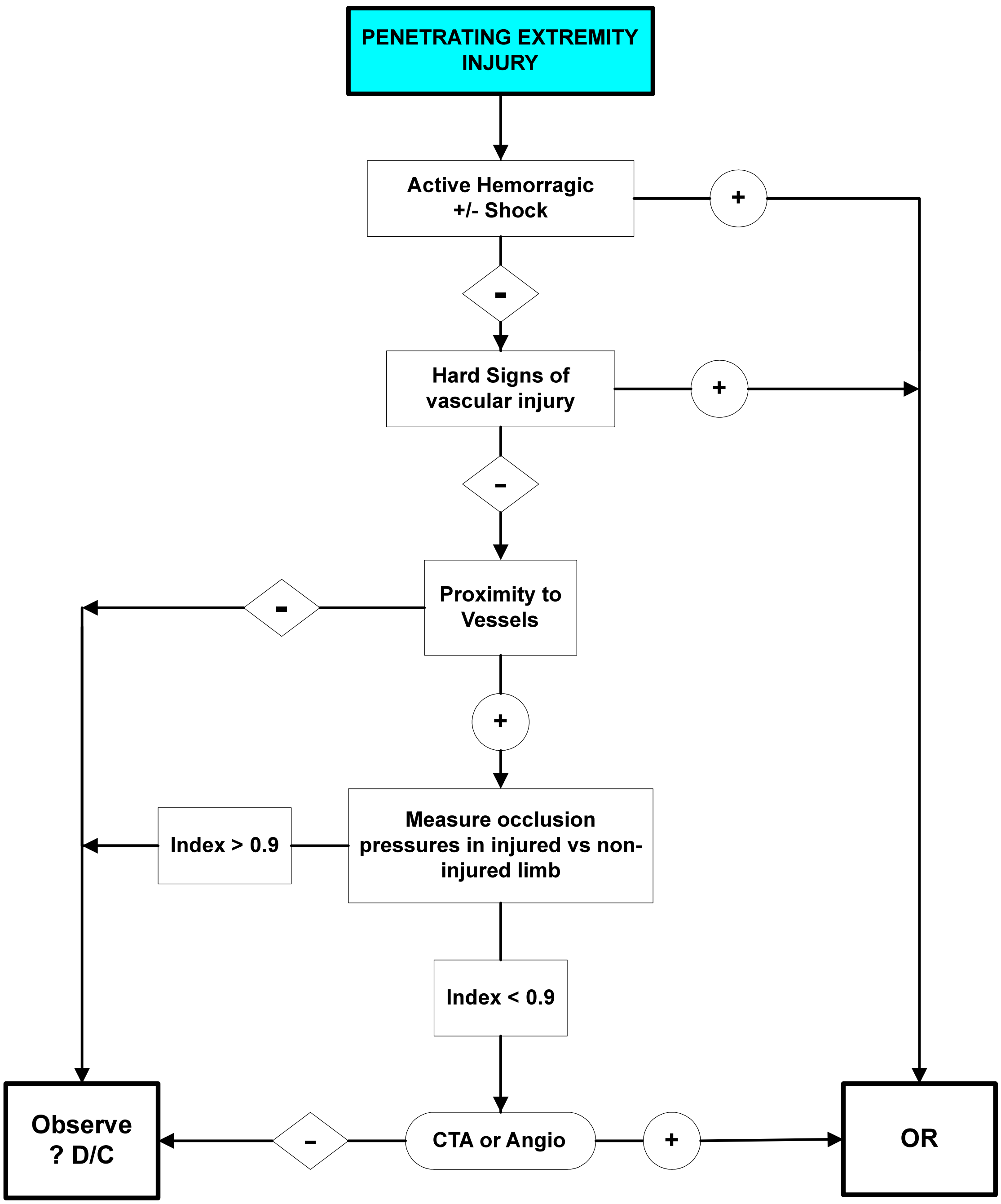
Draft

# VCH Trauma Program CPG's
# Penetrating Extremity Injury
# (PET)




Version #1
Draft
July 22 / 2005

## FRACTURE GUIDELINES

| Type of Fracture/Dislocation | Time to OR | DVT Prophylaxis | Antibiotics |
|---|---|---|---|
| Femoral diaphysis | <8-12h | LMWH | Ancef |
| Femoral neck (Hip) | <24h | | Ancef |
| Hip dislocation (failed closed reduction) | <4h | | Ancef |
| Tibial Shaft | <24h | | Ancef |
| Pelvis | | LMWH | Ancef |
| Upper extremity | <24h | | Ancef |
| Open fractures | <8h | | Ancef/Gent |
