CODE CRIMSON

Cognitive Aids for Anaesthetists

Version 1.0
Feb 2021

ASCAR

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All feedback is welcome and we will aim to incorporate your suggestions in future versions of this resource. As always, thank you for your support and enthusiasm.
You can contact us on our website: www.ascargroup.com

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HOW TO USE THE COGNITIVE AIDS

CORE Cognitive Aids

- Room Setup
- Team Briefing ↔ Task Cards
- Damage Control
- Forward Flow
- Closing

Troubleshooting and Adjuncts

- TBI
- Shock
- Traumatic Cardiac Arrest
- Anti-thrombotic reversal
- Induction
- ROTEM

Appendix

- Art Line + Bloods
- EZ-IO
- Device removal
- IV Inventory
- Coag Inventory

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FOREWORD

The concept and introduction of the Code Crimson process has taken many years to develop and (only after a few years in practice in NSW) has provided a massive cultural and conceptual change to modern trauma care.

It is to be reinforced that the process of a code crimson is a cascade of events that aims to have a patient moving through the hospital system rapidly to an area of bleeding control, with simultaneous commencement of a **catastrophic massive transfusion protocol**.

It is **called by the most senior experienced trauma clinician** (for the use in trauma patients only). This can be a surgeon, an anaesthetist or an Emergency or Trauma Physician. The guiding underlying principles are of **Consultant led care**, expeditious transfer to a definitive site for bleeding control, along with simultaneous provision of meaningful interventions, and damage control resuscitation. These cases are extremely complex, and benefit from a **dedicated, gloves off, experienced team leader**. This team leader sets the pace, coordinates the other experts in the resuscitation, and drives the journey from ED to ICU, **with or without imaging**, through the operating theatre or **hybrid suite**. The team leader role is not to micro-manage the surgeons, anaesthetists or nursing staff; rather to take accountability, **seek expert opinion** and have **regular pause points** to ensure that the whole team are able to share the mental model.

The teams that are involved in these cases are often ad hoc “flash teams” and regularly comment in debriefs that one of the major factors in a successful code crimson case is the highly functioning team leader role.

The logistics of blood product use, transport, checking and monitoring is also a regularly highlighted area of importance. **Dedicated clinicians are often required** for the liaison with blood bank, the checking and administering of blood products and regular assessment of point of care coagulation testing and blood gas measurement. By ensuring **little to no crystalloid** administration for these patients, we have found that instances of ongoing coagulation derangement have reduced and Disseminated Intravascular Coagulation has become more rare.

Each case is **audited, debriefed and key learning points are highlighted**. This strengthens the process and reinforces that although somewhat rare (in our experience once a month) - fantastic outcomes are achievable. In fact, many of the cases we have seen would some years ago have had not survived without a code crimson process in place.

I would encourage you to familiarise yourself with this booklet, organised as a series of aide memoirs, to help prepare yourself for your role in these complex cases and enable effective sharing of the Code Crimson mental model.

Dr Geoff Healy MBBS, BSpSc, DCH, Dip IMC (RCSEd), Dip RTM (RCSEd), FANZCA
Co-Director of Trauma, Trauma Physician, Royal North Shore Hospital.
Deputy Medical Manager, Consultant PreHospital and Retrieval Physician, ANZCA Supervisor of Training, Greater Sydney Area HEMS, NSW Ambulance.
Consultant Anaesthetist, Royal North Shore and North Shore Private Hospitals.Clinical Lecturer, Sydney Medical School, University of Sydney.

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ROOM SETUP

Call Blood Bank: confirm Catastrophic MTP

Warming:



OT warmer



Underbody Warmer

PPE:



Lead Gown



Eye Protection / Stickers

Imaging:



USS (CVC)



USS (Art)



TOE +/- Cardiac Anaes

Airway:



CMAC



Airway Trolley

Vascular Access:



Art lines



CVC (4 lumen)



Large Access (RIC, Sheath)



EZ-IO



16G Cannula Kits

Fluids:





2x Warmer-Pumpsets with 500ml Hartmanns



Level-1 primed



100ml Saline Flushes



x3 Syringe Drivers

Monitoring:



Art-line Set up



Transducers + Bar



Temp Probe



Entropy



Arm Boards

Drugs:



500mcg



200mg



200mg



2g



Multiple CaCl + ABX vials



3% Hypertonic Saline available if massive massive Head Injury

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TEAM BRIEFING

☐ **Room Set up, Zero Point Survey, Team Leader**

Share Aloud Mental Model

- Mechanism
- **Injuries (most significant)**
- Vital Signs + best GCS
- Treatment so far
- PMHx/Meds/Allergies
- **Imaging results**
- **Current Goals**

Allocate Sub-teams + Give out Task Cards

Anaesthesia



Airway
Paralysis
CVC/Sheath
TOE

Surgeon



Correct specialties?
Consultant present?

Transfusion



Access, A-line
1:1:1 transfusion
TXA, CaCl etc
ABG + ROTEM
Perfusion

Logistics



Floor Manager
Scribe
SSO/OA
Runners (ICU etc)

Confirm

- Arms out on boards (not tucked)
- if eFAST needs repeating? (if results not seen by those in room)

