Royal North Shore Neuro-Anaesthesia Crisis Aids

Version 1. 2020

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RNSANAESTHESIA

RNS ASCAR
People. Practice. Performance.

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About the Author:

RNS ASCAR (Royal North Shore AnaeSthesia Cognitive Aid Research) is a Human Factors Interest Group operating within the RNSH Anaesthesia Department with a special focus on Cognitive Aid research, design and implementation. Daniel Zeloof and Jessie Maulder are joint co-founders of RNS ASCAR.

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Introduction

Neuro-anaesthetic crises are fortunately rare at RNSH. As a result, using cognitive aids to troubleshoot these scenarios may be crucial. For example, the nuanced inter-disciplinary response to a ruptured aneurysm out-of-hours is enough to make most occasional neuro-anaesthetists uneasy. These emergencies have evolving priorities, unfamiliar interventions and challenging team dynamics.

Access to cognitive aids can help our department perform under duress. It has been recognised that their use forms a pivotal part of effective Crisis Resource Management.

These aids are designed to support anaesthetists of all levels in the management of neuro-anaesthetic crises by utilising a unique double-sided 'front-back' formula.

The 'fronts' are designed to offer operators a concise, distilled and visually appealing framework to respond in the initial moments of a crisis. They are intentionally lacking in the detail encountered in other aids in order to specifically highlight the key interventions and priorities that typically get overlooked during the catecholamine surge.

The 'backs' on the other-hand are designed to be used once the 'cavalry' arrive, by offering larger teams a more comprehensive, linear and contextualised guide that is more suited to a scenario in which there are multiple hands available. This side of the aids will often offer explanations and provide options where they exist. Incidentally, these 'backs' therefore also serve as useful educational tools to reflect upon these rare scenarios ahead of cases or during periods of lower acuity.
We hope they will also form a valuable resource to those attempting the ANZCA part 2 examination.

The aids are most certainly not designed to be a 'how-to' recipe book for novices nor a replacement for sound clinical judgement. Rather, their aim is to allow expert teams to perform at their best in the pursuit of clinical excellence and reduce cognitive load during times of stress.

It should also be recognised that in their present form, these aids are specifically tailored to practice at Royal North Shore Hospital accounting for the current ergonomics, surgical expertise and culture that we are fortunate to be a part of.

We look forward to integrating these tools into a wider program of neuro-anaesthesia simulation and training in the near future as well as maintaining currency as the guidelines evolve.

Dan Zeloof + Jessie Maulder
RNS ASCAR
Royal North Shore AnaeSthesia Cognitive Aid Research
Feedback and ideas welcome: RNSASCAR@gmail.com

Acknowledgements

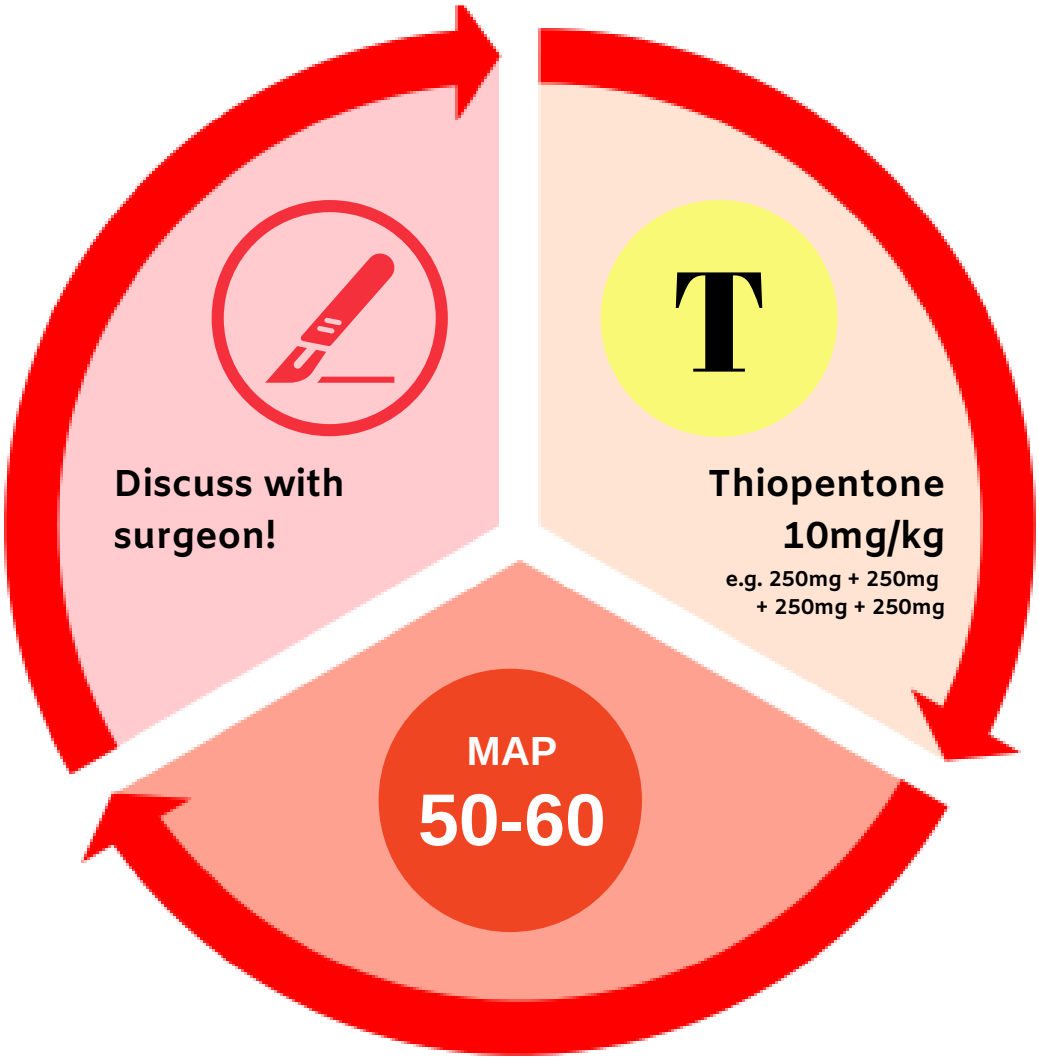
This undertaking could not have been possible
without the contributions and enthusiasm of so many.
In particular we'd like to express our deepest appreciation
to the following people who shared the vision and were so readily
giving of their time, wisdom and experience.

D. Pickford ; C. Garfinkel ; O. Hambidge ; G. Lee ; A. Rehak ;
N. Royan ; B. Olesnicky ; G. Khong

Our Neurosurgical +
Interventional Neuroradiology colleagues.

Uncontrolled Ruptured Aneurysm in OT

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



Adenosine 24mg — If surgeon requests

MTP — Consider activating (rare to transfuse)

"Controlled Rupture" (majority):

- SBP 90 - 120
- Blood into OT

If Temp Clip placed:

- SBP 140 - 160
- T Thio 10mg/kg (if clip on > 10 mins)

Ruptured Aneurysm in OT

RNS ASCAR

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help

Controlled bleed

Most ruptures are secured quickly with suction and temporary clipping.
Target **SBP 90-110**
4 units PRBC into OT in case of haemorrhagic shock

Temporary Clip placed

Once clip on -- aim **SBP 140-160** to avoid cerebral ischaemia.
If clip on >10 mins give **Thiopental 1-2 vials** (10mg/kg)
for neuroprotection. Target **BSR > 70% on entropy**

Uncontrolled bleed

Very few ruptures are uncontrolled.
This requires close communication with surgeon to rapidly lower BP and arrest flow to facilitate a temporary clip placement

Thiopental

To simultaneously **lower MAP** and **reduce CMRO2**
Give **10mg/kg** in increments of 250mg. Target BSR > 70% on entropy
Caution if patient severely shocked

MAP 50-60

Initially with **propofol and thiopental** and by titrating
other agents e.g. SNIP, Clevidipine, Labetolol, Esmolol.

Adenosine

If surgeon ok -- give Adenosine 0.3mg/kg (3-4 vials) for flow arrest 40-50 secs. Tachyphylaxis, so a 2nd dose may be ineffective.
NB: Some patients will need pacing; get resus trolley into OT.

MTP

In event of haemorrhagic shock, activate MTP.
Will need to **request Cyroprecipitate separately (10-12 units).**
Consider **TXA 1g slow IV injection**