| Compartment syndrome | Stat | | Ancef |
| Vascular compromise | Stat | | Ancef |

# Section C

# INTENSIVE CARE / SPECIAL CARE UNIT PROTOCOLS

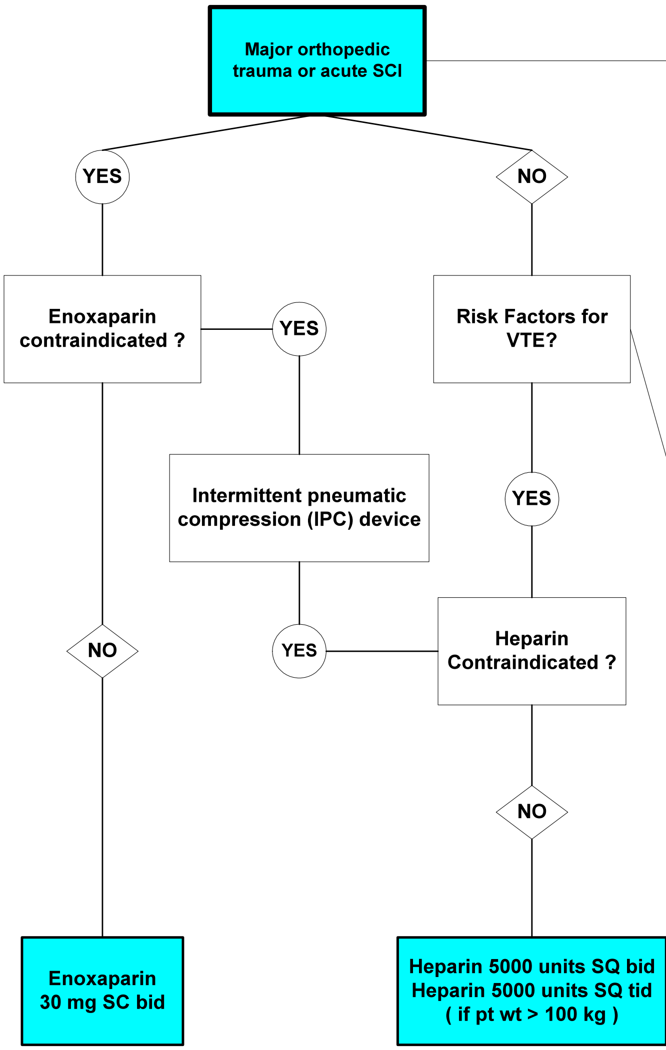
Rapid and complete resuscitation along with early definitive care will reduce complication rates and delayed mortality following trauma. Certain post-traumatic complications can be anticipated and in large part prevented by appropriate prophylaxis.

Some groups of patients (e.g. elderly or pregnant) haveunique monitoring requirements requiring specific guidelines.