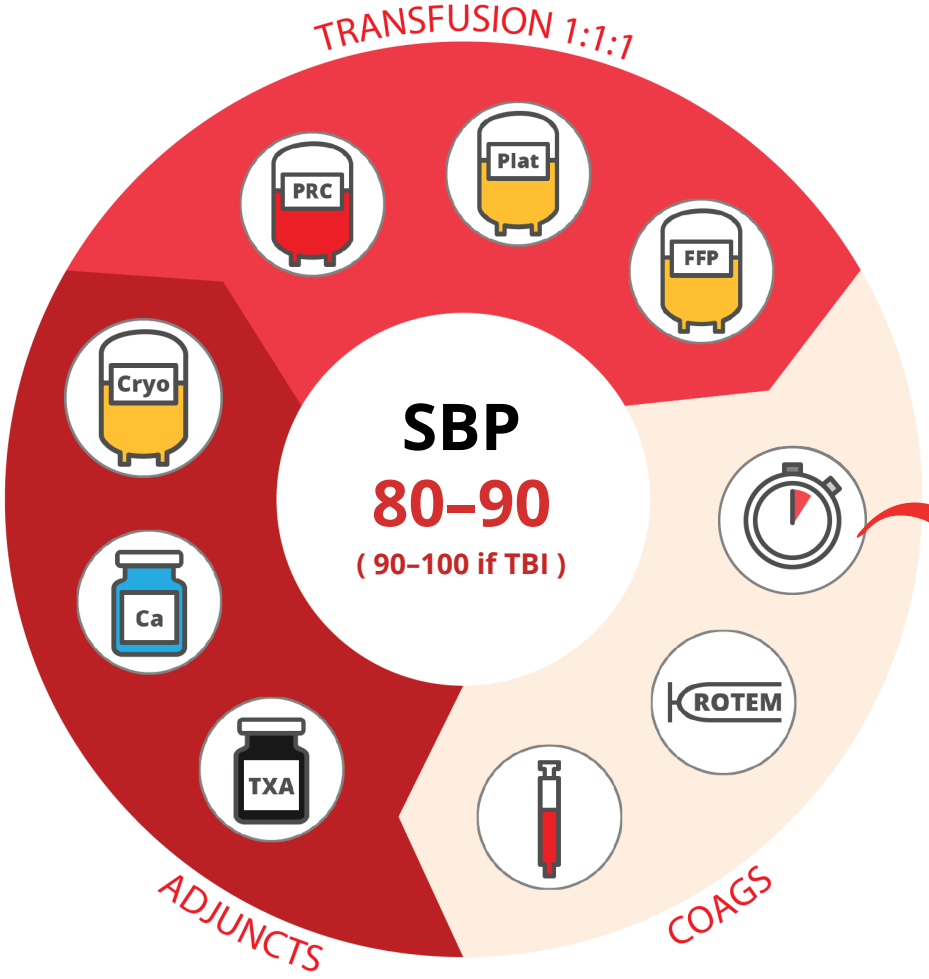
Brief Surgical Team

- **Most likely thing to kill the patient is...**
- Damage Control Surgery only **aim < 2hrs**
- **Aortic control if peri-arrest** (X-clamp/Endovasc)
- Inform if **further expertise** needed
- Insert **IDC** (if still absent)

START TIMER AND TURN TO DAMAGE CONTROL CARD

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DAMAGE CONTROL



SURGICAL CHECK-IN

- **Share the mental model**
- Emphasise **< 2 hours** in OT
- **Aortic control** (if peri-arrest)
- **Further expertise / IR** needed?

Goals:

Hb > 90
Fibtem A5 > 10
Extem A5 > 35

Extem CT < 90
iCa > 1.1
BE > -6

Lac < 2
pH > 7.2
Crystalloid < 1L

Redose antibiotics as required

Refractory coagulopathy

Consider Novo-7 (90 mcg/kg)

Conditions for successful use:

- Coagulopathic bleeding
- pH > 7.2
- Temp > 35
- Recent FFP / platelets / cryo
- **Very last resort**

Calcium Chloride



1g CaCl to every 3 PRBC aiming iCa > 1.1

Anaesthesia Checks

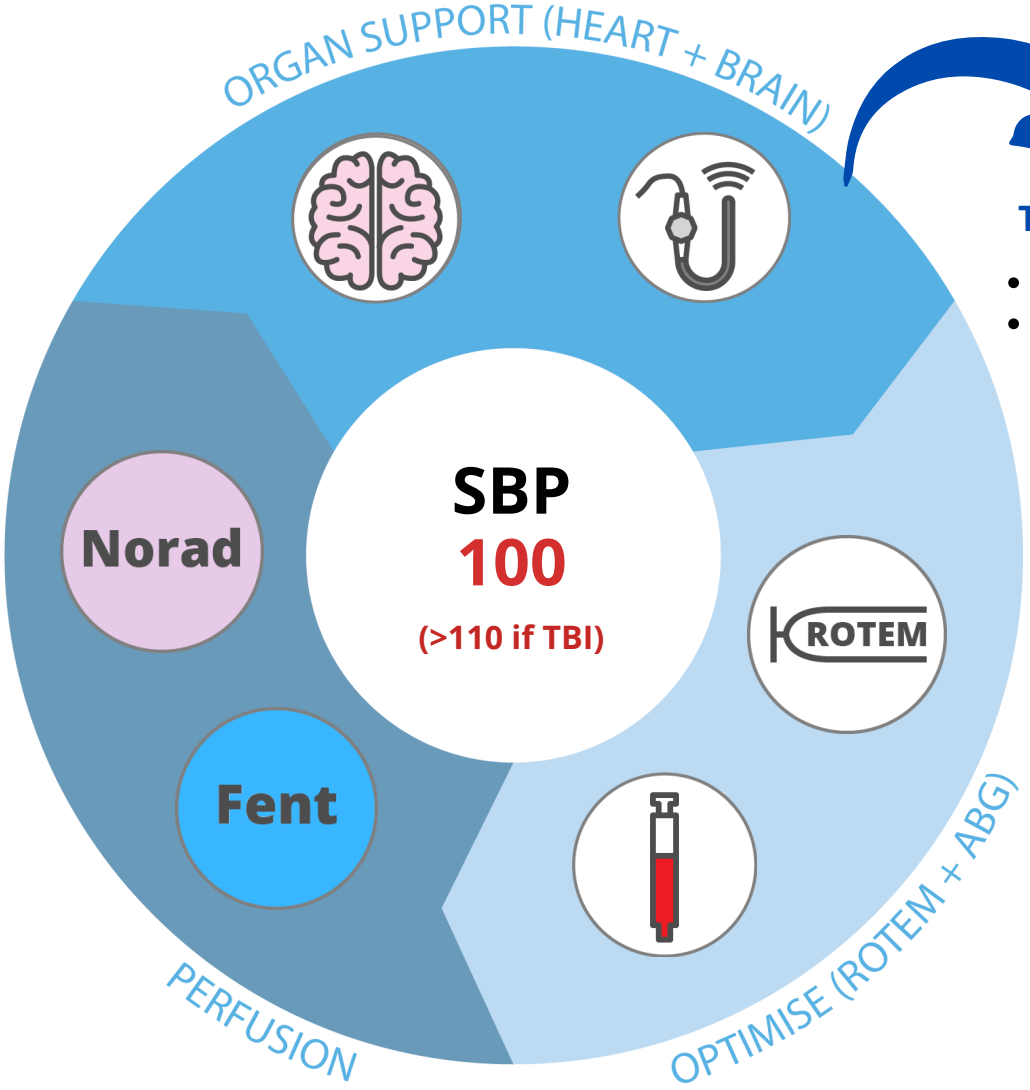


- **Warming on, temp probe in**
- **OT warmed**
- **Sevoflurane titrated**
- **ETCO2 (titrate to paCO2 35-40)**
- **Recent paralysis**

TURN TO **FORWARD FLOW** ONCE **SURGICAL HAEMOSTASIS** CONFIRMED

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FORWARD FLOW



TOE CHECK

- Optimise Filling pressures
- Identify myocardial dysfunction

TBI OPTIMISATION

- Aim **SBP > 110**
- **Check pupils**
- See **TBI card** for other strategies
- Contact NSx re: **? EVD post CT scan**