Carotid Occ

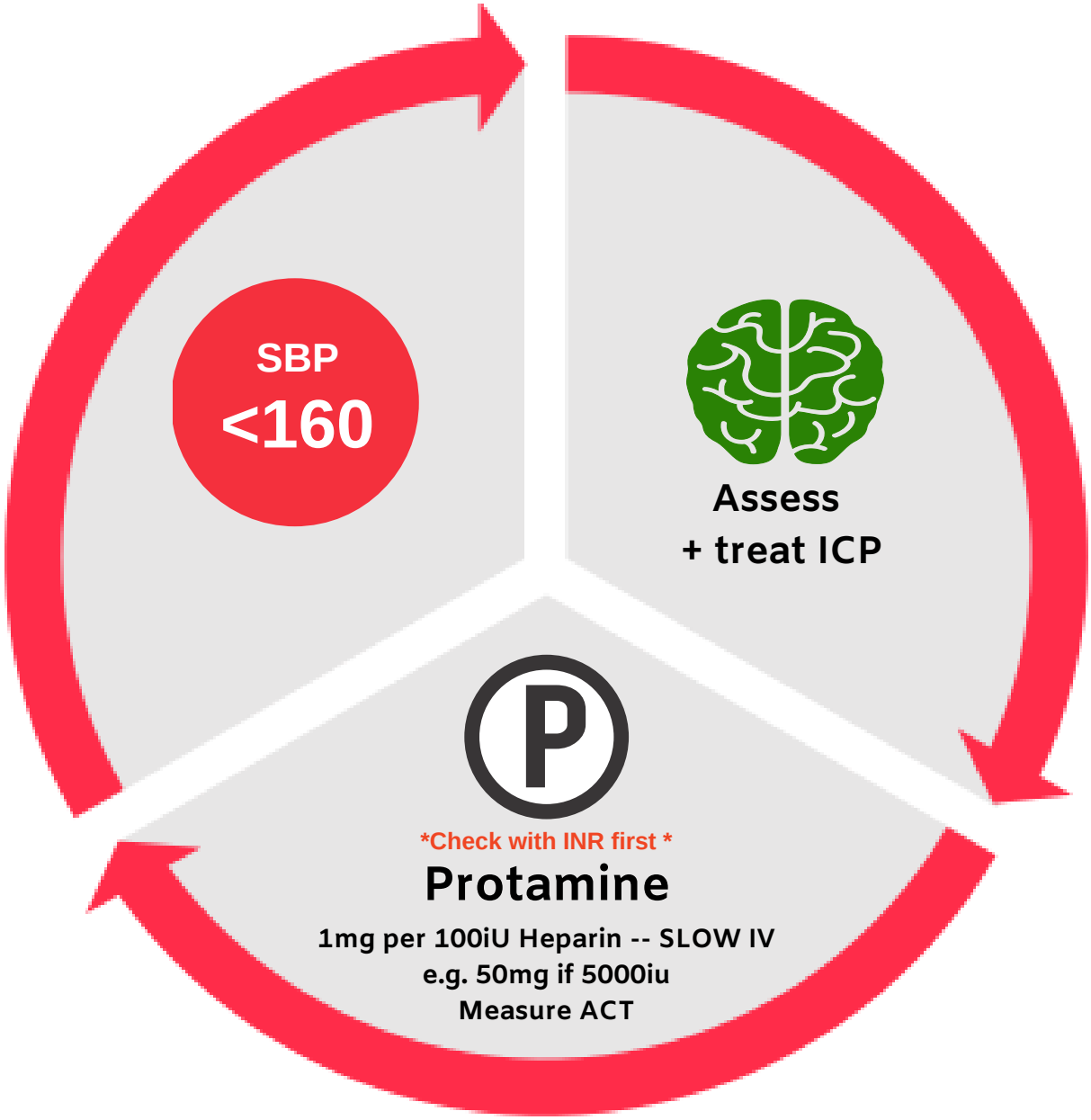
Uncontrolled rupture of **Anterior Circulation** aneurysm
that cannot be clipped, surgeon may attempt to access and clamp the carotid artery

Temporary Clip placed

Once clip on -- aim **SBP 140-160** to avoid cerebral ischaemia.
If clip on > 10 mins give **Thiopental 1-2 vials** (10mg/kg) for neuroprotection. Aim **BSR >70% on entropy**

Aneurysm rupture in INR

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



Despite Preparations for OT - rupture may be secured in INR

Inform NSx
0459 893 919

Inform DD
Ext. 58385

X-match
4 units to OT

Assess ICP (pupils, Cushings)

if ↑ICP clinically, treat:

Mannitol 5ml/kg
Hyperventilate
Thiopental 10mg/kg
Paralysis
Switch to TIVA

Transfer Kit

Suction
Self-inflating Bag
Oxylog Ventilator
Transport Monitor
IV Fluids pumpset
Propofol TIVA + Thiopental
Paralysis syringes
Mannitol

Ruptured aneurysm in INR

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Involve Proceduralist

Further attempts to coil / secure the aneurysm may occur.
These **cases don't necessarily need to go to OT.**
Communicate with Proceduralist.

SBP < 160

To maintain perfusion pressure whilst minimising ongoing blood loss.

Protamine

Check with proceduralist first.
SLOW IV * Risk hypotension* Dose = 1mg for every 100IU of Heparin. e.g. 5000 Heparin = 50mg Protamine. Monitor ACT

Thiopental

Aliquots of 250mg + 250mg + 250mg + 250mg
Aim approximately 10mg/kg + BSR > 70%
Propofol is an alternative. Always maintain SBP.

Call NSx 0459 893 919

May require EVD or decision to move to OT

Assess and manage ICP

Assess ICP clinically. Treat if raised.
Mannitol 5ml/kg + hyperventilation ETCO2 30-35mmHg
Switch to TIVA + re-paralyse

Call DD - 58385
Call Blood Bank

Emergency OT to be made available
X-match 4 units PRBC for OT Fridge

Transfer Kit

Suction
Self-inflating Bag
Oxylog Ventilator
Transport Monitor
IV Fluids
Propofol TIVA + Thiopental
Paralysis syringes + Mannitol

OT team to set up

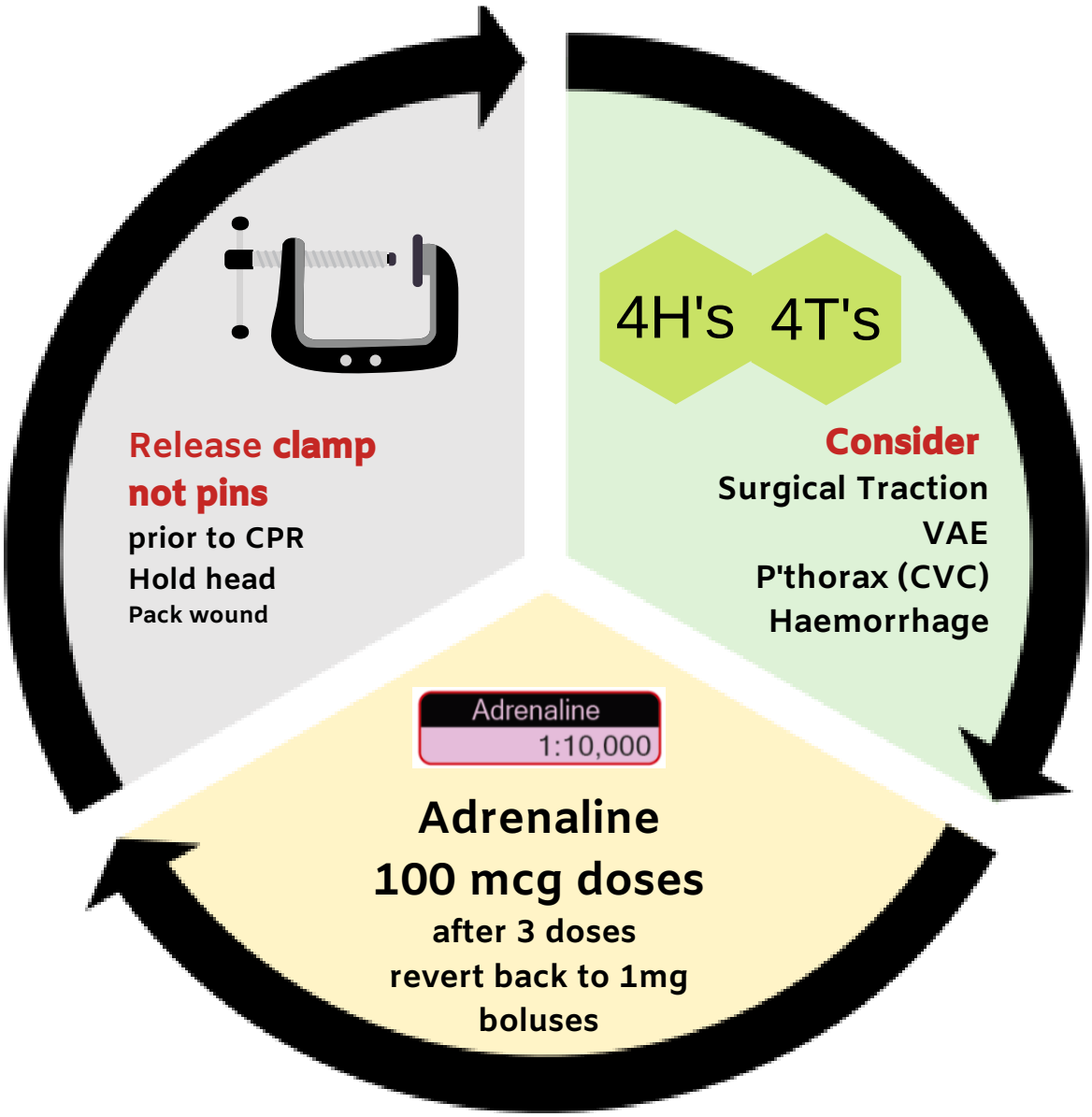
2x Pump sets with Warmers
Mannitol with Giving Set
Propofol + **Remifentanil** TCI
Paralysis Infusion
Vasopressor + Dilator Infusion
Adenosine vials into OT
Dedicated runner for Blood

Signs of Raised ICP

- **Hypertension**
- **Bradycardia**
- **Blown Pupil**
- **Slow injection of contrast**

Cardiac arrest in Neuro

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



Ensure during CPR :

- Anaesthetic Stopped
- RR 4-6
- ETCO2 > 20mmHg
- DBP > 30mmHg

Unique Prone CPR concepts:

Hand / Pad Position (see reverse)
Fluid bag beneath sternum for purchase
Turn supine if CPR inadequate

Consider:
Concealed Bleeding
Neurogenic Shock
LA Toxicity

Shockable

Energy: **200J**

Adrenaline after 2nd shock
Then every 2nd cycle

Amiodarone after 3rd shock

Non- shockable

Adrenaline immediately
Then every 2nd cycle

Cardiac Arrest in Neuro OT

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ALS "CODE BLUE"

2222 / PUSH BUZZER

Defibrillator Pads Bi-axillary if prone (see below)

Mayfield release and wound

Release Mayfield device by **detaching clamp from table.**
Surgeon to hold head. Wound to be packed.

Stop Anaesthetic Modify Ventilation

Stop Infusions +/- Volatile
Ensure **100% Oxygen**
Ventilate at **4-6 breaths** per minute. Cease PEEP

Ensure CPR effective

Aim
ETCO2 >20mmHg
DBP > 30mmHg

If not achieved:
Change Compressor
Turn Supine (if prone)

Consider specific reversible causes

VAE
Surgical Manipulation
Haemorrhage / Hypovolaemia
Anaphylaxis

Review 4H's + 4T's

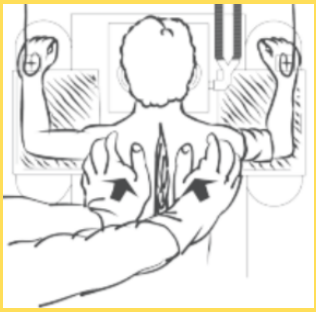
Hypoxia
Hypovolaemia
Hypo/Hyperkaelamia
Hypothermia

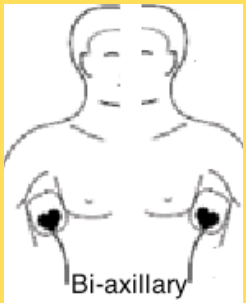
Toxins (LA toxicity)
Tension (trauma or CVC)
Thrombosis (MI, PE)
Tamponade

If prone arrest

Fluid bag beneath sternum during CPR
Wound packing prior to roll.
Formal **Log-roll if Spine unstable**

CPR + pads position



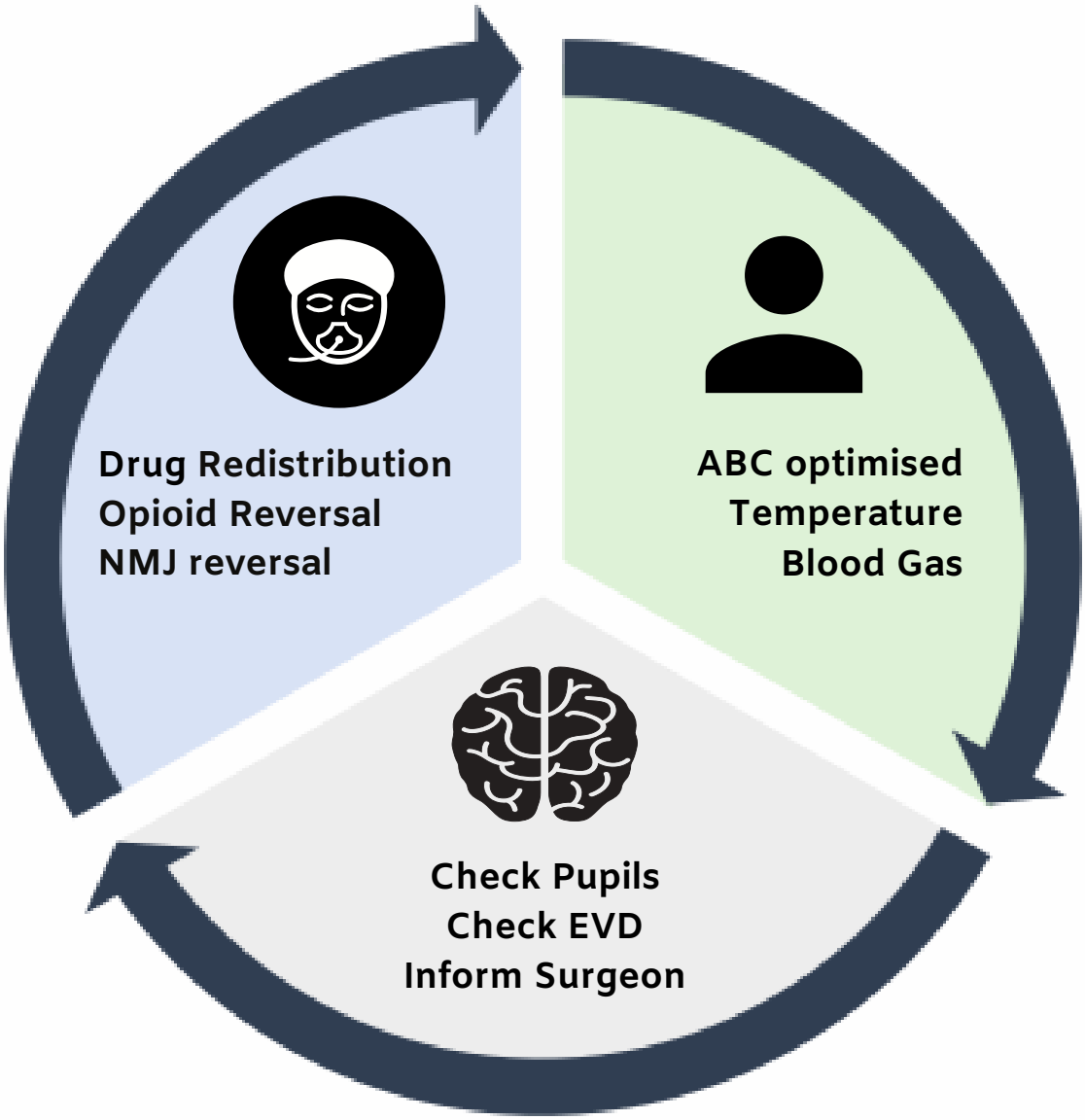


Adrenaline

100mcg Boluses, NOT 1mg.
Once 3 x 100mcg boluses given, upgrade to 1mg

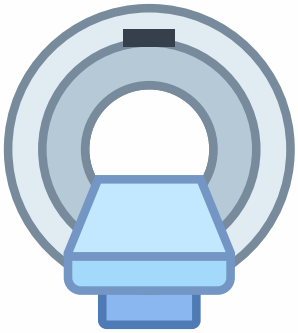
Delayed Emergence

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



Common Causes

- Propofol Redistribution
- Thiopental burst suppression
- Surgical Retraction
- Frontal Lobe Surgery
- Posterior Fossa Surgery
- TBI / SDH / ICH
- Brain Oedema



Aim CT Brain within 1 hour

Reversal Doses

Sugammadex:
PTC < 2: 16mg/kg
PTC 2 - TOF 2: 4mg/kg
TOF > 2: 2mg/kg

Naloxone:
40-100mcg

Flumazenil:
100-200mcg

Delayed Emergence

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Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help

ABC

Patent airway - **don't extubate**
Ventilation - check ETCO2, ETO2 **Circulation** - Adequate MAP
Consider reaction to Sugammadex

Common Causes

Propofol washout after long case Thiopentone - if used for Burst Suppression
Prolonged retraction by Surgeon
Frontal Resection / Temporary Arterial Clipping

Reverse Drugs

Naloxone 40-100mcg q2min to 2mg
Flumazenil 100-200mcg q2min to 1mg - caution re seizure
Sugammadex (dose = 4mg/kg if TOF < 2)

Check NMJ

Use nerve stimulator to ensure
TOF ratio >0.9

Neurology

Check pupil size and reactivity, focal neurology
Consider Non-Convulsive Status Epilepticus
Liaise with Surgeon promptly

Metabolic screen

ABG: pH, HCO3, PCO2, lactate, Na+, Ca++, BSL,
Venous Bloods: urea, ammonia, TFT
Temperature: warm patient if < 36

Comorbidities

Pre-op GCS (unlikely to improve post op)
TBI - evolving insult

Urgent Imaging

Aim for CT within 1 HOUR

Pneumocephalus. Haemorrhage, CVA, Vasospasm, Oedema

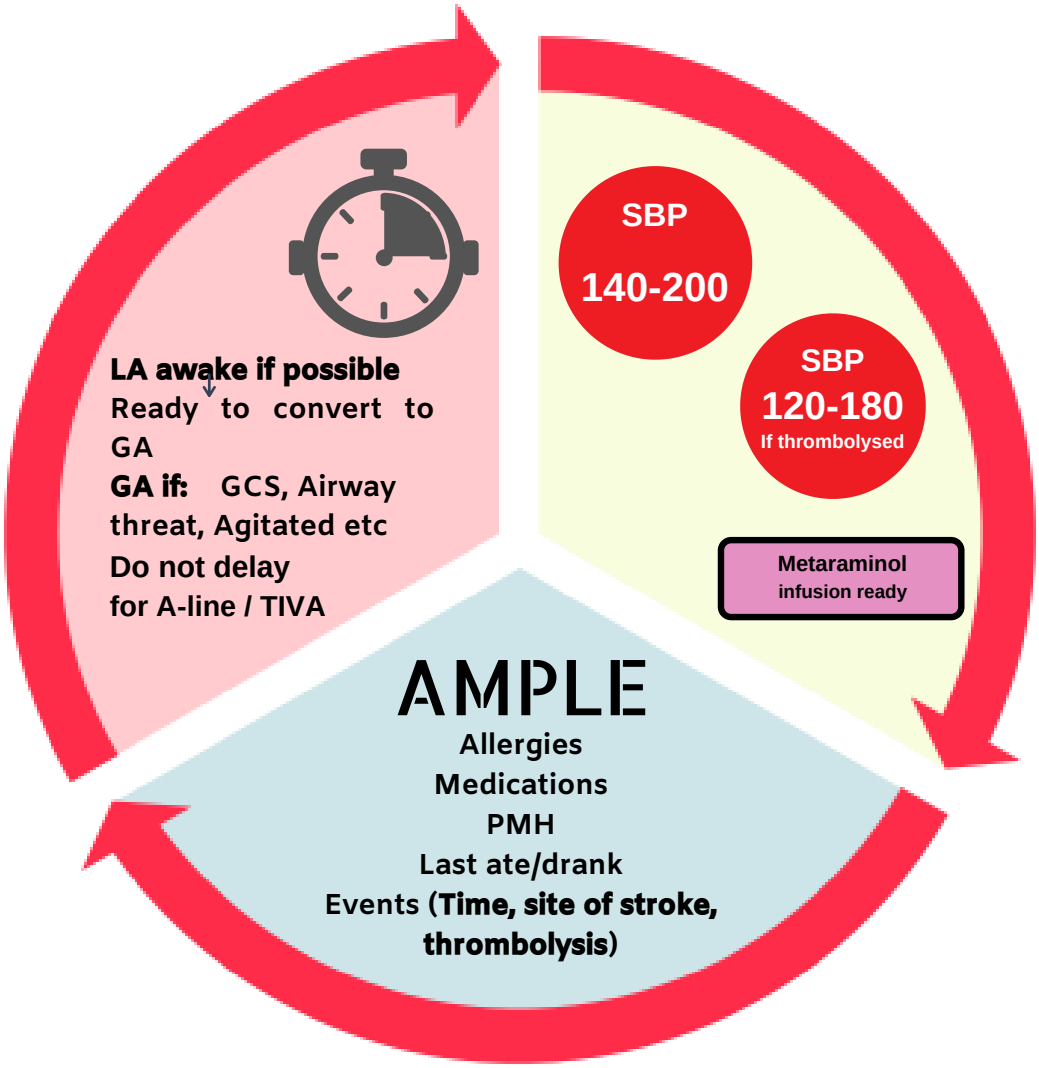
Check EVD

Volume
Color
Position

Endovascular Thrombectomy

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help

"Time is Brain"



Other

A **Monitoring**
ETCO2 into facemask
NIBP q1min - until A-line established
A-line when possible / A-line via Sheath
Ipsilateral Entropy E.g L-side for L-MCA CVA

B **Once settled** - Minimise IV Fluids, Normoglycaemia, Normothermia

C **Clot Aspiration Pain** - Paracetamol ASAP + **Alfentanil / Fentanyl** just prior

GA Physiology

- Maintain SBP targets
- **Minimise FiO2** (SpO2 >94% is better)
- **Low-Normal CO2** (ETCO2 30-35 until ABG)
- **Convert to TIVA** when possible
- **Smooth extubation**

Post Procedure

- Discuss new **SBP targets w/ INR**
- Discuss with **ICU 6F**
- Attain **transfer equipment**

Endovascular Thrombectomy

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Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help

Involve Proceduralist

Discuss LA vs GA
If patient cooperative and no bulbar symptoms often done awake
***TIME IS BRAIN ***

Time is Brain

Avoid unnecessary delays. NIBP will often suffice initially.
invasive BP can be measured off femoral sheath - discuss early with proceduralist

Assessment

GCS, cooperative vs. uncooperative, ability to lie flat, stroke territory - posterior circulation, aspiration risk - may need GA. AMPLE hx including baseline BP on admission.

Prioritise BP

Target SBP > 140mmHg but <200mmHg. Ideally SBP 10% from basleine BP. **If thrombolysed SBP 120-180**
Set up metaraminol infusion. NIBP 1 minutely

Anaesthesia for GA

TIVA when able - dont delay start. Prioritise BP.
paracetamol +/- fentanyl/alfentanil prior to clot aspiration.
Limit IV fluids - no IDC. Entropy to same side as infarct.

Anaesthesia for LA

ETCO2 via Hudson. Limit IV fluids.
Small fentanyl/alfentanil aliquots prior to clot aspiration.
Aim for awake co-operative patient. **Prepare to convert.**

Metabolic

SPO2 >94% Minimise FiO2 as hyperoxia is harmful.
ETCO2 30-35mmHg until ABG
BSL 6-10mmmol/L. Normothermia antipyretics + cool if temp >37

If Thrombolysed

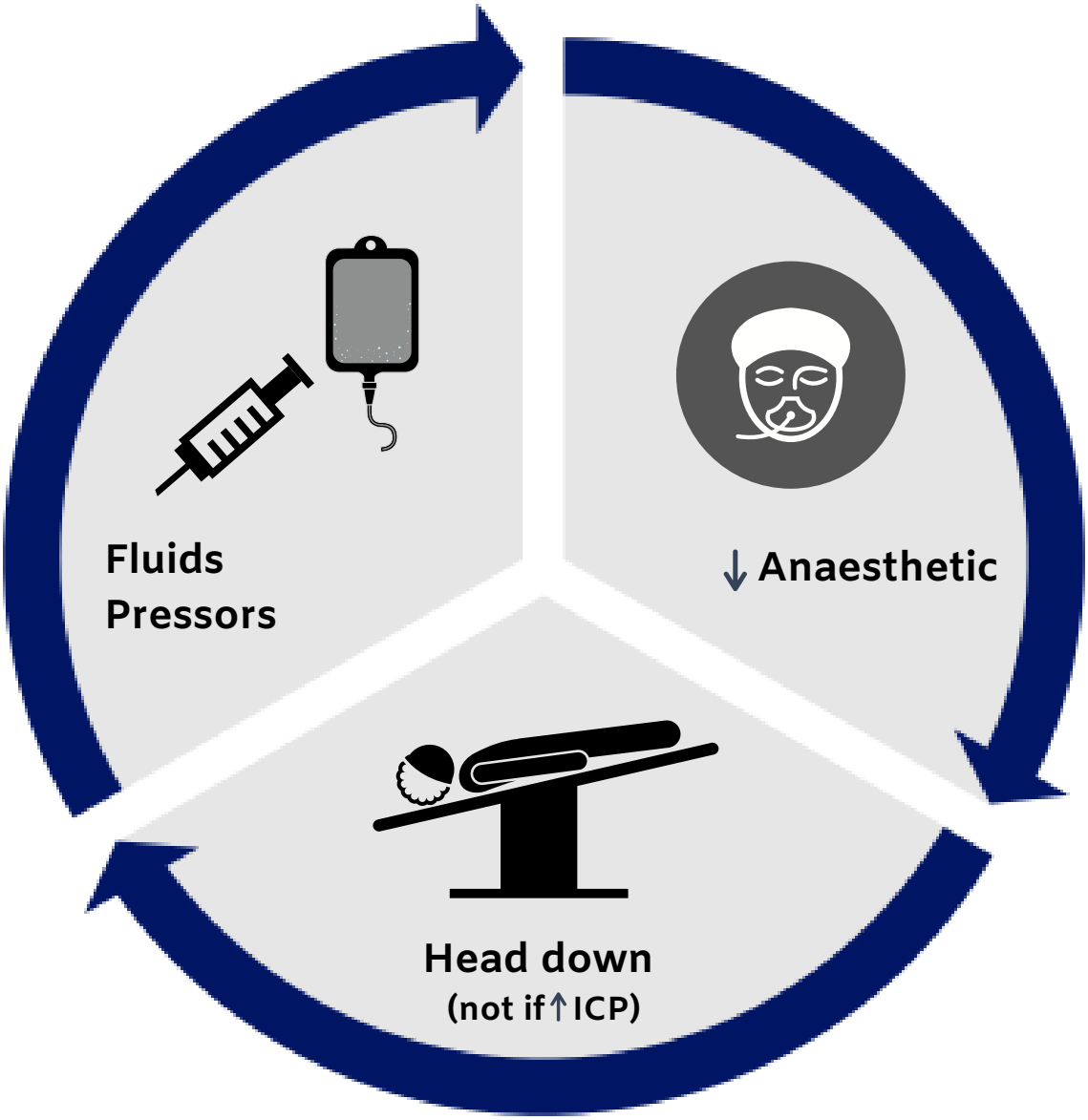
Aim **SBP 120 - 180**
vigilance for haemorrhagic transformation
Avoid IDC

Emergence

Aim to wake at end of procedure
Smooth extubation - avoid cough/straining
Routine admission to 6F.

Hypotension in Neuro OT

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



Neuro specific causes

Haemorrhage
VAE
Surgical Traction

Anaesthesia Depth
Anaphylaxis

Other causes

- Hypovolaemia (e.g. Mannitol)
- Sepsis / SIRS
- Obstructive (PTx from CVC / PE)
- Cardiogenic (MI, Arrythmia)
- Addisonian (steroid withdrawal)
- **Hypotensive Infusions running**

Check Transducer Height

Hypotension in Neuro OT

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Hands off Leader	100% O2	RNS ASCAR	Minimise noise	Call for Help

Involve Surgeon	**Inform Surgeon.** **Ceasing Traction on a vital structure may help** **Think about VAE early!**
Vasopressor + Fluids	Titrate Fluids + Vasopressor Bolus +/- Infusion. **2-3L are essential in Anaphylaxis**
Decrease Anaesthesia	Reduce depth of anaesthesia if appropriate. Utilise entropy. Cease other hypotensive infusion e.g. SNIP
Art line Transducer	**Confirm height of Art Line transducer.** **Correlate with NIBP if needed.** Check peripherssl pulse if in doubt
Head Down	Head down as permitted by surgeon. May not be possible if raised ICP / tight brain. This will help minimise air entrainment in VAE too
Review causes and treat	As overleaf. In Anaphylaxis - **cease Paralytic Infusion** Consider delayed Anaphylaxis (**Chlorhexidine in IDC**)
Send Blood Gas	**Note:** Haemoglobin can be misleading in acute haemorrhage

Adrenaline

10mcg boluses
Infusion: Draw up 6mg in 100ml = 60 mcg/ml
Rate of: 1ml/hr = 1 mcg/minute.

In arrest: Use 100mcg boluses. (see Cardiac Arrest Aid)

Diagnostic Aids

Volume in Suction Canister

TOE / TTE

USS Chest

Raised ICP in Theatre

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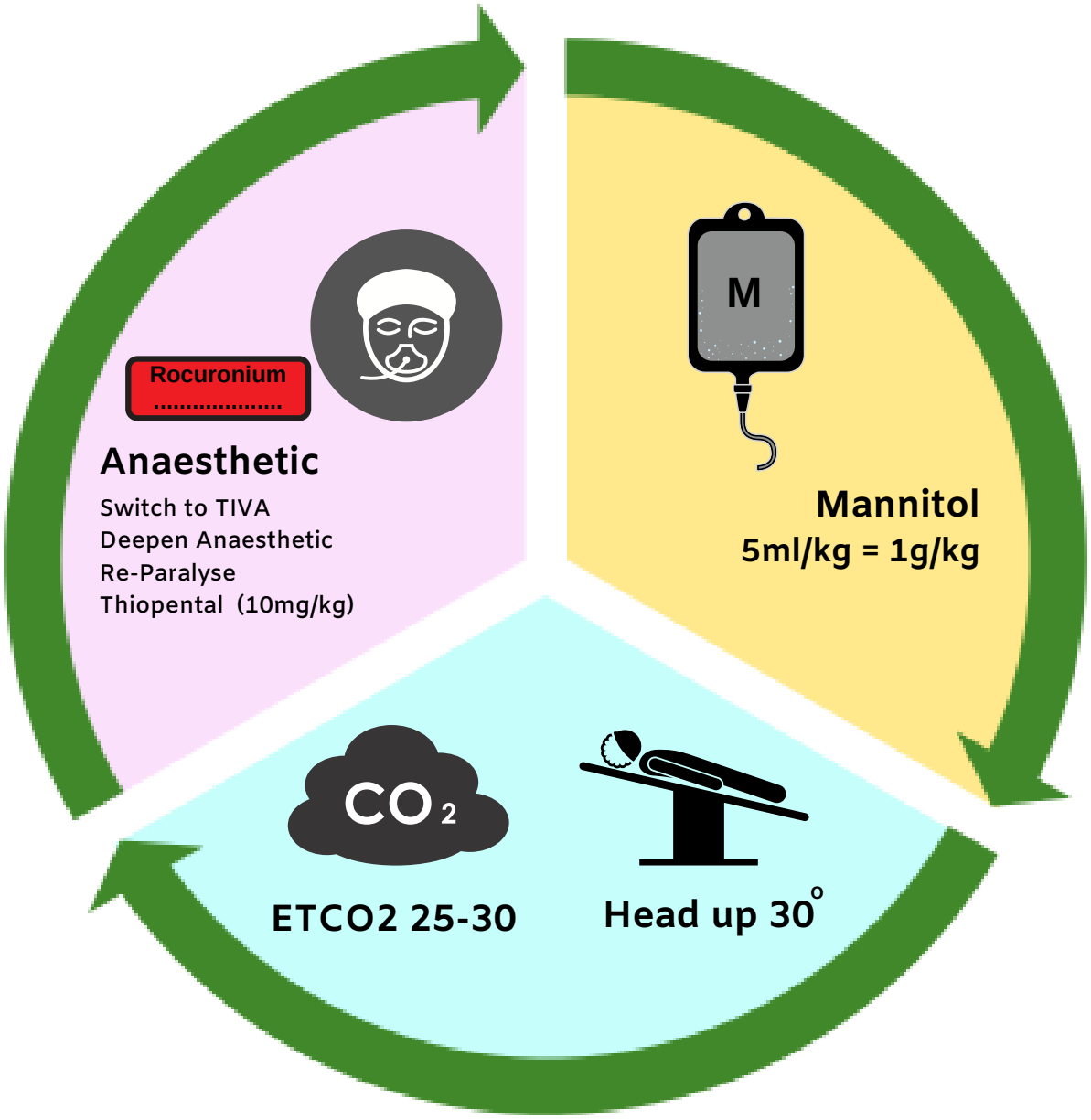

Consider Hypertonic Saline > Mannitol if hypovolaemic e.g. multi-trauma patient

↑ **CPP:**

MAP 90-100

↓ **CSF**

EVD or Drain CSF

Raised ICP in OT

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Involve surgeon	**INVOLVE SURGEON EARLY** Mannitol may worsen Intracranial bleeding if delays to Craniotomy expected
Maintain CPP MAP 90-110	Vasopressors as required
Anaesthetised + Paralysed	**T**IVA - **cease volatile anaesthetic** Propofol 1mg/kg or Thiopentone 10mg/kg. **Deep paralysis** (aim PTC 2-12)
Head up 30	Head neutral. Head up 30 degrees Remove ETT ties/hard collar if able
ETCO2 25-30	Target PaCO2 **30-35mmHg for 10min** Then 35-40mmHg PEEP off
Osmotherapy	Mannitol 20% 5ml/kg (max 7.5ml/kg) **Saline 3% 3ml/kg (if hypovolaemic)** Frusemide 10-20mg
Open EVD/ Commence Crani	If EVD insitu - **drain 5-10ml** Expediate removal of bone flap

ABG

Na+ (aim > 135)
BSL (aim 6-10)

Adjust Ventilation to PaCO2

Mannitol

May worsen an Extradural Haematoma or Ruptured Aneurysm if given prior to arrival in OT

CMRO2

Cool if > 37 degrees
IV Keppra for Seizures
Consider Thiopental 10mg/kg Infusion for BSR > 70%

Venous Air Embolism

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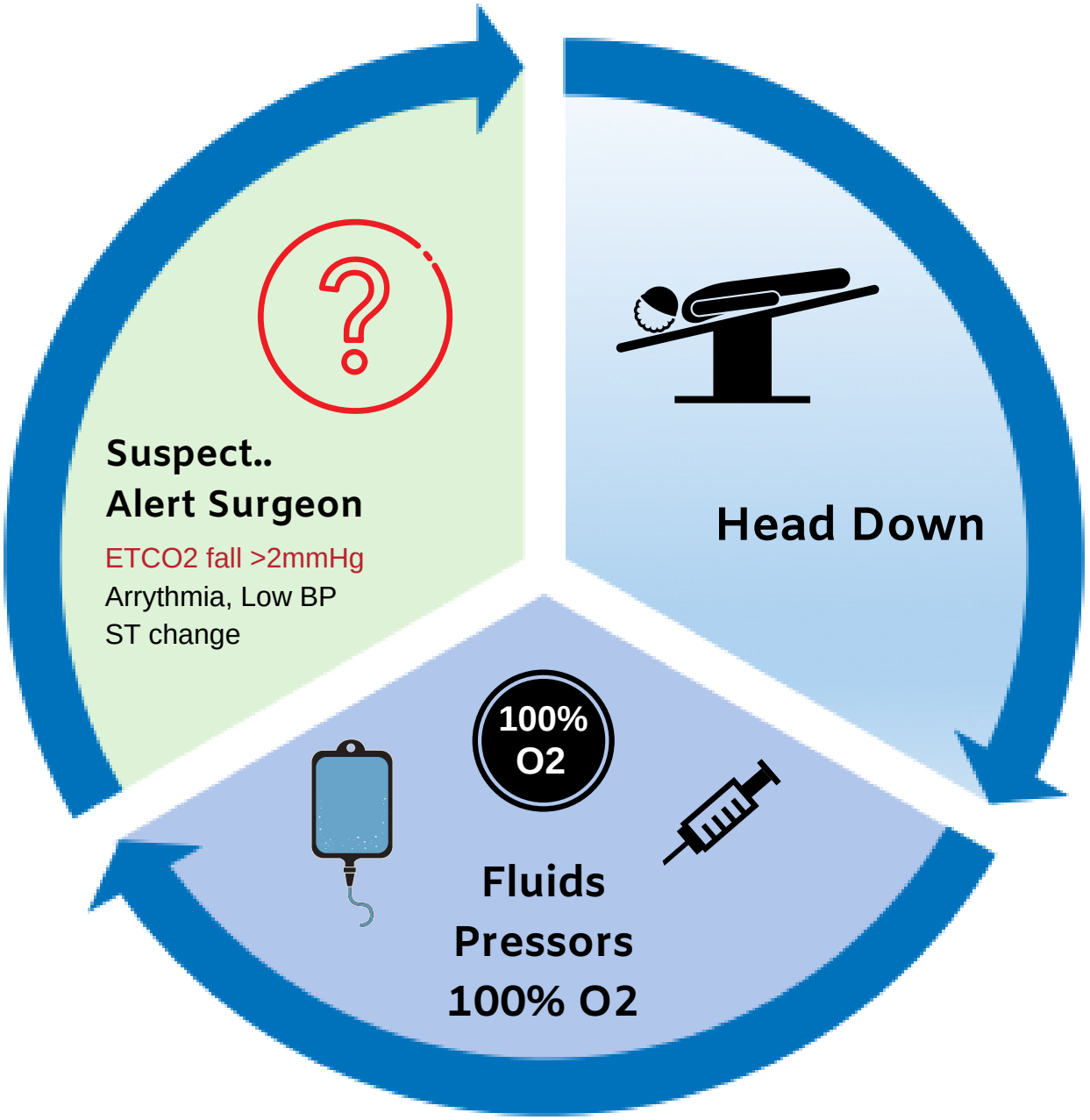
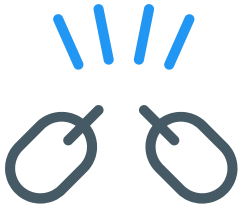


Aspirate CVC
(If Catastrophic VAE only)



Check for IV / CVC disconnections

Venous Air Embolism

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Suspect	**ETCO2 Drop > 2mmHg** New Arrythmia, ST Changes, CVS instability Proximity to Venous Sinus, Sitting Surgery
Inform Surgeon	**Inform Surgeon immediately** of possible VAE. Surgeon to ok head down, flood surgical field and apply bone wax
Head down	To stop entrainment +/- move air bubble out of RVOT. If unable to achieve head down, **consider bilateral jugular compression in extremis.**
Stop Nitrous 100% O2	FiO2 100% To reduce size of air bubbles + aid resolution.
Support Haemodynamics	IV fluid bolus and Vasopressors. Cardiac arrest - Adjust Adrenaline dose and release mayfield clamp
Aspirate CVC	Only if Catastrophic VAE / Peri-arrest. **No evidence to emergently insert CVC**
Exclude other sources of air entry	Check IV medication lines Check **CVC bung connections**

Adrenaline

10mcg boluses
Infusion: Draw up **6mg in 100ml** = 60mcg/ml concentration
Rate of: 1ml/hr = 1mcg/minute.

In arrest: Use 100mcg boluses (see Cardiac Arrest in Neuro Aid)

TOE/TTE

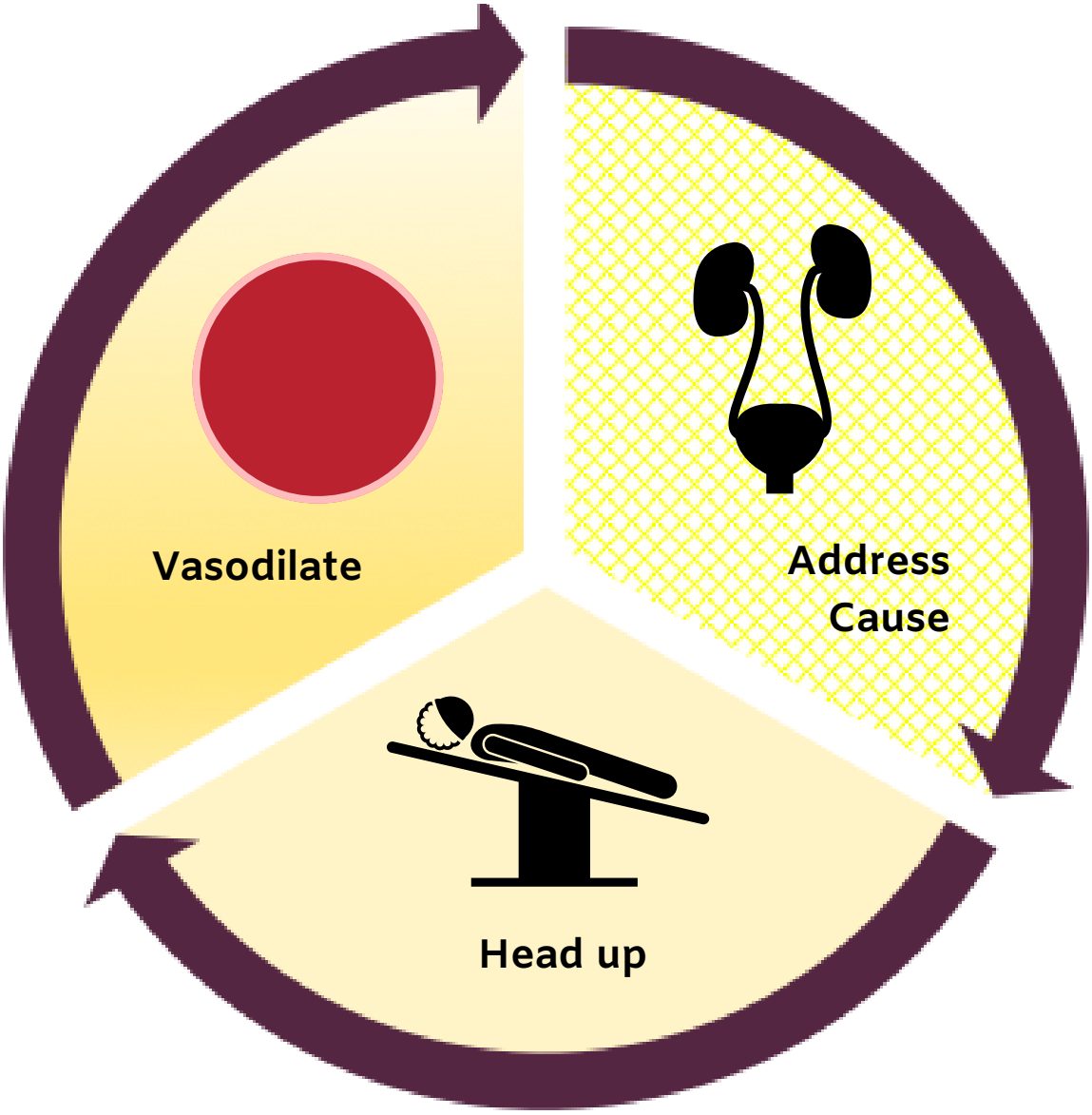
Useful for differential diagnosis especially in arrest.
TOE difficult to insert in Mayfield pins.
Features: RV strain, Air in RVOT

PEEP

Benefit unclear
Risk of Paradoxical Embolism
May be useful if PFO excluded.
May also be helpful transiently if delay to going head down.

Autonomic Dysreflexia

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



STOP **Surgeon to stop** STOP

Vasodilate

- Volatile
- Propofol
- GTN patch / Bolus
- Clevidipine infusion
- SNIP

Address Cause

- Full Bladder
- Full Bowel
- Pressure points
- Surgical Stimulation

Autonomic Dysreflexia

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Anticipate	**Spinal cord injury above T6** Establish triggers and usual management Consider ICU post op
Inform surgeon	**If hypertension, bradycardia / dysrhythmias** Cease stimulation
Deepen anaesthesia	Propofol bolus or opioid Increase Volatile
Lower BP	**GTN 50-100mcg IV** or **sublingual spray 400mcg** **Avoid B Blockers as patient usually bradycardic**
Head up	Head up if possible to encourage venous pooling
Treat Cause	**Surgical Stimulation** - Cease **Bladder** - Verify IDC patency / Minimise IV fluids **Bowels** - consider dis-impaction **Pressure Care** - check pressure points
Exclude complications	*CNS:* ICH, seizure *CVS:* AMI, Heart Blocks *Resp:* Pulmonary oedema

Clevidipine

Consider Clevidipine
Can use **Peripherally.**
Start at **3ml/hr and titrate up**
Use with Aguila Pump
Max rate is 32ml/hr

Monitoring

Arterial Line

Consider ICU post op

Bleeding in Spine Surgery

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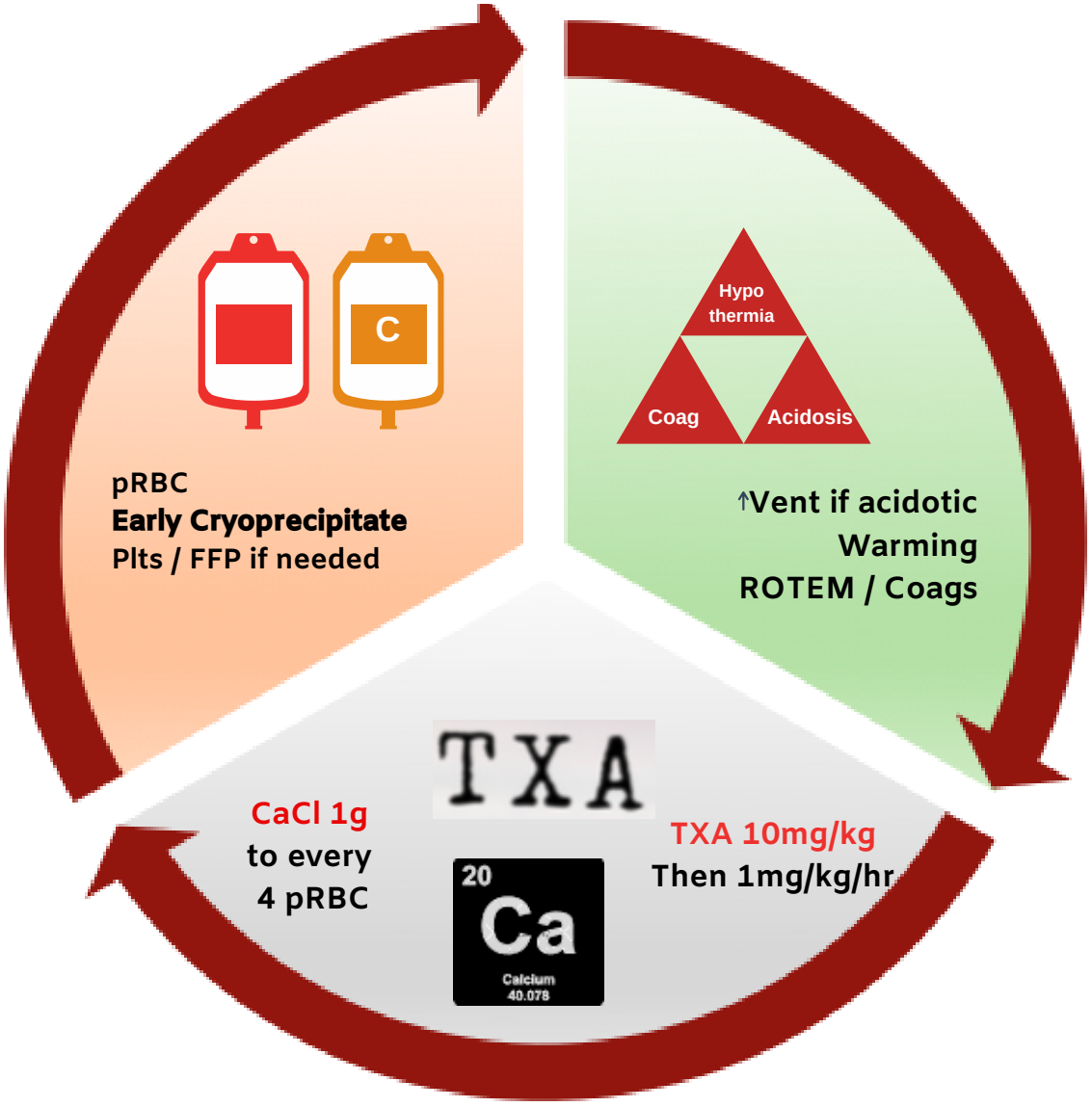


Monitor Losses

Calculate MABL

Maintain MAP

Cell Salvage

(not if malignancy)

ROTEM

Bleeding in Spine Surgery

RNS ASCAR

Hands off Leader	100% O2	RNS ASCAR	Minimise noise	Call for Help

Inform Surgeon

Early discussion with surgeon
Decision may be made to **temporarily pack** wound or **stage the procedure**

Blood Products

PRBC (**see 'Transfusion' below**)
Cryoprecipitate / FFP if > 4 pRBC given
Platelets if > 8 pRBC given
Ideally **use ROTEM** (**ICU ROTEM out of hrs**)

TXA

10mg/kg Bolus then **1mg/kg/hr** Infusion

Ventilation

If Acidotic, **increase ventilation** as acidosis worsens coagulopathy

Calcium

10ml (1g) of Calcium Chloride
30ml (3g) of Calcium Gluconate
To maintain **iCa > 1.1**

Temperature

Increase **OT temperature 23-25 C**
Bair Hugger set to Max (consider 2nd)
Fluid Warmers turned on

Cell Salvage

Discuss with Perfusionist.
Use may be **limited during cancer surgery**

Targets

Hb: 90-100 (in acute bleeding)
Plts > 100
INR < 1.5
Fibrinogen > 1.5
BXS < -6
Ca > 1.1

Transfusion

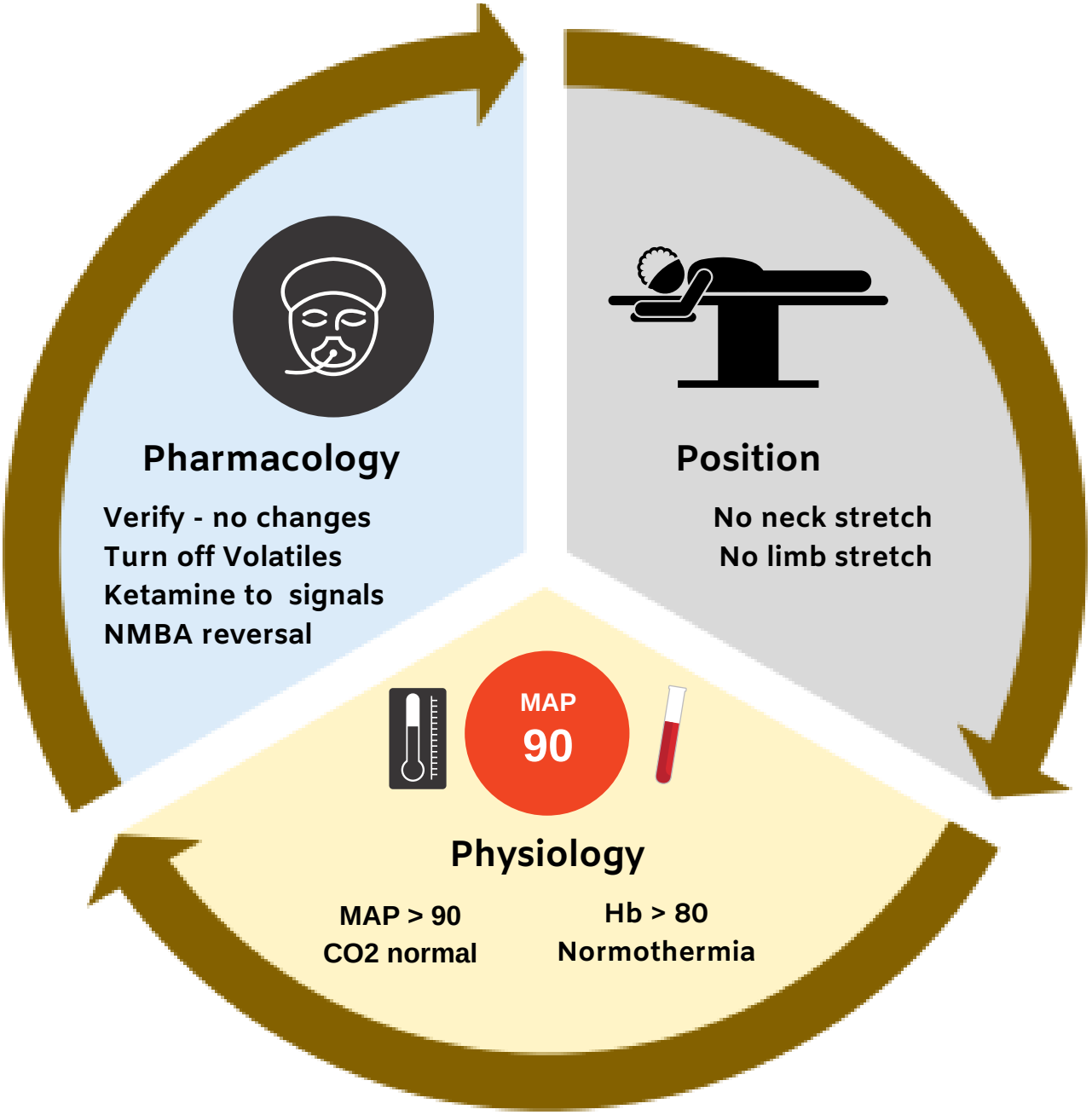
Serial Hb monitoring = misleading in acute blood loss. **Calculate MABL and monitor blood loss in suction canister.** Consider transfusion if >20% of Blood Volume is lost i.e. 1000-2000ml.

BP targets

Bleeding during spinal surgery **is usually venous.**
There is no role for hypotensive techniques.
Maintain spinal perfusion at all times

Loss of MEP / SSEPs

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help



Pharmacology

Verify - no changes
Turn off Volatiles
Ketamine to signals
NMBA reversal

Position

No neck stretch
No limb stretch

Physiology

MAP 90

MAP > 90
CO2 normal

Hb > 80
Normothermia

Surgeon

Stops Temporarily
Reduces Traction
Checks sites
Warm irrigation (not cold)

Neurophysiologist

Check connections

Check Pressure areas

Repeats Trial

Loss of MEP / SSEPs

RNS ASCAR

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help

Inform Surgeon

Cease surgery.
Surgeon - Warm wash, reduce traction
Check sites. Consider staging procedure

Ventilation

SpO2 > 94%
PaCO2 35-40mmHg (CO2 affects Signals)

MAP 90 - 100

Target **MAP 90-100**

Anaesthetic Agent

Verify no Depth Change Turn off Volatile.
Check NMJ - **Paralysis Reversed. Consider Ketamine to boost signals. Verify no A2 agonists.**

Temperature

Aim Normothermia
Increase OT temp. Extra Bair Hugger.
Surgeon to use Warm wash.

Positioning

Always check positioning to minimise stretch on neck and limbs especially if signal change occurs after proning

ABG

ABG: pH, HCO3, PaCO2, lactate, Hb, BSL
Consider transfusion if <80g/dL or if significant volume lost

Transfusion

Maintain Hb > 80
Note that serial Hb values take time to equilibrate.
Use blood loss to guide transfusion

Wake up Test

If required, seek appropriate expertise

Technical cause

Physiologist to **verify connections**
Physiologist to repeat trial of Monitoring

ADDENDUM

Before Proning trauma patient

RNS ASCAR

Hands off Leader | 100% O2 | RNS ASCAR | Minimise noise | Call for Help

Repeat 1° Survey	Treat Life-threatening injuries **Repeat FAST exam** Bind Pelvis if appropriate
Secure ETT / Lines	Patient may come from ED / ICU **Tape ETT.** Secure IV lines. Consider siting **2nd Arterial Line**
USS Chest	To exclude pneumothorax If concerns, discuss with CTx
Fluid Bolus	Appropriate fluid to optimise preload **Avoid Albumin if TBI**
Eyes	Examine eyes for **signs of raised ICP** and for **Retrobulbar haematoma** that may require urgent canthotomy
Paralysis	Bolus Paralytic Agent
Airway Pressures	Note Airway pressures **pre/post Sandwiching** patient and **post turning prone**

BP Goals

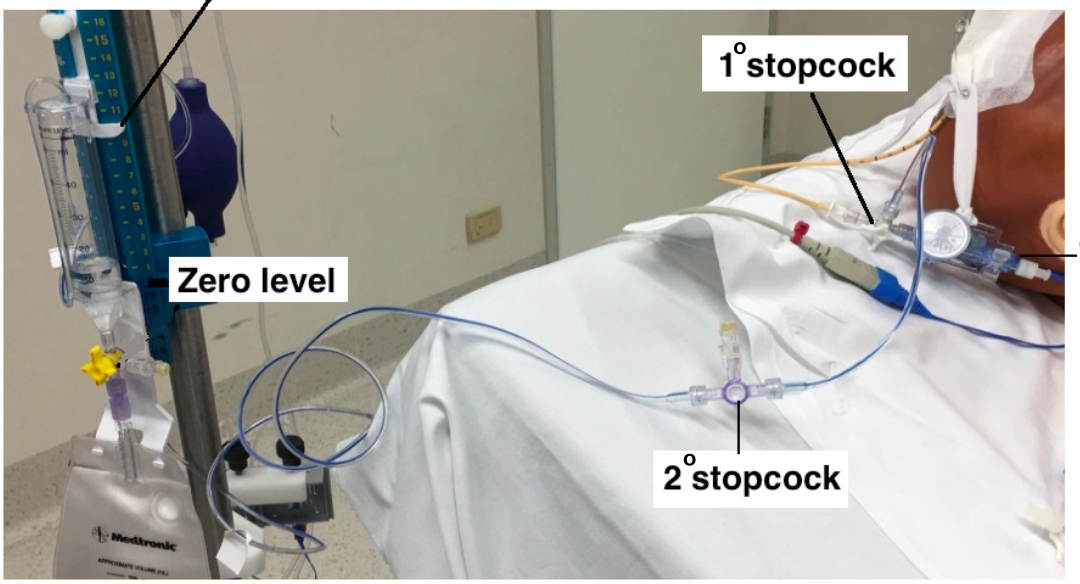
TBI: SBP 100-110
SCI: MAP 90-100

Mimics

Consider **Neurogenic Shock** as possible cause especially if Bradycardia

EVD Anatomy

RNS ASCAR



Anatomy explained

- **1°Stopcock** - to clamp EVD / switch b/ween Drainage + Transducing
- **Transducer** - never disconnect bacterial filter
- **Zero level** - always ensure at level of tragus before opening to drain
- **White Wings** - **set to cmH2O pressure order of NSx**

Contact Neurosurgery if:

Ext 58046 (6F TL)

0459893919 (NSx Reg)

>15-20ml/hour drainage of CSF

May signify increasing ICP

Sudden change in colour of CSF

May signify aneurysm bleed

Decline in CSF drainage or No drainage

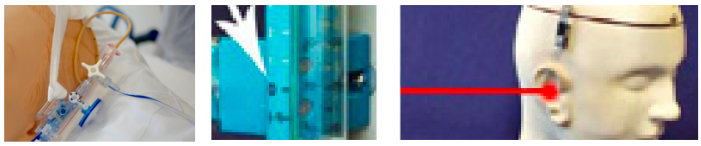
May signify occlusion

EVD Set-up and Basics

RNS ASCAR

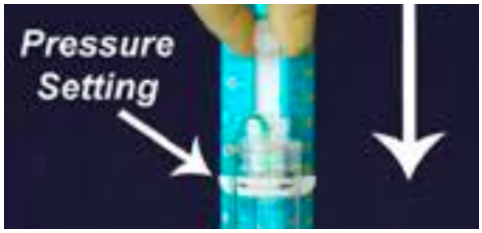
SETUP - level

1. **Transducer** - level w/ tragus
   0cm level on ruler - level w/ tragus



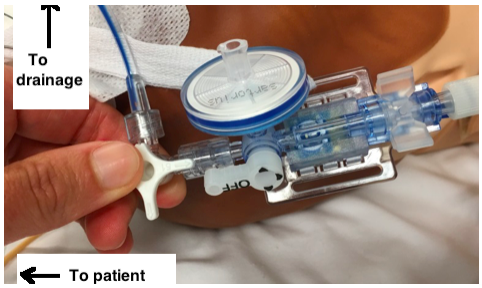
SETUP - Pressure setting

2. **White wings** to correspond with Neurosurgeon order using **CM-H2O scale (not mmHg)**



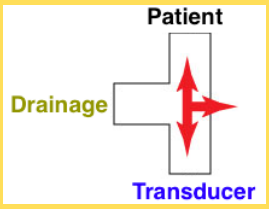
SETUP - Zero to ATM

3. **Ensure 1° stopcock off to drainage but open to transducer.** Turn the **transducer tap OFF to patient.**
   Keep Bacterial Filter on.
   Press ZERO on the monitor



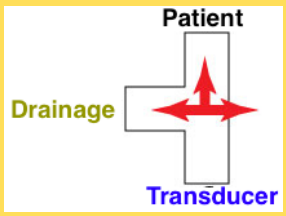
Measure ICP

Turn 1° Stopcock off to drainage bag. Wait 20 seconds



Drain

Turn 1° Stopcock off to transducer.



Verify Patency

Briefly lower the pressure level to below 0cmH2O and look for CSF drainage.

If no drainage Contact 6F / NSx

Contact Neurosurgery if:

Ext 58046 (6F TL)
0459893919 (NSx Reg)

>15-20ml/hour drainage of CSF
Sudden change in colour of CSF
Decline in CSF drainage or No drainage

EVD Intraoperative Management

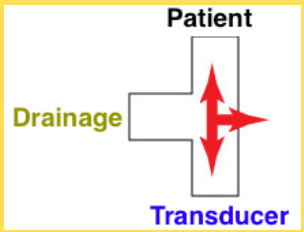
RNS ASCAR

Set up

(see overleaf more detail)

- **Separate Pole** available
- **Transducer level** at Tragus (by pillow)
- **0cmH2O line levelled** at Tragus
- White wings @ **prescribed cmH2O setting**
- **Transducer Zeroed** to Atmosphere

Ongoing Intraop Management



Transduce ICP at least q1hrly

Verify Patency if CSF stops

EVD Antibiotics to be dosed

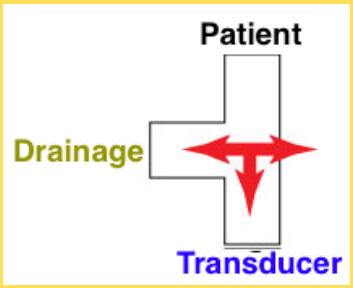
Documentation / Hourly checks

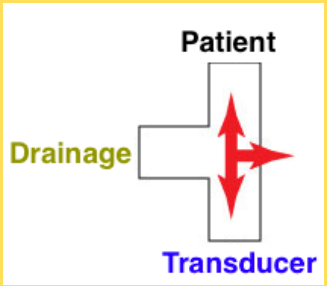
ICP checks may be needed more frequently

- EVD Output (ml/hr)
- CSF color
- ICP
- CPP (= MAP at tragus - ICP)
- Pressure level order from NSx (cmH2O)
- Position of 1 Stopcock (Open / Closed)

Changes in Bed height

- Turn 1° Stopcock **OFF TO PATIENT**
- Reposition / Move the patient.
- Adjust **ZERO LINE** to level of **TRAGUS**
- Turn 1°Stopcock to Transduce / Monitor





Contact Neurosurgery if:

Ext 58046 (6F TL)

0459893919 (NSx Reg)

>15-20ml/hour drainage of CSF

Sudden change in colour of CSF

Decline in CSF drainage or No drainage

EVD Transport Checklist

RNS ASCAR

Prior to departure

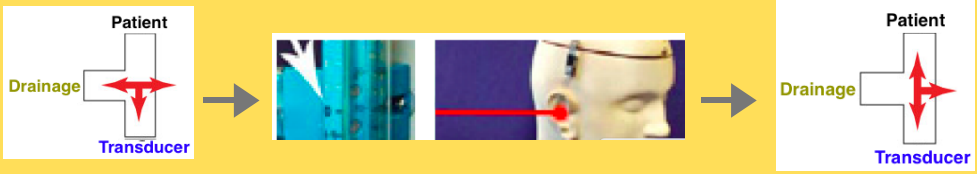
- Dedicated **Pole to mount EVD**.....**Confirm**
- Confirm **Transducer levelled w/ Tragus**.....**Confirm**
- Confirm **ZERO LINE levelled w/ Tragus**..... **Confirm**
- Confirm **EVD set to "CM ABOVE" ORDER**.....**Confirm**
- Confirm **OK / NOT OK to CLAMP EVD**.....**Confirm**
- Confirm **Baseline ICP + Colour of CSF**.....**Confirm**
- Confirm **BASELINE ETCO2 level**.....**Confirm**
- **Prepare to treat Raised ICP**.....**Confirm**
  -Head up / Mannitol available / CO2 / BP

Monitor ICP during transfer if CLAMPED.

EVD is NOT MRI COMPATIBLE

Changing patient position / moving onto another surface

- Turn 1° Stopcock **OFF TO PATIENT**
- Reposition / Move the patient.
- Adjust **ZERO LINE** to level of **TRAGUS**
- Turn 1° Stopcock to Transduce / Monitor



General Transfer Conduct

Head up 30 degrees

Paralysed in last 5 mins

Sedated adequately

ETCO2 @ pre-transfer levels

Contact Neurosurgery if:

Ext 58046 (6F TL)

0459893919 (NSx Reg)

>15-20ml/hour drainage of CSF

Sudden change in colour of CSF

Decline in CSF drainage or No drainage

NEURO-TRANSFER CHECKLIST

TO BE COMPLETED PRIOR TO TRANSFER

RNS ASCAR

Agreed SBP targets

Systolic Targets
Based on NIBP cuff

R Pupil: mm

L Pupil: mm

Best GCS:

Mannitol Dose + Time:

- ☐ **Head up 30 degrees**
- ☐ **ETCO2 30-35**
- ☐ **SBP as per NSx**
- ☐ **Paralysis @ time of Departure**
- ☐ **Propofol 1% infusion (aim: 40ml/hr)**

Please Circle: **ROC / VEC**

GCS tool

Best motor response	Best verbal response	Eye opening
6 Obeying commands	**5** Oriented (time, place, person)	**4** Spontaneous
5 Localizing to pain	**4** Confused conversation	**3** In response to speech
4 Withdrawing to pain	**3** Inappropriate speech	**2** In response to pain
3 Flexor response to pain	**2** Incomprehensible sounds	**1** None
2 Extensor response to pain	**1** None	
1 No response to pain		

Contact numbers

Neurosurgical Registrar
0459893919

Anaesthetic Duty Director
Ext. 58385

ICU Admitting Officer
Pager: 45725

SBP targets

SAH: 100-140

ICH / TBI: 100-150

Discuss w/ NSx where possible

Mannitol 20%

1g/kg = **5ml/kg**

Propofol Sedation

Aim **Propofol at 40ml/hr for neuroprotection** unless haemodynamically compromised. Discuss w/ Senior if uncertain

I'm a...

HANDS OFF TEAM LEADER

RNS ASCAR

People. Practice. Performance.