## Index to Intensive Care / Special Care Protocols

**ICU/TSCU**
**VENOUS THROMBOEMBOLISM (VTE) PROPHYLAXIS PROTOCOL**
Vancouver Coastal Health Authority - VGH site






**Indications for Enoxaparin**

- Major orthopedic trauma with pelvic, femoral shaft, or other complex lower-extremity fractures (open fractures or multiple fractures in one extremity) requiring operative fixation or bedrest > 5 days; and/or
- Acute spinal cord injury (SCI)

**Contraindications to prohylaxis**

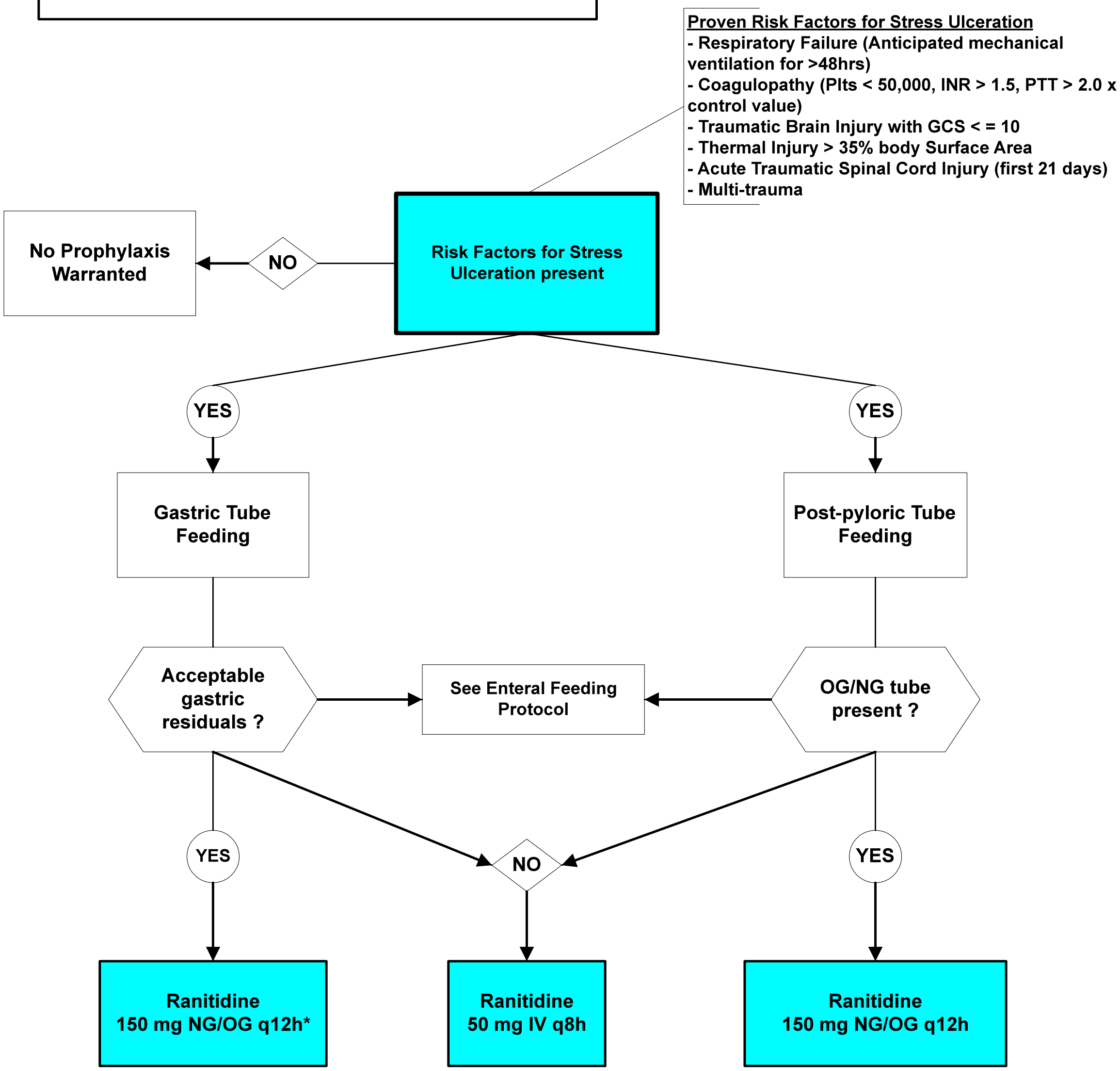
- Contraindications for early heparin or enoxaparin use may include: Intracranial bleeding; uncontrolled major bleeding; DIC; absence of adequate primary hemostasis; intraocular injuries; incomplete spinal cord injuries with significant perispinal hematoma; intra-abdominal solid-organ injuries managed non-operatively ; renal failure; and a history of HIT.
- A risk/benefit analysis of use in these settings should be considered before initiating prophylaxis, and further diagnostic studies and/or clinical monitoring may be required to guide the decision.