DESTINATION

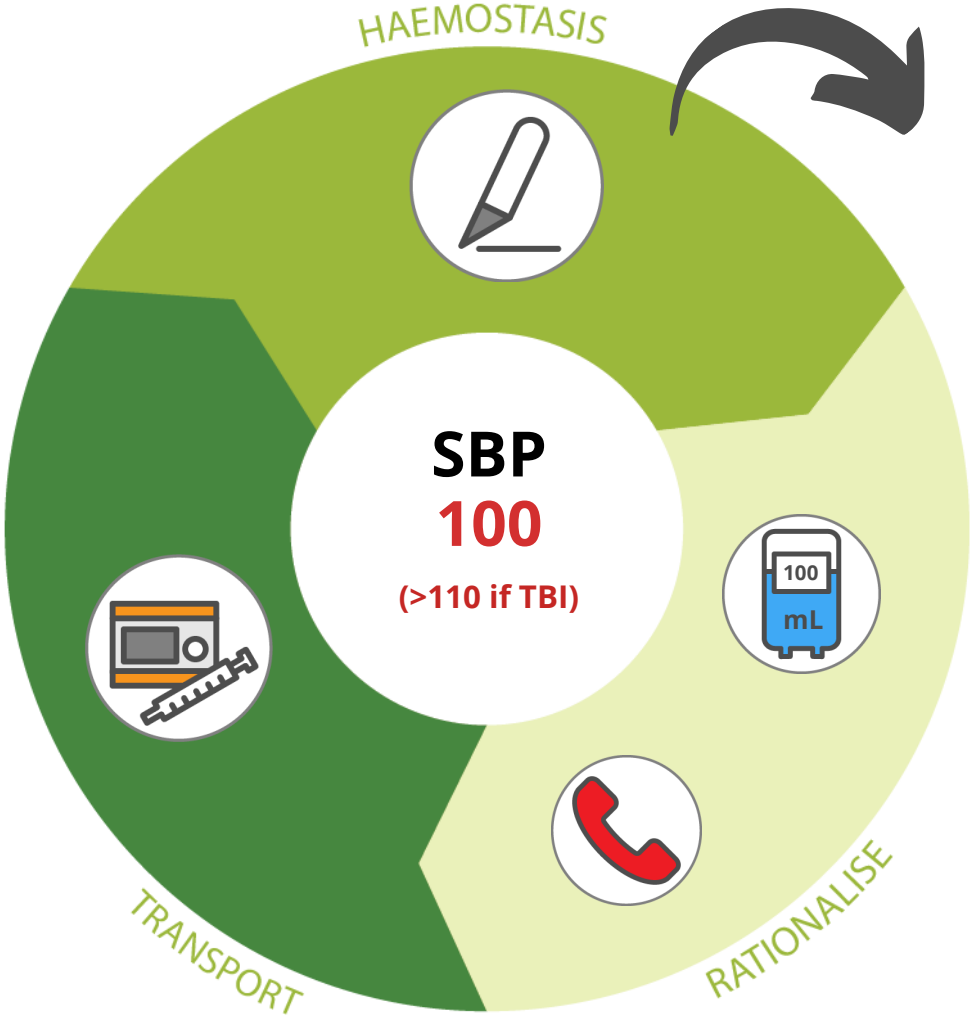
ICU

- Inform ICU
- Inform Radiology

TURN TO **CLOSING** ONCE **SWAB COUNTS BEGIN**

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CLOSING



HAEMOSTASIS CHECK

- Encourage **final check** for surgical haemostasis.
- **Encourage senior surgeon** to close cavity.
- Enquire **timing of further surgery** to assist ICU decision making.

Transport Preparation:

- CT scanner call (Full trauma series)
- ICU 30 minute call
- Monitor, Ventilator, Suction + BVM
- Propofol infusion, Roc, Fentanyl, Norad

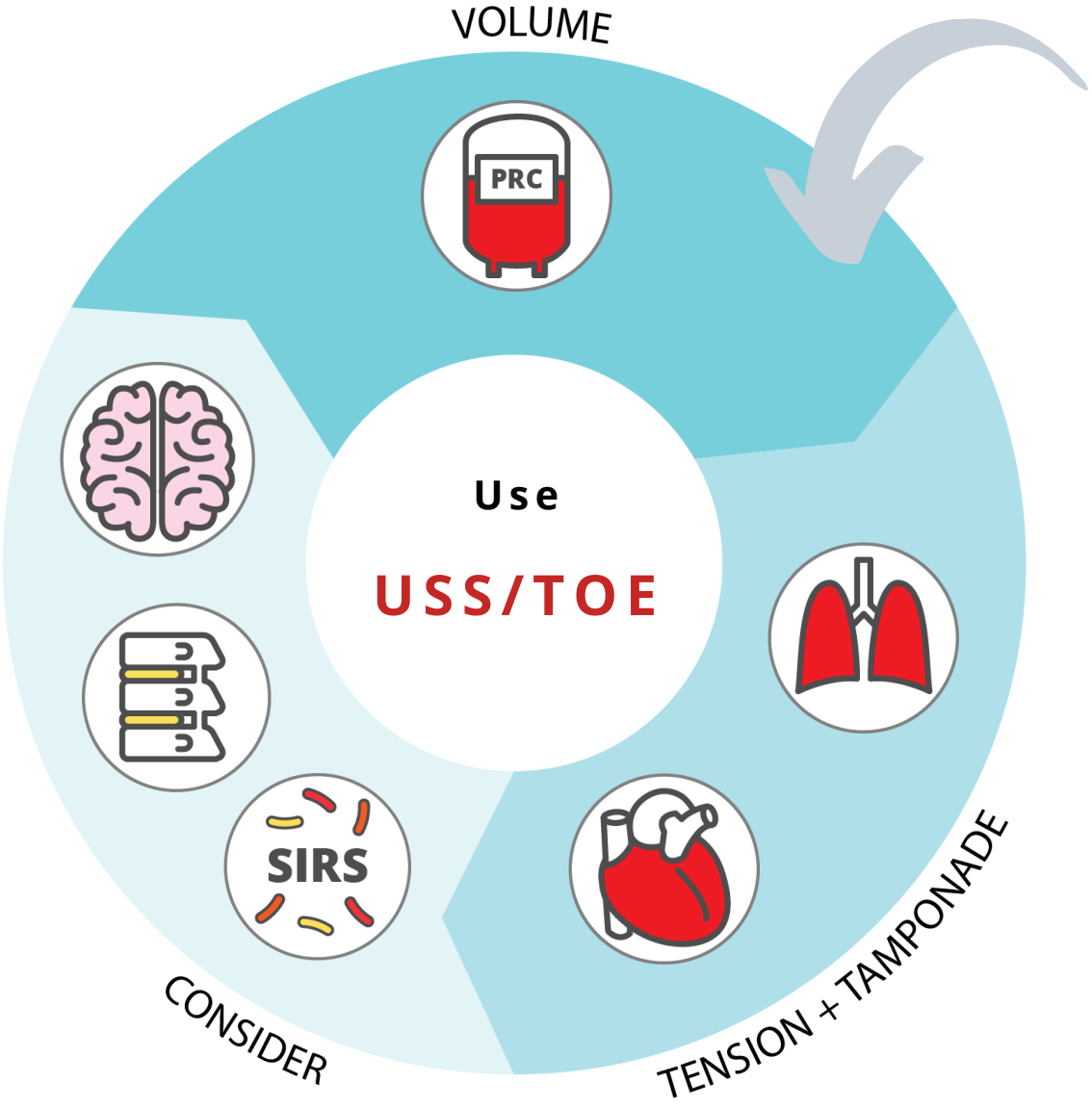
Rationalise:

- De-activate MTP if no longer needed
- Flush products with 100ml NS bags
- Secure CVC connections
- Re-attach Bungs

COMPLETE DOCUMENTATION. THANK THE TEAM. WELFARE CHECK. ARRANGE DEBRIEF.

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HYPOTENSION DD$_x$



Think:

1. **Scalp**
2. **Chest**
3. **Abdomen**
4. **Pelvis**
5. **Long bones**

Other trauma shock mimics:

?

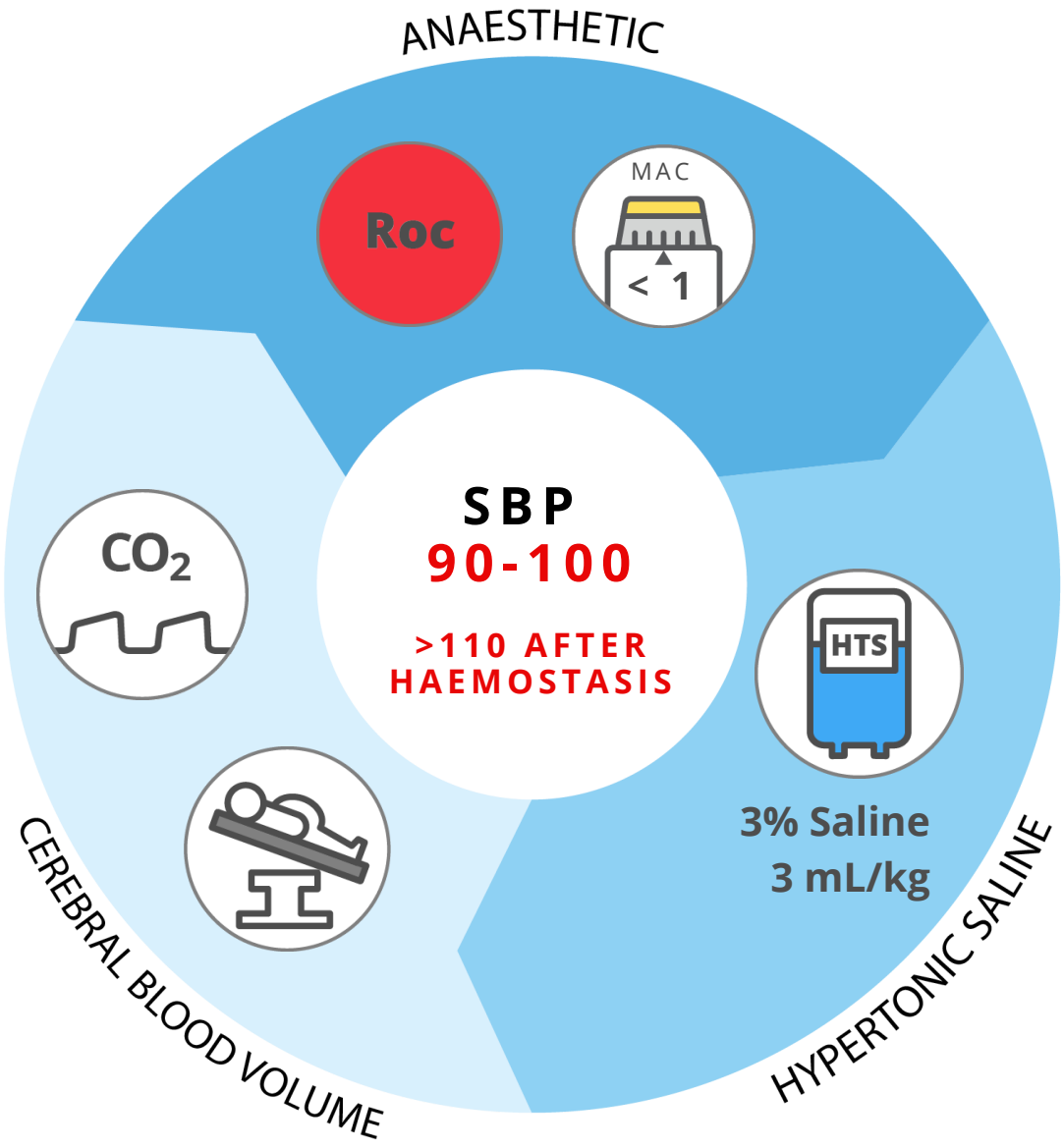
- Retroperitoneal bleeding
- **Neurogenic Shock**
- Anaphylaxis, Transfusion Rx
- **Massive Head Injury**

Causes of Bradycardia:

- Visceral injury (penetrating)
- **Neurogenic Shock (> T5)**
- **TBI (herniation)**
- Pre-terminal / Peri-arrest

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TRAUMATIC BRAIN INJURY



Severe TBI can cause profound coagulopathy, mimicking surgical bleeding.

Regular checks

- Head up (if able)
- ETT taped (not tie)
- Paralysed
- Sevo MAC < 1
- Hb > 80
- BSL 6 - 10 mmol/L
- Pupil size q15 mins
- PaCO2 35-40
- SBP targets (above)

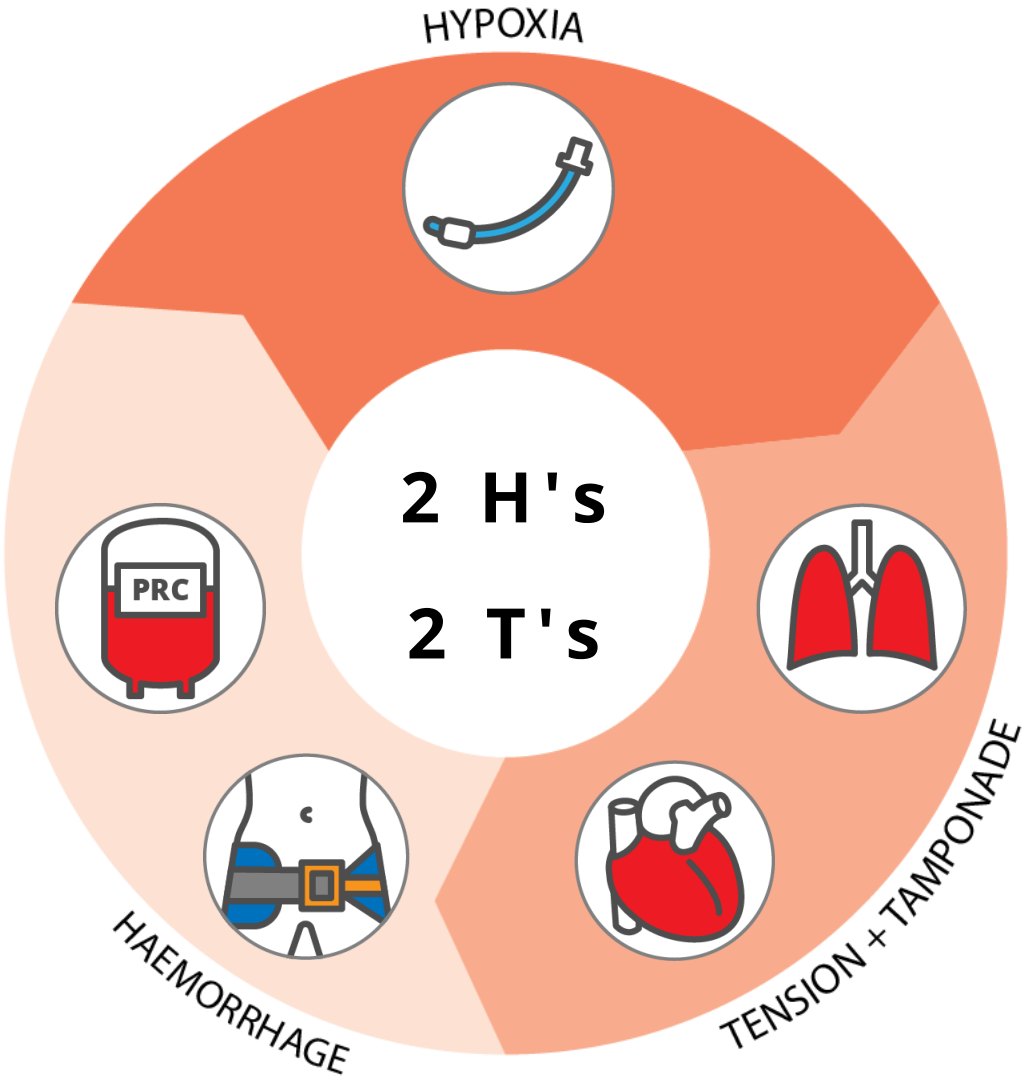
After Haemostasis:

- Aim SBP > 110
- Consider TIVA
- Contact NSx for ?EVD placement post CTB

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TRAUMATIC CARDIAC ARREST

Avoid CPR + Adrenaline if no haemorrhage control

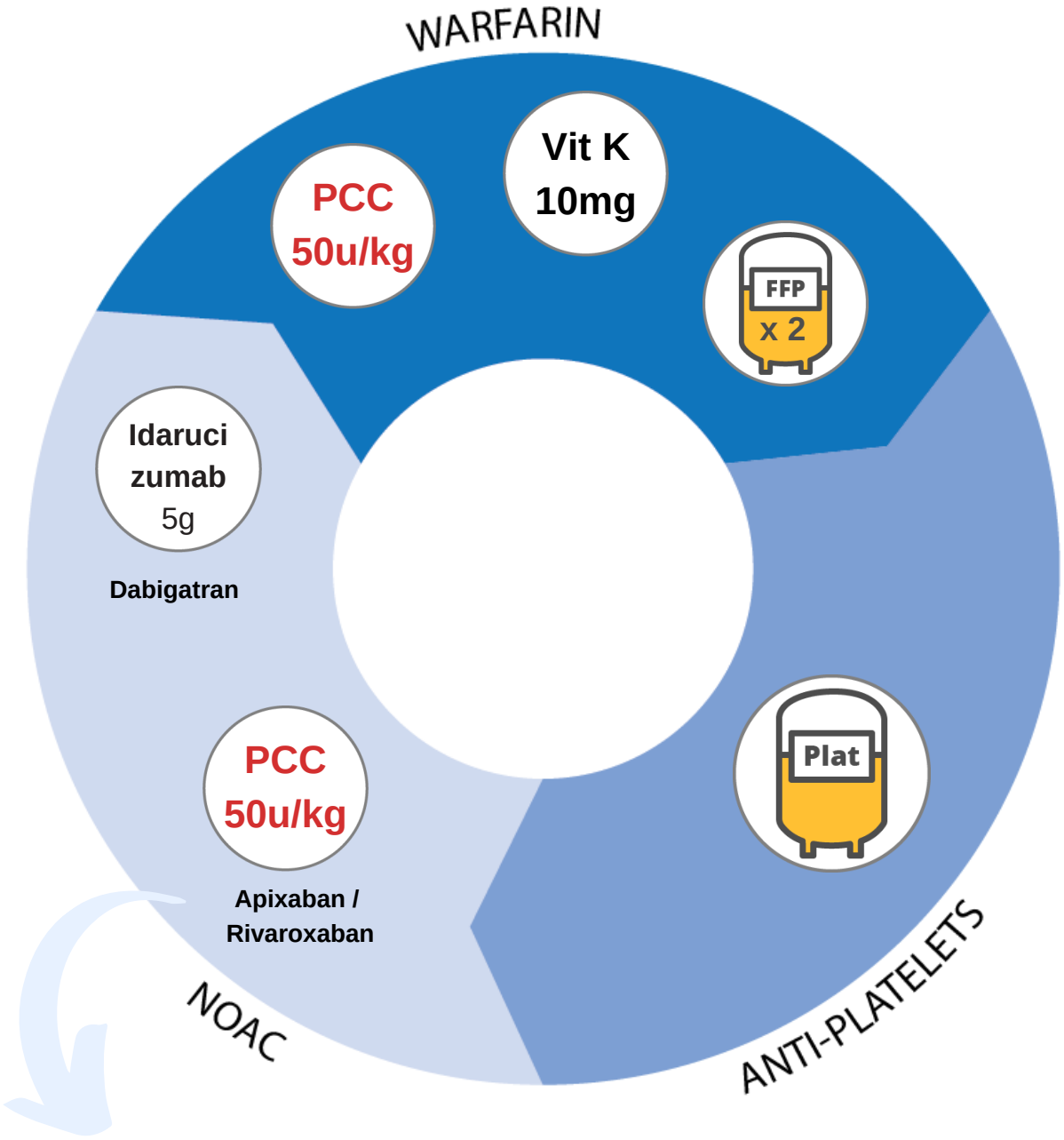


Consider:

Resus Thoracotomy / Laparotomy
+/- Aortic X-Clamp

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ANTI-THROMBOTIC REVERSAL



NOACs:

Discuss with Haematology prior to treatment

Send baseline Coag +/- Dabigatran level +/- anti-Xa level

AKI / Severe CKD:

DDAVP: 0.3mcg/kg IV to counter-act uraemic effect on newly infused platelets

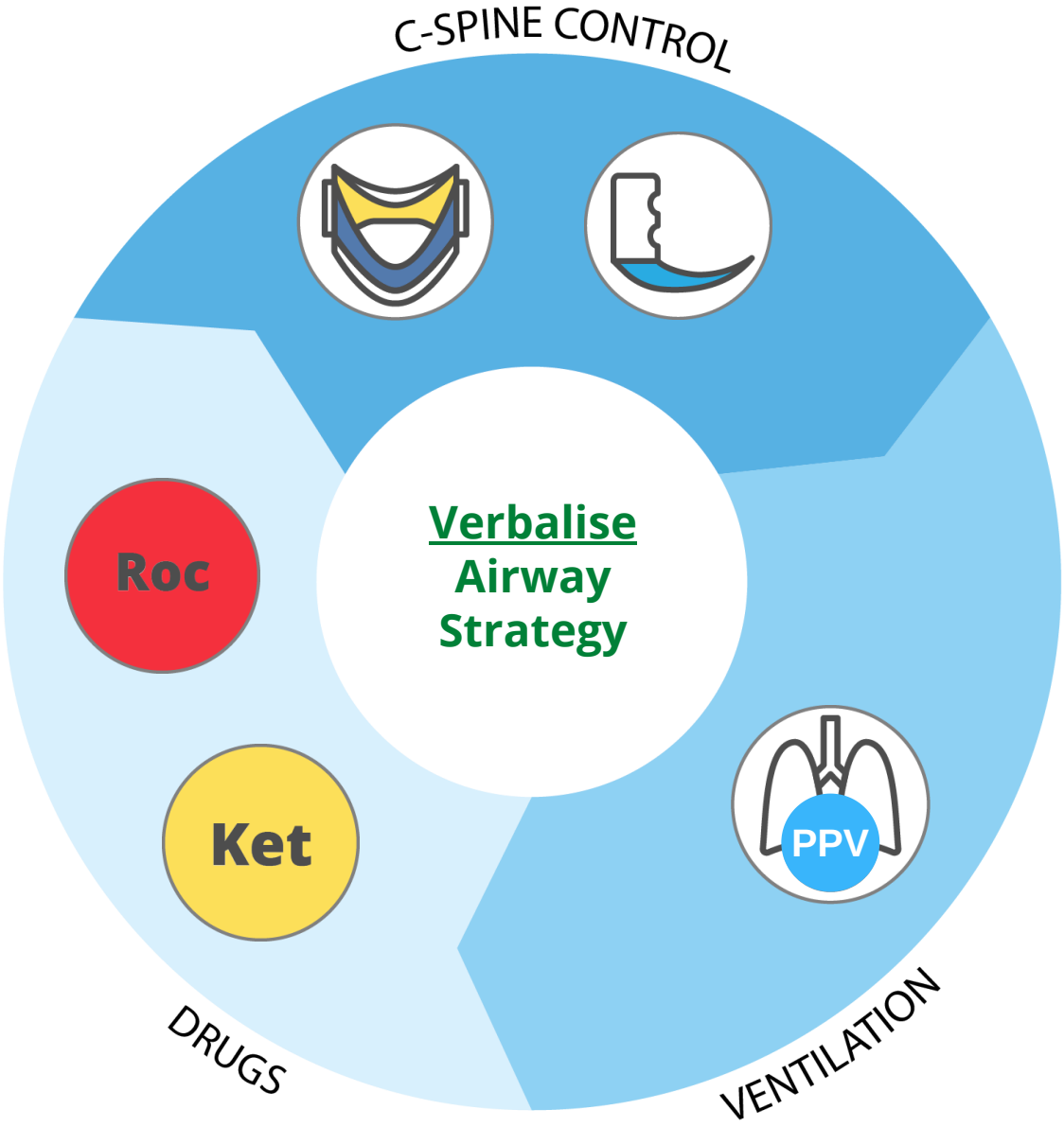
Idarucizumab:

5g = 2 vials of 2.5g
Push over 10 mins



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INDUCTION BRIEF



Do NOT DELAY induction to place arterial line.

C-spine:

Open Collar.
Use **MILS** for stability

Utilise **VL +/- bougie**

Induction Drugs:

Ketamine
(reduce dose in shock)
+
Rocuronium
(1.5 - 2mg/kg)

IPPV:

Careful transition to IPPV. Monitor haemodynamics and consider **Tension Pneumothorax** as a cause of hypotension within first 5-10 minutes.

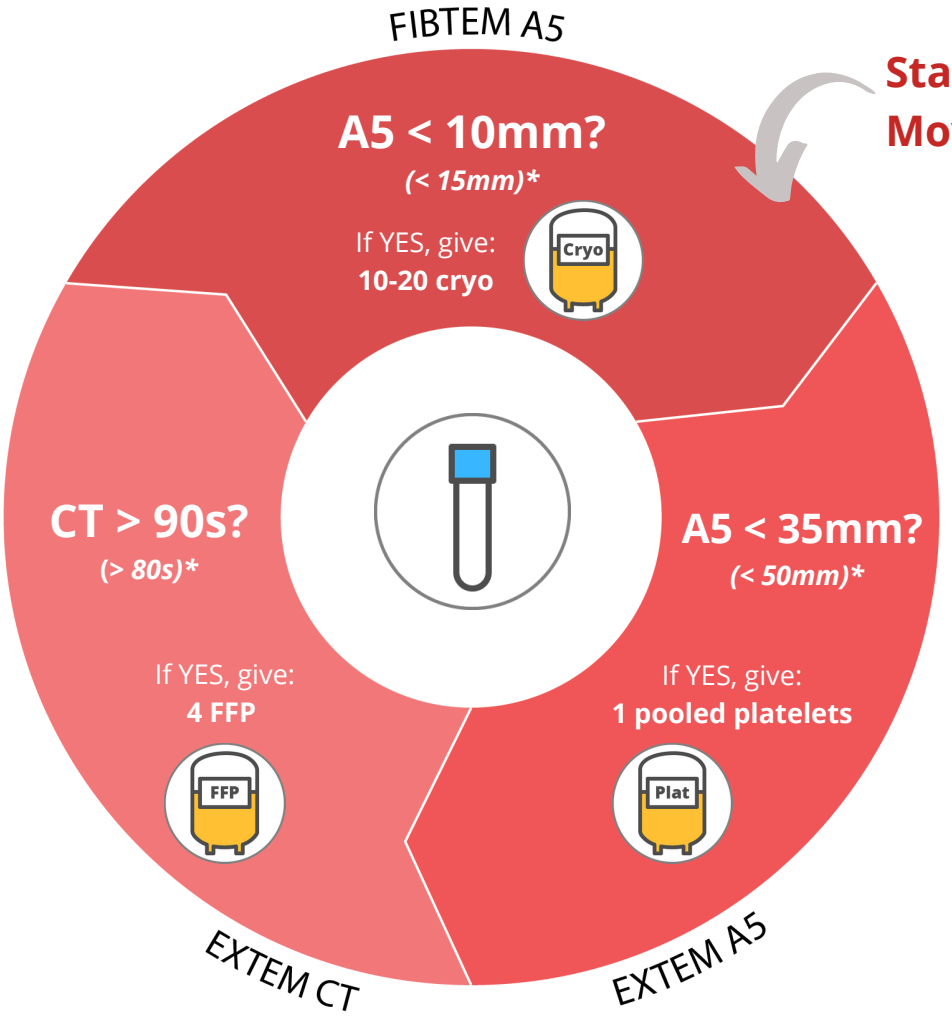
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ROTEM IN TRAUMA

If TXA not given already, give 1 g and start 1 g / 8 hrs infusion

Is there still significant bleeding?

If YES, treat each variable before moving on to the next.



***In Refractory bleeding:** use more aggressive thresholds in (brackets)

Other measures

Temp > 36°C
pH > 7.2
iCa > 1.1

FFP alternative

Consider
10 iu/kg
of PCC

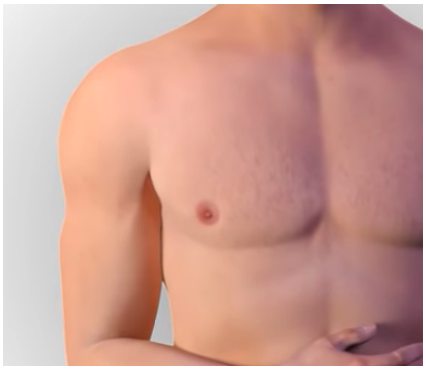
Re-assess ROTEM, 10 minutes after therapy

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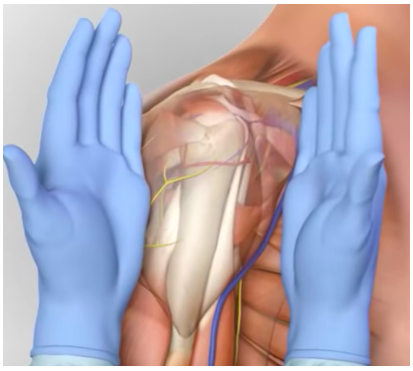
APPENDIX

DIFFICULT IV ACCESS

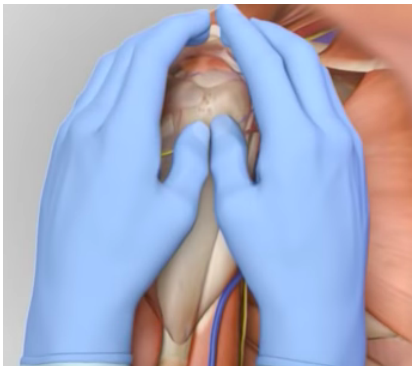
EZIO INSERTION IN UPPER LIMB



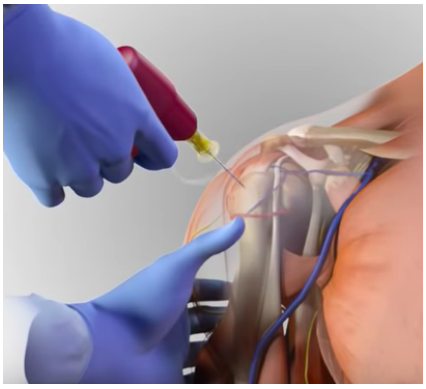
Internally rotate arm



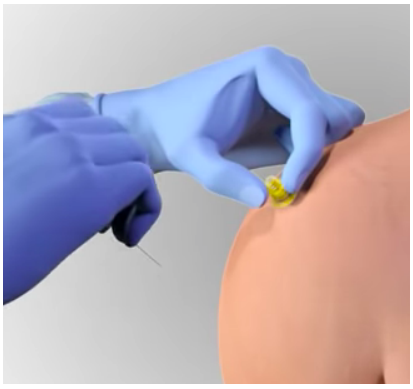
Hug the humerus



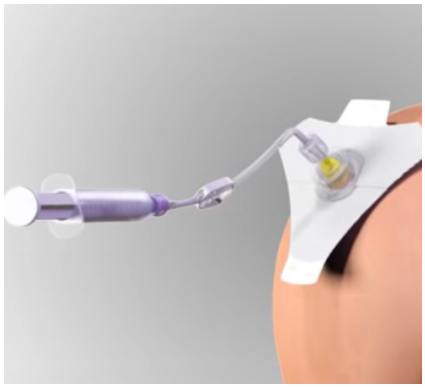
Identify surgical neck



Inject in direction as shown

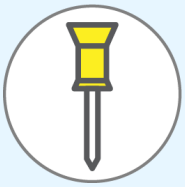


Remove trocar + stabilise

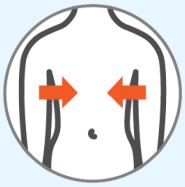


Aspirate, dress + connect

Blood gases from IO should be
sent to Pathology Lab and labelled as such.



Use "yellow" needle for humerus insertion in adults.



Be mindful of abducting the arms as needle can be easily kinked or displaced

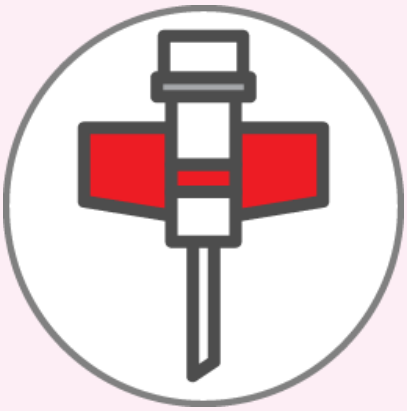


If arm abduction is required prior to further IV placement, keep arm internally rotated.

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ART LINE + TRAUMA BLOODS

Arterial lines don't save lives, surgery does!

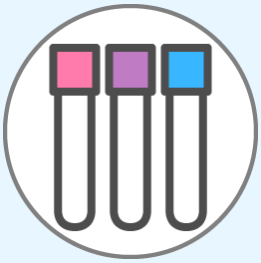


Go Brachial for first attempt.

Use a longer catheter.

If difficulty, do not delay life-saving surgery.

Laboratory

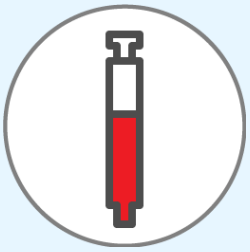


FBC/Coag & X-match

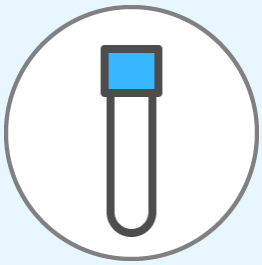


Forensic BAL

Point of Care



ABG



ROTEM

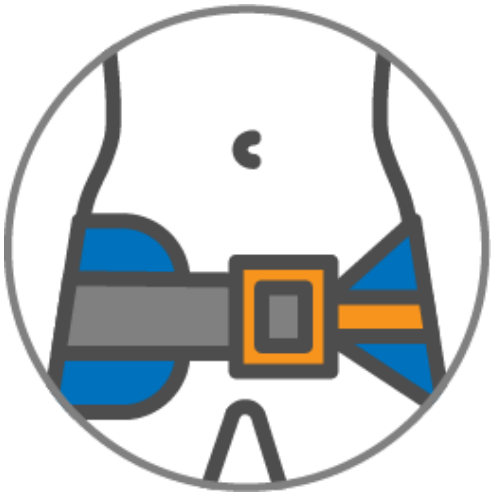
Obtain Forensic kit in ED and deposit back in ED police box.

Do not put IO aspirated marrow in ABG machine

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REMOVING DEVICES

PELVIC BINDER + TOURNIQUETS



Removing a pelvic binder in OT:

- Pelvic binders can impair access to groins and urethra.
- Ideally a pelvic binder should never be removed in a haemodynamically unstable patient.
- If needed, allocate team member/s to provide manual compression of the pelvis and others to re-fasten the binder. Always keep the feet strap/tie on.



Removing a tourniquet in OT:

- Document clearly

1. Location on limb
2. Total tourniquet time
3. Time of removal

- Prepare for haemodynamic instability
- Prepare to re-apply tourniquet or use pneumatic tourniquet if bleeding occurs.

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COAG INVENTORY

	Whats in it:	Indications:	How to give:
 Cryo	Fibrinogen Factor 8 Factor 13 VWF Fibronectin	MTP	Start with **20 units cryoprecipitate in Code Crimson MTP**. Titrate to FIBTEM A5 (see ROTEM). 5 cryo will usually increase FIBTEM A5 by 2 mm. **1 apheresis cryo = 2 std cryo**
 Fib Conc	Fibrinogen	MTP instead of or together with Cryo	4 g should increase Fibrinogen by 1 g/L. **If FIBTEM < 5mm: give 8 g** **if FIBTEM 5-10mm: give 4 g** **Always use local policy**
 FFP	Most factors Fibrinogen (small)	MTP	Aim 1:1:1 with RBC and Plts.
 Prothrombinex-VF	Factors 2,9,10 Heparin	MTP to replace Factors Warfarin + NOAC reversal	Comes in vials of 500 iu. Need to ring Blood Bank, but no X-match required. **CI: Known HITS (contains heparin).** **MTP dose: 10 iu/kg** **Rapid Warfarin reversal: 50 iu/kg** + FFP + Vit K IV 10 mg
 Novo-7 / rFVII	Factor 7a	Coagulopathic bleeding despite products, temp and pH correction	Needs Haematology approval Ensure given after **RECENT administration of FFP / cryo / plts.** **90 mcg/kg**, rounded to nearest whole vial. Comes in 5 mg and 1 mg vials. **Last resort as Thrombotic risk.**
 DDAVP	Desmopressin	Bleeding in Uraemic pt (AKI / CKD)	0.3 mcg/kg

Above is a guide only; always follow haematology advice and local policy

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IV INVENTORY

	Diameter / Size	Infusion time 1L	Notes
 Large Bore IV	**14 G** **16 G**	**90 sec** **140 sec**	Remove bungs for faster flow
 RIC line	**8.5 F**	**46 sec**	Need minimum 20G in situ to convert to RIC
 Quad CVC	**14 G** **(grey lumen)**	**320 sec**	Use grey lumen (14 G), but flow rates are still poor due to length
 Swan Sheath	**8.5 Fr**	**65 sec**	
 MAC line	**9 Fr**	**120 sec** (without Rapid Infusor, likely higher with level 1)	Use brown lumen (9 Fr) for rapid fluid.
 EZ-IO	**15 G**	**600 sec** (Using Syringe + 3 way tap)	Use yellow needle in adults

Above is a guide only. Infusion time listed utilises a Rapid-Infusor directly into a bucket

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Purpose:

Code Crimson Cognitive Aids for Anaesthetists was created using expert opinion and current clinical guidance. Where appropriate, information has been adapted for simplicity with a pragmatic lens.

This is because the aim of the booklet is optimise team dynamics and decision-making during Code Crimson trauma cases in which ad-hoc flash teams are having to confront profound uncertainty in a rapidly deteriorating unstable patient.

It is our hope that by producing this booklet, this pathway and it's key decision-making steps become widely accessible and easy to access under conditions of immense stress. Ultimately we hope this leads to improved patient outcomes.

Thank you for your support and the amazing job you are already doing in the management of these cases. We will take on board all feedback for future versions.

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BE A...

HANDS OFF TEAM LEADER

AND...

SHARE THE MENTAL MODEL



ASCAR

CONTACT NUMBERS AT RNSH

Emergency Dept

Trauma Lead: ext 32422

NUM: pager 41320

Operating Theatre

Floor manager: ext 58386

Anaes Cons/Fellow: ext 58385

Anaes Reg: pager 42028

Surg Reg: 0434 568 087

Vascular Fellow: mobile

NSx Reg: 0459 893 919

CTx Reg: mobile

ENT Reg: mobile

ICU

Admitting Officer: ext 32675

Team Leader: ext 58048

Blood Bank

Blood Bank: ext 64477
pager 41366

Haem Reg: pager 42208 (in-hrs)

Radiology

Radiographer: pager 41310

IR: ext 59206 (in hrs)

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