**Proven risk factors for Venous Thromboembolism (VTE)**

- Age > 65 years
- Obesity
- Smoking
- Prior venous thromboembolism (DVT or PE )
- Prolonged immobility or paresis
- Surgery (particularly involving abdomen, pelvis, lower extremities)
- Trauma
- Acute medical illness
- Cardiac or respiratory failure
- Central venous catheterization
- Inflammatory bowel disease
- Myeloproliferative disorders
- Paroxysmal nocturnal hemoglobinuria
- Nephroitc syndrome
- Inherited or acquired thrombophilia
- Pregnancy and the post-partum period
- Estrogen-containing contraceptives or hormone replacement therapy
- Selective estrogen receptor modulators
- Malignancy
- Cancer therapy (hormonal, chemotherapy, or radiation)
- Varicose veins

Adapted from Chest 2004;126:338S-400S

**ICU/TSCU**
**STRESS ULCER PROPHYLAXIS PROTOCOL**
Vancouver Coastal Health Authority - VGH site


Stress ulceration prophylaxis should be continued until risk factors are resolved or patients are tolerating on oral diet.
*Option to NOT initiate prophylaxis in gastrically-fed patients with acceptable residuals if the ONLY risk factor is mechanical ventilation

# Section D

# BCAS PRE-HOSPITAL PROTOCOLS

## Index to BCAS Protocols

# BC AMBULANCE FRACTURED HIP PROTOCOL – VANCOUVER COASTAL HEALTH

Policy Statement

In accordance with BCAS Policy, Volume II, Section 6.4.10 (Transport to Nearest Healthcare Facility) paramedics will transport patients to the nearest healthcare facility where appropriate care can be provided. This directive is provided as clarification in accordance with Procedure #1 of the noted policy with respect to where appropriate care can be provided for elderly patients with suspected hip fractures in the Greater Vancouver Regional portion of the Vancouver Coastal Health area.

Background

The VCHA has requested that elderly patients who have had a simple fall or other event resulting in a suspected fractured hip be transported on a systematic basis to where the surgical capacity and expertise is located to facilitate improved utilization of the health care system.

Procedure:

1. Patients within the GVRD VCHA area meeting the following criteria will be transported to one of the appropriate receiving hospitals in accordance with the catchment area map for this specific presenting problem:
    a. Paramedic suspects the patient has a fractured hip based on standard prehospital assessment criteria; and are otherwise medically stable, and
    b. The patient is over the age of 60; and
    c. The fracture is NOT the result of a high energy injury; and
    d. The patient does NOT meet the Trauma 99 protocols

2. Patients meeting Trauma 99 protocol criteria will continue to be transported in accordance with that policy.

3. Where a physician has arranged or directed transport of a patient meeting these criteria to a specific facility prior to ambulance arrival, the physician direction will be followed regardless of the catchment area.

4. The general intent of the catchment area as described on the attached map is that patients meeting the criteria will be transported as follows:
    a. North Shore – to the Lions Gate Hospital
    b. Downtown Vancouver – East Side – to St. Paul's
    c. Central Vancouver – to Vancouver General
    d. Richmond – to Richmond General
    e. East Vancouver – for patients normally within Burnaby General catchment area, continue to transport them to that location.

5. *Patients normally transported to Delta hospital will continue to be triaged to the Delta ED. Once an appropriate bed is located through BC Bedline, BC Ambulance shall transport the patient within a 2 hr timeframe from the time of call for secondary transport.*

General Catchment Area Descriptions: