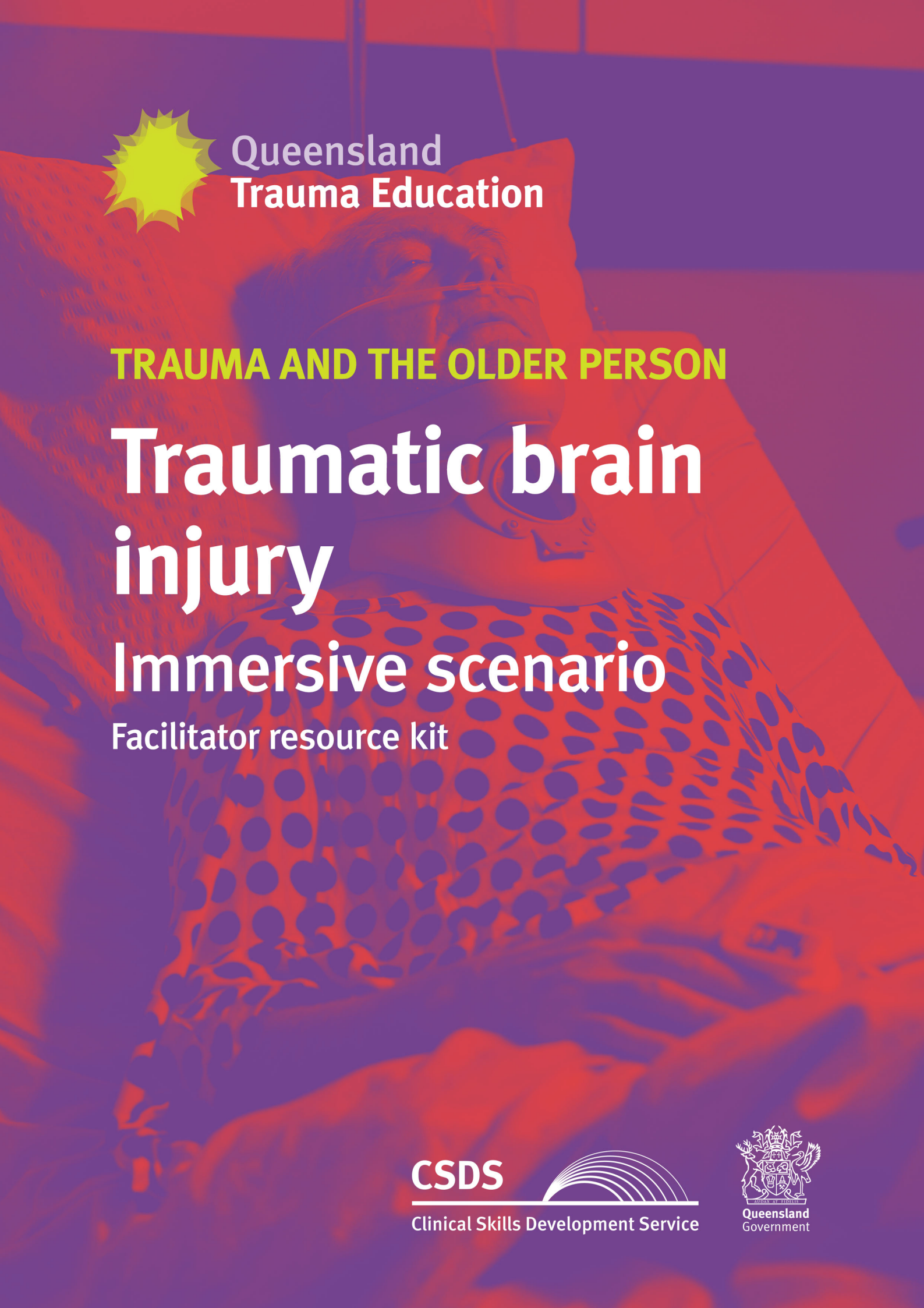

Queensland
Trauma Education

TRAUMA AND THE OLDER PERSON

Traumatic brain injury

Immersive scenario

Facilitator resource kit

CSDS
Clinical Skills Development Service

Queensland Government

Queensland Trauma Education

The resources developed for Queensland Trauma Education are designed for use in any Queensland Health facility that cares for patients who have been injured as a result of trauma. Each resource can be modified by the facilitator and scaled to the learners needs as well as the environment in which the education is being delivered, from tertiary to rural and remote facilities.

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Reviewed by
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Queensland Trauma Education
Trauma and the Older Person – Traumatic brain injury: Immersive scenario – Facilitator resource kit, Version 1.0

Published by the State of Queensland (Clinical Skills Development Service), 2021

About this training resource kit

This resource kit provides healthcare workers with the knowledge and skills for the assessment and management of traumatic brain injury in the geriatric population.

National Safety and Quality Health Service (NSQHS) Standards

Target audience

- Emergency department medical and nursing clinicians.
- Allied health – pharmacists.

Duration

45-60 minutes (including setup, scenario, debrief).

Group size

4-6 participants (or team composition applicable to local area).

Learning objectives

By the end of this session the participant will be able to:

- Perform a structured assessment and recognise severe traumatic brain injury (TBI).
- Implement neuroprotective management strategies and perform anticoagulant reversal.

Facilitation guide

1. Facilitator to provide participant resource kit to participants.
2. Facilitator to use resource guide and attached documents to deliver immersive scenario.

Supporting resources

- Primary survey: Structured assessment in trauma - infographic
- Specific management

Overview of traumatic brain injury

Traumatic brain injury (TBI) is a common cause for emergency department presentation in the over 65yr age group. Falls are the leading cause for TBI presentations in older adults, with traffic and motor vehicle related trauma less common (51 vs 9%).[1] Diagnosis of TBI is more challenging in this cohort, as demonstrated in one study 17% of older adults with TBI and a normal neurological examination were found to have an acute intracranial injury on CT brain.[2] In addition, older adults with co-morbidities generally have a higher morbidity and mortality, with more complications and worse functional recovery than younger patients.[3]

Anticoagulant therapy, in particular warfarin and the DOACs, pose additional challenges in this cohort with poor prognosis from neurocritical bleeding (50% mortality).[4]

Further reading

Traumatic brain injury in older adults: do we need a different approach?	
Publication	Future Medicine
Link	https://doi.org/10.2217/cnc-2018-0001

Traumatic brain injury—the effects of patient age on treatment intensity and mortality	
Publication	BMC Neurology
Link	https://doi.org/10.1186/s12883-020-01943-6

Mild head trauma in elderly patients: experience of an emergency department	
Publication	Heliyon
Link	https://doi.org/10.1016/j.heliyon.2020.e04226

Reversal of warfarin anticoagulation in geriatric traumatic brain injury due to ground-level falls	
Publication	Trauma Surg Acute Care Open
Link	https://doi.org/10.1136/tsaco-2019-000352

Management of bleeding and/or over coagulation	
Organisation	Therapeutic Guidelines
Link	https://tgldcdp.tg.org.au/viewTopic?topicfile=anticoagulant-therapy&sectionId=cvg7-c31-s15#tcvg7-c31-tbl4 *(requires log in)*

Clinical guidelines

Non-vitamin K Antagonist Oral Anticoagulant (NOAC) Guidelines	
Organisation	Clinical Excellence Commission, NSW Health
Link	https://www.cec.health.nsw.gov.au/__data/assets/pdf_file/0007/326419/noac_guidelines.pdf

Managing patients on dabigatran (Pradaxa®)	
Organisation	Queensland Health
Link	https://www.health.qld.gov.au/__data/assets/pdf_file/0029/443666/dabigatran-info.pdf

Guideline for managing patients on a factor Xa inhibitor –Apixaban (Eliquis®) or Rivaroxaban (Xarelto®)	
Organisation	Queensland Health
Link	https://www.health.qld.gov.au/__data/assets/pdf_file/0026/147662/qh-gdl-950.pdf

Guidelines for Anticoagulation using Warfarin – Adult	
Organisation	Queensland Health
Link	https://qheps.health.qld.gov.au/__data/assets/pdf_file/0033/1797702/warfarin.pdf

Clinical decision-making tool

Closed Head Injury (Adult) Clinical Pathway	
Organisation	Queensland Health
Link	https://qheps.health.qld.gov.au/__data/assets/pdf_file/0026/2158307/SW214.pdf

Queensland Trauma Education

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PRIMARY SURVEY

Structured assessment in trauma

C — Catastrophic haemorrhage

Rapidly assess, control haemorrhage

Immediate management: Application of direct pressure, consider tourniquet application, do not remove penetrating foreign objects, initiate large bore IV access and rapid fluid resuscitation.

Life threats: Exsanguinating external haemorrhage, blunt/penetrating thoracic and/or abdominal injury.

A — Airway/C-spine

Rapidly assess, maintain or secure airway and C-spine

Life threats: Airway obstruction, blunt/penetrating neck injury.

B — Breathing/ventilation

Rapidly assess, support ventilation/oxygenation

Life threats: Tension pneumothorax, massive haemothorax, open pneumothorax, flail chest, ruptured diaphragm.

C — Circulation with haemorrhage control

Rapidly control, assess and support haemodynamics

Life threats: Exsanguinating external haemorrhage, cardiac tamponade, penetrating cardiac injury.

D — Disability

Rapidly assess and protect neurological status

Life threats: Catastrophic cerebral haemorrhage.

E — Exposure

Expose patient, assess for further injuries, maintain normothermia

Specific management

1. Institution of neuroprotective measures for traumatic brain injury.
2. Reversal of anti-coagulant therapy in life threatening haemorrhage.

Simulation event

This section contains the following:

1. Pre-simulation briefing poster
2. Immersive scenario
3. Resource requirements
4. Handover card
5. Scenario progression
    a. State 1: Initial assessment
    b. State 2: Ongoing management / secondary assessment
    c. State 3: RSI / Intubation for neuroprotection
6. Supporting documents
7. Debriefing guide

Pre-simulation briefing

Establishing a safe container for learning in simulation

1 Clarify objectives, roles and expectations

- Introductions
- Learning objectives
- Assessment (formative vs summative)
- Facilitators and learners' roles
- Active participants vs observers

2 Maintain confidentiality and respect

- Transparency on who will observe
- Individual performances
- Maintain curiosity

3 Establish a fiction contract

Seek a voluntary commitment between the learner and facilitator:

- Ask for buy-in
- Acknowledge limitations

4 Conduct a familiarisation

- Manikin/simulated patient
- Simulated environment
- Calling for help

Note: Adjust the pre-simulation briefing to match the demands of the simulation event, contexts or the changing of participant composition.

5 Address simulation safety

Identify risks:

- Medications and equipment
- Electrical or physical hazards
- Simulated and real patients

V2 Effective: 1/7/2021. Adapted from Rudolph, J., Raemer, D. and Simon, R. (2014). Establishing a Safe Container for Learning in Simulation. Simulation in Healthcare: Journal of the Society for Simulation in Healthcare, 9(6), pp.339-349.

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Immersive scenario

Type	Immersive scenario
Target audience	• Emergency department medical and nursing clinicians • Pharmacists
Overview	This resource is for facilitators to explore the management of severe TBI with warfarin reversal after initial assessment.
Learning objectives	• Perform a structured assessment and recognise severe Traumatic Brain Injury (TBI). • Implement neuroprotective management strategies and perform anticoagulant reversal.
Duration	45-60 minutes including debrief.

Resource requirements

Physical resources

Room setup	Resus bay in emergency
Simulator/s	1 manikin - SimMan3G / ALS Simulator
Simulator set up	• Street clothes lying supine (drops of blood on shirt and pants). • Cervical collar insitu. • Moulage: bruising/wound L scalp(bandaged and blood-soaked), haematoma L orbit, blood from L ear.
Clinical equipment	• Standard precautions PPE. • Resus/trauma bay role identification stickers (if applicable to local area). • Standard Resus bay equipment: Monitors, Resus trolley, infusion pumps, blood warmers. • Fluids/blood products: N/saline, Hartmann's, Packed Red blood cells/blood components, Prothrombinex/FFP (if applicable to local area). • Medications: IV analgesia/sedation, Vitamin K 5-10mg, Prothrombinex/FFP (if applicable to local area).
Access	2 x IVC setups with 'NO' IV stickers attached
Other	ED chart & relevant paperwork (optional)

Human resources

Faculty	2 facilitators (Dr/Nurse with debriefing experience) to take on roles of scenario commander and primary debrief.
Simulation coordinators	1 for manikin set up and control
Confederates	• QAS officer for handover (optional) • 1 nurse and 1 doctor in room

Handover card

Handover from ambulance officer

Thank you for your ongoing care of Simon. He is a 78yo man who was found by his daughter this morning when he didn't answer the phone. On our arrival he was unconscious, responding to painful stimuli only and groaning. During assessment he has been seen to move all limbs to painful stimuli. He is hypertensive with a BP 180/100mmHg with HR 70 in AF.

We think he slipped off the step ladder in the kitchen, but it is unclear how long he was on the floor. He has a large haematoma and laceration to his L scalp, we have placed a cervical collar and spinal precautions have been maintained.

His daughter confirms his PMHx is AF on warfarin and metoprolol 25mg mane, hypertension which has been managed with the b-blocker and he is an ex-smoker. He has no allergies.

He lives alone and is independent with his ADLs.

Thank you for looking after Simon.

Scenario progression

<table>
<tr><th colspan="4">STATE 1: INITIAL ASSESSMENT</th></tr>
<tr><th colspan="2">Vital signs</th><th>Script</th><th>Details</th><th>Expected actions</th></tr>
<tr><td>ECG</td><td>AF</td><td rowspan="9">Simon
Moaning to any stimuli</td><td rowspan="9">Primary survey results
A: patent, cx collar in-situ, anterior neck normal.
B: equal BS, nil crepitus/subcutaneous emphysema.
C: warm and well perfused peripherally.
D: GCS 9, pupils small and reactive, moving all limbs to stimuli.
E: nil extra.</td><td rowspan="9">Commence primary survey
❑ Assess airway including cervical spine and anterior neck.
❑ Assess Breathing: optimise oxygenation/ventilation.
❑ Assess circulation: hypertensive (from TBI and PMHx).
❑ Assess Disability: recognise low GCS as significant TBI.
❑ Expose patient.</td></tr>
<tr><td>HR</td><td>70</td></tr>
<tr><td>SpO₂</td><td>98% RA</td></tr>
<tr><td>BP/ART</td><td>190/100mmHg</td></tr>
<tr><td>RR</td><td>22</td></tr>
<tr><td>Temp</td><td>36</td></tr>
<tr><td>BGL</td><td>5</td></tr>
<tr><td>GCS</td><td>E2 V2 M5</td></tr>
<tr><td>Pupils</td><td>L 2mm
R 2mm</td></tr>
</table>

STATE 2: ONGOING MANAGEMENT / SECONDARY ASSESSMENT				
Vital signs		**Script**	**Details**	**Expected actions**
ECG	AF	**Simon** Unresponsive **Confederate** Prompt if failure to recognise deterioration of GCS – "He doesn't seem to be moaning anymore… has he got worse?"	**Secondary survey results** Improvement in saturations to 98% if oxygen is applied. **Secondary survey results** **Head**: large haematoma/laceration to L boggy mass felt. **Face**: blood from L ear noted, hemotympanum, L orbit haematoma, L sided facial bruising/deformity/crepitus. **Chest**: nil bruising/wounds. **Abdomen**: soft, no wounds/abrasions. **Pelvis**: aligned, no wounds/abrasions. **Long bones and limbs**: nil injury. **Log roll**: nil injury. **Results**: **CXR:** NAD **Pelvic Xray:** NAD **EFAST:** negative **INR:** 3.2	**Secondary survey** ❑ Perform top to toe assessment. ❑ Manage bleeding head wound: expose, stable/suture/reinforce bandaging. ❑ Identification of severe TBI. ❑ Recognise risk of ongoing bleeding with anticoagulants. **Initiate investigations** ❑ Urgent CT brain and cervical spine. ❑ CXR and Pelvic Xray. ❑ VBG. ❑ Bloods: FBE, Coags, crossmatch or Point of Care Test INR, hemocue, chem8/CG4. **Management** ❑ Recognition of severe TBI. ❑ Apply oxygen - optimise oxygenation/ventilation. ❑ Requirement for RSI to facilitate further Ixn and institute neuroprotection ❑ Discuss INR 3.2 - Initiate early reversal of warfarin therapy. - Vit K 5mg IV - Prothrombinex 50units/kg IV - FFP 150-300mls (2 units) ❑ Call for help early (communication and liaison with neurosurgical services / RSQ as applicable).
HR	50			
SpO_2	95% RA			
BP/ART	200/90 mmHg			
RR	22			
Temp	36			
BGL	5			
GCS	E1 V1 M3			
Pupils	L 6mm R 2mm			

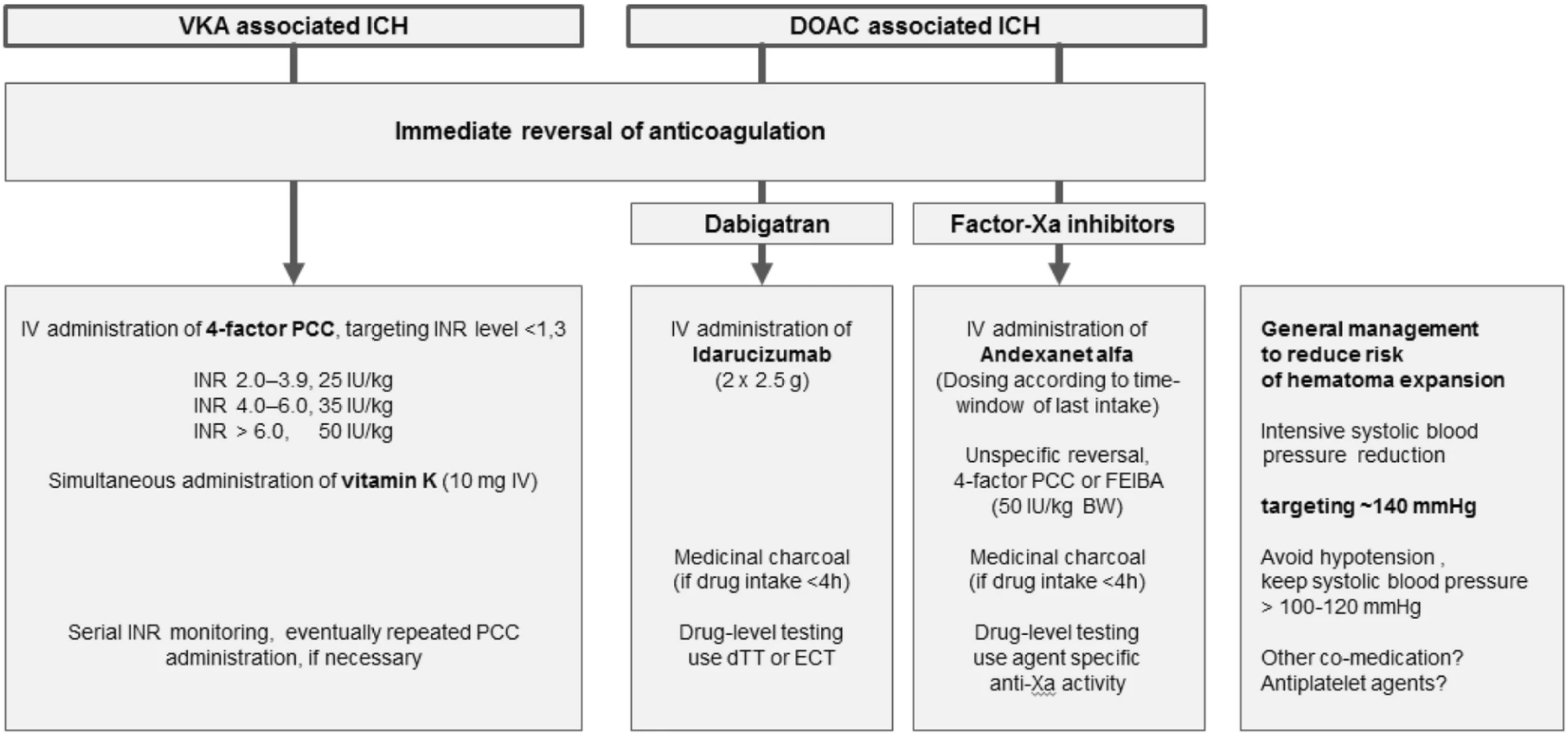
STATE 3: RSI / INTUBATION FOR NEUROPROTECTION				
Vital signs		**Script**	**Details**	**Expected actions**
ECG	AF	**Simon** Unresponsive **Confederate** If team fail to administer Warfarin reversal therapy confederate to ask, "I thought this patient was on Warfarin. Should we do anything about that?"	**Perform RSI** Prioritisation of avoiding hypoxia and maintaining blood pressure. **Examination results post-intubation:** **A**: ETT. **B**: equal BS, ECTO2 45 **C**: HR 80 AF, BP 160/80, well perfused. **D**: GCS 3 E1V1M1, pupils remain unequal. **E**: kept warm.	**Management** ❑ Perform RSI - Use of appropriate sedative and muscle relaxant agents. - Avoidance of hypotension and hypoxia. - Post RSI head up 30deg, loose ties - Clinical and radiological. confirmation of ETT placement, OGT. ❑ Consideration of hyperosmotic therapy - Hypertonic saline. - Mannitol. ❑ Notification to ICU and neurosurgical team for ongoing care and consideration of urgent decompression. ❑ (Referral to RSQ if appropriate) ❑ If not performed in State 2: Discuss INR 3.2 - Initiate early reversal of warfarin therapy. - Vit K 5mg IV - Prothrombinex 50units/kg IV - FFP 150-300mls (2 units) ❑ Scenario can end with transfer to CT (use CT images to discuss further management) ***or*** discuss patient disposition and transfer preparation (rural/regional/remote sites)
HR	80			
SpO_2	100%			
FiO_2	1.0			
BP/ART	160/90 mmHg			
RR	18			
Temp	36			
BGL	5			
GCS	3			
$ETCO_2$	55			
Pupils	L 6mm R 2mm			

Supporting documents

The following supporting documents are provided for this immersive scenario:

1. Reversal of oral anticoagulation in patients with acute intracerebral haemorrhage
2. Warfarin reversal: Victorian Agency for Health Information/ Safer Care Victoria
3. Guidelines for Anticoagulation using Warfarin - Adult
   Source: Queensland Health, https://qheps.health.qld.gov.au/__data/assets/pdf_file/0033/1797702/warfarin.pdf
4. CT brain: L SDH + Oedema and mass effect, L extra-axial collection
5. CT brain: (axial slice/bony recon): BOS and facial #s
6. CXR 1: NAD
7. CXR 2: Post ETT and OGT
8. VBG
9. FBC
10. Coagulation profile
11. Chem20

Reversal of oral anticoagulation in patients with acute intracerebral haemorrhage



Source: Kuramatsu, J.B., Sembill, J.A. & Huttner, H.B. Reversal of oral anticoagulation in patients with acute intracerebral haemorrhage. Crit Care 23, 206 (2019). https://doi.org/10.1186/s13054-019-2492-8

Warfarin reversal: Victorian Agency for Health Information/ Safer Care Victoria

Warfarin Reversal

With bleeding

Australian Red Cross Lifeblood

Management of patients on warfarin therapy with bleeding

INR	Bleeding risk	Warfarin	Vitamin K	PTX-VF	FFP	Check INR	Comments
INR ≥ 1.5 with life-threatening (critical organ) bleeding		Cease	5–10 mg IV[1]	50 IU/kg	150–300 mL **If PTX-VF not available** administer FFP 15 mL/kg	In 20 mins	Resume warfarin when bleeding has ceased and adjust dose to maintain INR within therapeutic range
INR ≥ 2.0 with clinically significant bleeding (not life-threatening)		Cease	5–10 mg IV[1]	35–50 IU/kg	**If PTX-VF not available** administer FFP 15 mL/kg	In 20 mins	
Any INR with minor bleeding	Low	Cease				In 24 h	Resume warfarin at reduced dose when INR reaches the therapeutic range
or **INR > 4.5 with minor bleeding**	High	Cease	Consider 1–2 mg PO or 0.5–1 mg IV[2]				

[1]Child: 0.3 mg / kg IV (max 10 mg) [2]Child: 0.03 mg / kg IV (max 1 mg)

transfusion.com.au Version 10.0 29 August 2019

Source: Victorian Agency for Health Information, https://www.bettersafercare.vic.gov.au/resources/clinical-guidance/emergency-care/warfarin-reversal

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Guidelines for Anticoagulation using Warfarin - Adult

1. Prescribing principles

- Consider if the benefits of anticoagulation outweigh the risks (e.g. bleeding) for each patient (see section 4).
- Ensure **pre-treatment INR**, platelets and liver function tests are normal. If not, seek senior / specialist advice.
- Warfarin should only be **prescribed** in the **designated area** of the medication chart.
- The initiating team must complete **target INR, indication, initial dose** and consider **duration** of therapy.
- If **admitted on warfarin**, an INR must be performed within 24 hours of admission, then every 2 to 3 days and documented in warfarin section of medication chart. If an INR has not been performed within 24 hours of admission, **warfarin is not to be administered until an INR is available** to guide dosing decisions.
- Check the patient has received **education** and **warfarin leaflets** before discharge. Ask your pharmacist to assist.

2. Starting warfarin therapy

- **Acute DVT** or **PE**: Start warfarin on same day as therapeutic UFH / LMWH* and overlap for a minimum of 5 days, until target INR reached for at least 2 consecutive days.
- **Chronic AF:** Start **warfarin alone** (may overlap with prophylactic heparin).
- **New mechanical or bioprosthetic valve**: as per treating team - SEEK ADVICE
- **Post-operative patients:** Restart with their 'normal' pre-operative maintenance dose - DO NOT RE-LOAD.

NB: High loading doses, such as 10 mg, should **not** be used due to an **increase in the risk of bleeding**.

3. Recommended starting nomogram for patients with no risk factors for increased sensitivity to warfarin

Day of Initiation	INR	Dose
1	Less than 1.4	5 mg
2	Less than 1.8	5 mg
	1.8–2	1 mg
	Greater than 2	Nil
3	Less than 2	5 mg
	2–2.5	4 mg
	2.6–2.9	3 mg
	3–3.2	2 mg
	3.3–3.5	1 mg
	Greater than 3.5	Nil
4	Less than 1.4	10 mg
	1.4–1.5	7 mg
	1.6–1.7	6 mg
	1.8–1.9	5 mg
	2–2.3	4 mg
	2.4–3	3 mg
	3.1–3.2	2 mg
	3.3–3.5	1 mg
	Greater than 3.5	Nil
After Day 4, dose is based on clinical judgement		

4. Risk factors for increased sensitivity to warfarin

- Age greater than 75 years
- History of bleeding or falls
- Baseline INR greater than 1.4
- Concomitant drugs affecting warfarin metabolism (see section 9)
- Co-morbidities i.e. hypertension, cerebrovascular disease, ischaemic stroke, heart disease, renal insufficiency, hepatic impairment or low platelets, malignancy
- Major surgery within the preceding 10 to 14 days

If **risk factors**, consider a smaller loading dose (**2–4 mg**) and seek senior / specialist advice.

If no risk factors, follow the recommended nomogram and monitor INR daily.

5. Recommended target INR ranges and minimum duration

To remain in end-of-bed folder

Indication	Target INR Range	Minimum Duration
Valve repairs; Bioprosthetic valve	2–3	6 weeks post op
DVT / PE	2–3	3 months
AF; Irreversible, clinically hyper-coagulable states; Mechanical AVR with no risk factors[¥]	2–3	Life-long, balanced against risks
High risk mechanical heart valves; Mechanical MVR; Mechanical AVR with risk factors[¥]	2.5–3.5	Life-long, balanced against risks

[¥]Risk factors: AF, previous VTE, hypercoagulable state, left ventricular dysfunction or older generation AVR

6. Perioperative thromboembolism risk stratification

Thrombosis risk	Indication for Warfarin Therapy		
	Mechanical valve	Atrial fibrillation	Venous thromboembolism
Low Bridging unlikely to be required	Present - discuss with cardiologist	• AF and no history of cardiac embolism • CHA_2DS_2–VASc score of 0–4[Ω]	• One DVT or PE more than three months ago • Prior VTE and low risk thrombophilia (heterozygous Factor V Leiden or prothrombin gene mutation)
Moderate to High Consider bridging	Present - discuss with cardiologist	• Rheumatic AF (mitral valve disease stenosis / regurgitation) • AF with history of cardiac embolism or mechanical heart valve in any position • CHA_2DS_2–VASc score 5–9[Ω]	• VTE within the past three months or very strong family history • High risk thrombophilia: Deficiency of protein C, protein S or antithrombin III; homozygous Factor V Leiden mutation; antiphospholipid antibody syndrome; more than one laboratory thrombophilic defect (compound heterozygotes) • Two or more arterial or idiopathic venous thromboembolic events

[Ω]There is uncertainty with CHA_2DS_2-VASc scores 4–6 and an individualised approach may be required

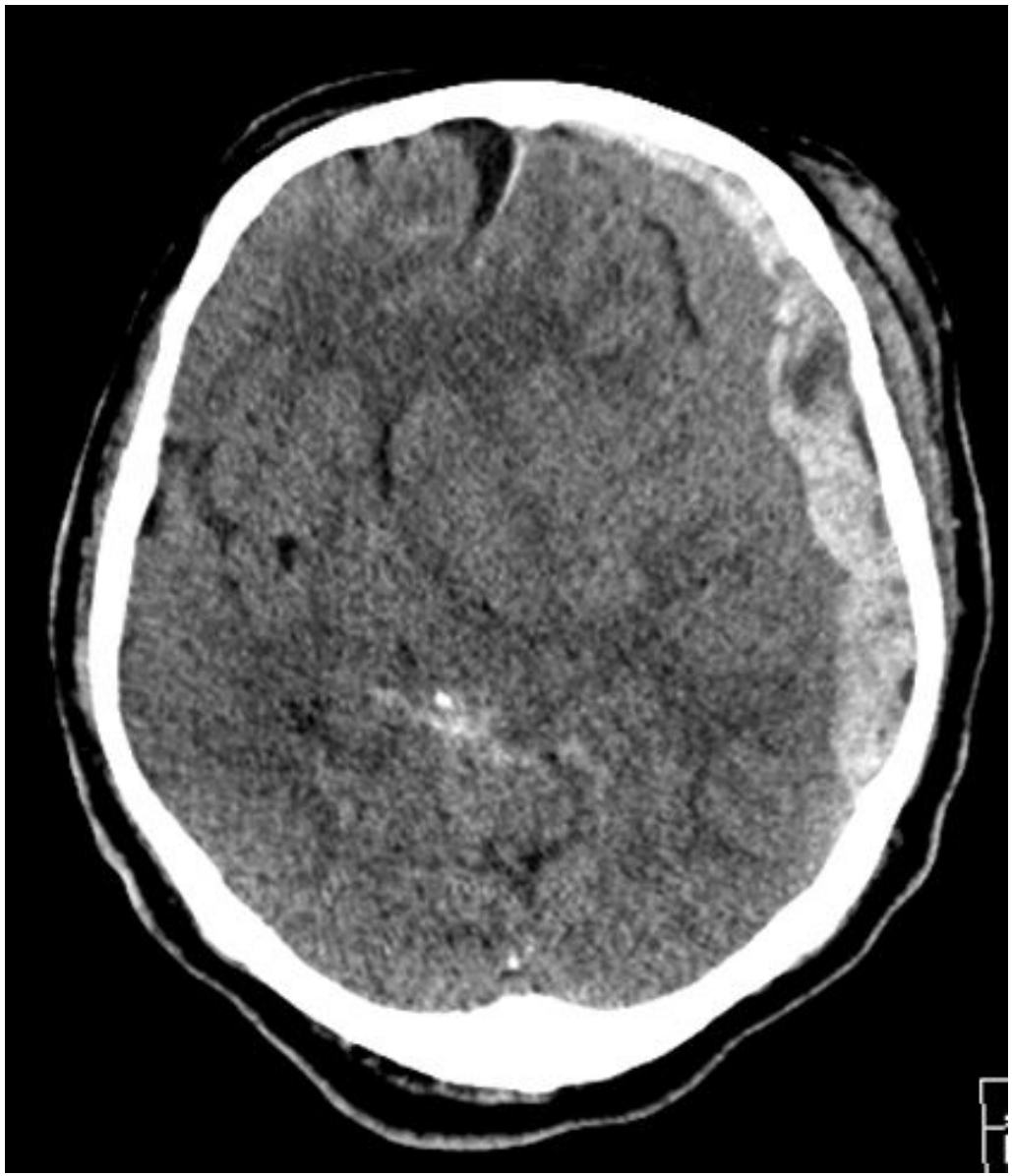
7. Managing warfarin therapy during invasive procedures

The decision to withhold, bridge and resume therapeutic anticoagulation in surgical patients should be made on a case-by-case basis in consultation with the surgeon, treating physician and anaesthetist, with careful consideration of the risk of thromboembolism and bleeding.

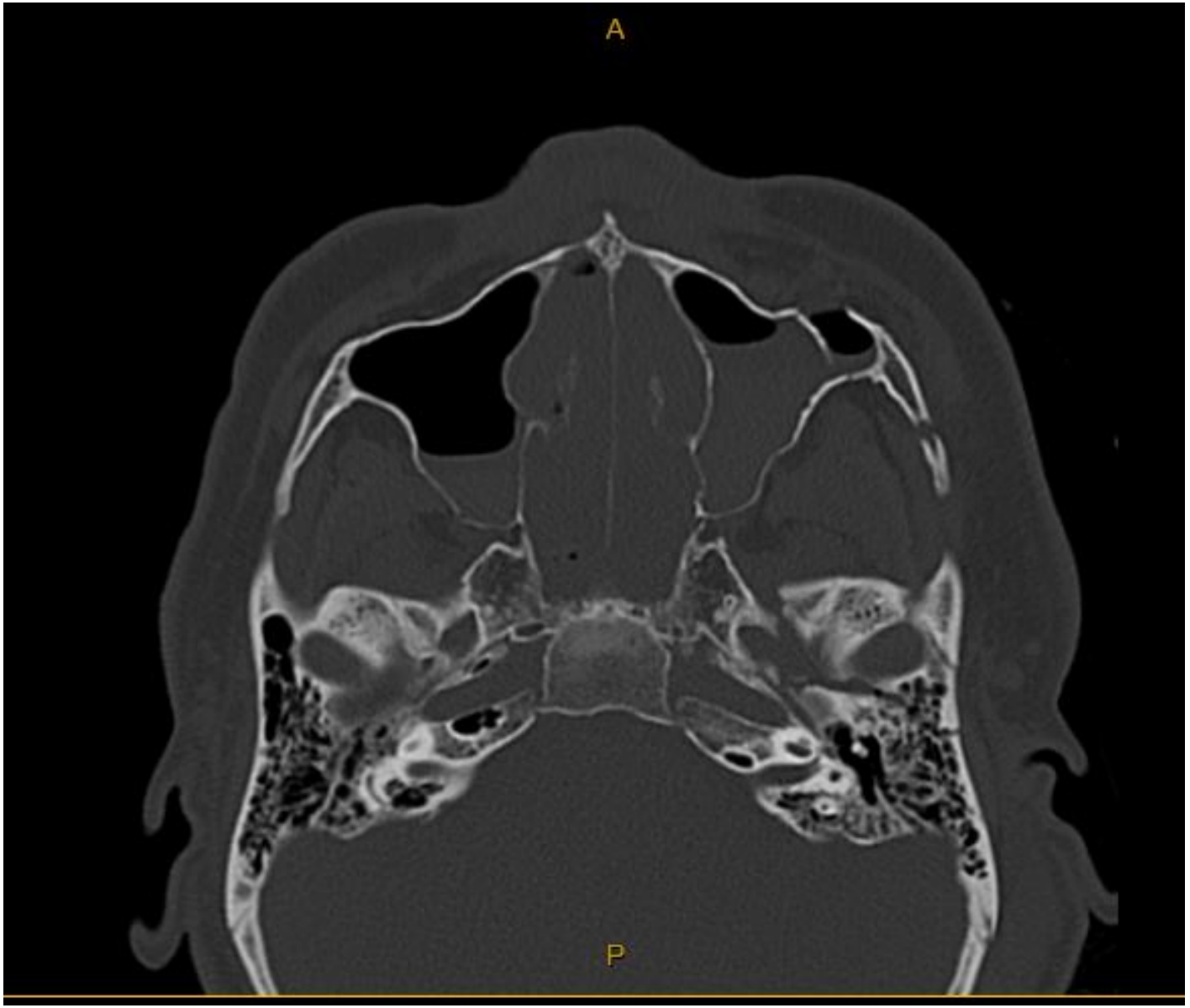
Thrombosis risk	Before surgery	After surgery
Low	• Withhold 4 daily doses of warfarin before surgery • Night before surgery: If INR greater than 2, give 3 mg vitamin K# IV or oral • Day of surgery: » If INR less than or equal to 1.5, surgery can proceed » If INR greater than 1.5, defer surgery or, if urgent give Prothrombinex™-VF 15–30 units/kg depending on initial and target INR or, if Prothrombinex™-VF not available, give FFP 10–15 mL/kg » Employ pre-operative thromboprophylaxis as per hospital policy	• Start warfarin on the day of surgery at the **previous** '**normal**' maintenance dose as long as there is no evidence of bleeding • Employ thromboprophylaxis as per hospital policy
Moderate to High	**Option 1: Planned surgery** • Withhold 4 daily doses of warfarin before surgery • 2 to 3 days before surgery: When INR is less than 2 commence treatment dose of LMWH* subcutaneously or UFH IV: » If using LMWH*, last dose should be given at least 24 hours before surgery » If using UFH IV, cease infusion 4 to 6 hours before surgery **Option 2: Planned surgery with stable INR in preceding weeks** • Night before surgery: If INR is stable at 2–3 in the 2 to 4 weeks preceding surgery, give 3 mg vitamin K# IV or oral • Day of surgery: » If INR less than or equal to 1.5, surgery can proceed » If INR greater than 1.5, defer surgery or, if urgent give Prothrombinex™-VF 15–30 units/kg depending on initial and target INR or, if Prothrombinex™-VF not available, give FFP 10–15 mL/kg **Option 3: Urgent surgery** • For urgent surgery, check INR before surgery and give Prothrombinex™-VF 15–30 units/kg depending on initial and target INR • For procedures with low risk of bleeding, warfarin may not need to be ceased	• Recommence warfarin as soon as possible at the **previous 'normal'** maintenance dose as long as there is no evidence of bleeding - DO NOT RE-LOAD • Consider bleeding risk against thrombosis • Start LMWH* or UFH 12 to 24 hours postoperatively: » If using LMWH*, begin with prophylactic dose » If using UFH IV, avoid bolus and aim to prolong APTT as recommended by your site • Consider delaying resumption of therapeutic LMWH* for 48 to 72 hours after major surgery • Continue LMWH* or UFH for minimum of 5 days and cease 48 hours after target INR is reached • In surgery with high risk of bleeding, consider using prophylactic dose LMWH* or UFH IV only and cease 48 hours after target INR is reached

v8.00 - 09/2017
Mat. No.: 10281951 OfficeMax No.: 4328582

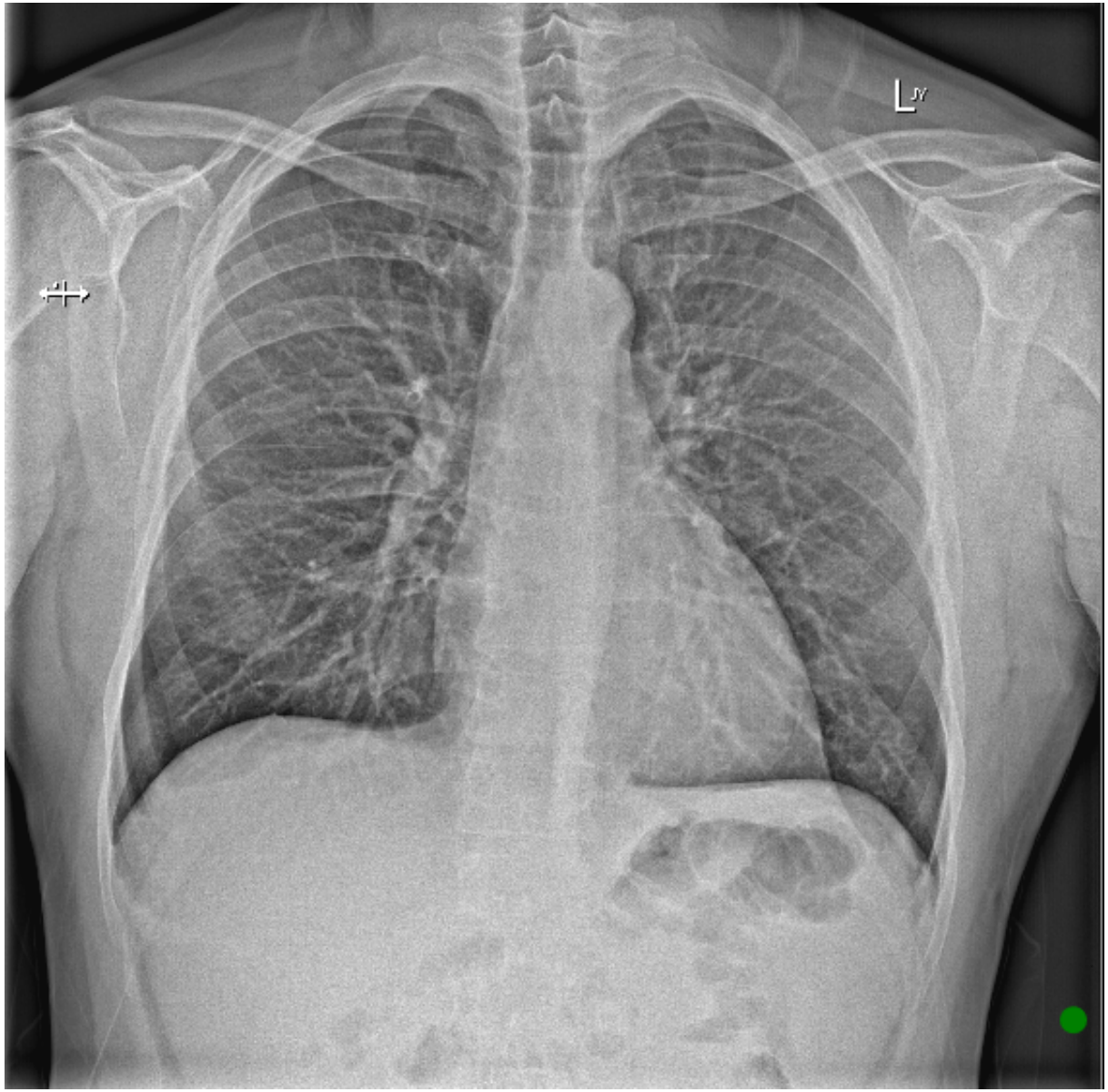
CT brain



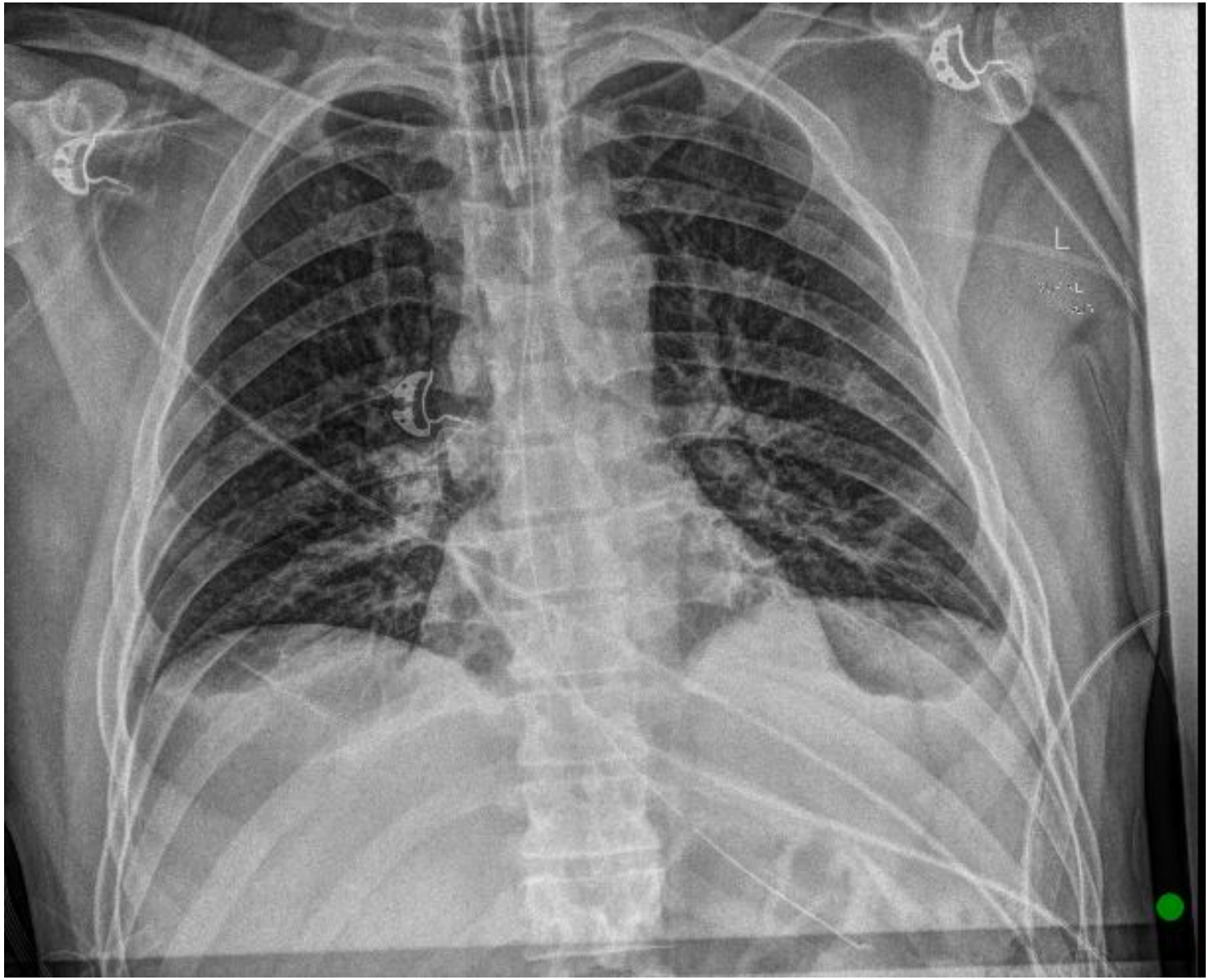
CT brain



CXR 1



CXR 2



VBG

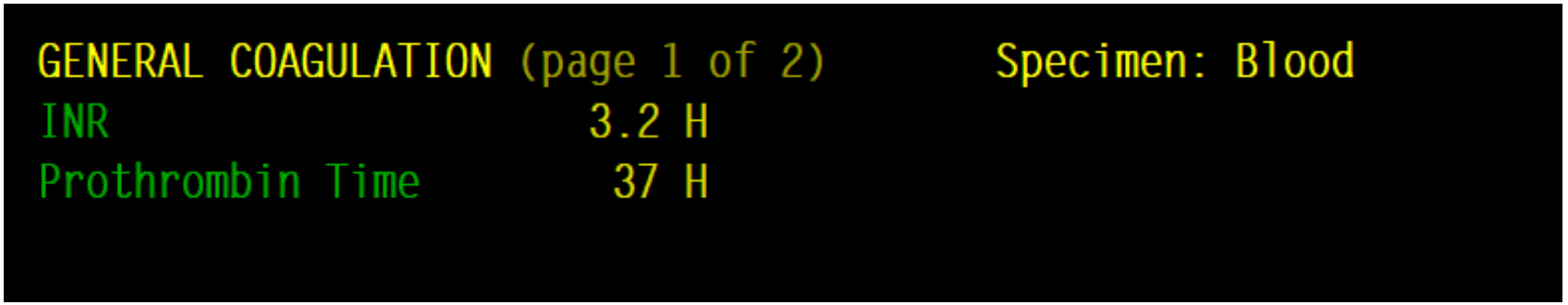
Venous			Temp.	37.0	Degree C	Na	141	mmol/L
Airway			Corr pH	7.41		K	3.9	mmol/L
FIO2	0.21		Corr pCO2	39	mmHg	Cl	108	mmol/L
pH	7.41		Corr pO2	38	mmHg	Anion Gap	9	mmol/L
pCO2	39	mmHg	Total Hb	108 L	g/L	Creatinine		umol/L
pO2	38 C	mmHg	Oxy Hb	66	%	Ca (Ionised)	1.16	mmol/L
O2 Sat.	67	%	Carboxy H	0.9	%	Glu	5.8	mmol/L
p50	29.6 H	mmHg	Met Hb	0.2	%	Lact	1.7	mmol/L
HCO3-	24	mmol/L	Sulph Hb					
ABE	0.0	mmol/L				Bili (Total)		umol/L
						Fetal Hb		%
Comp. Val.	Yes		MODE 1			MODE 2		

COMMENT:

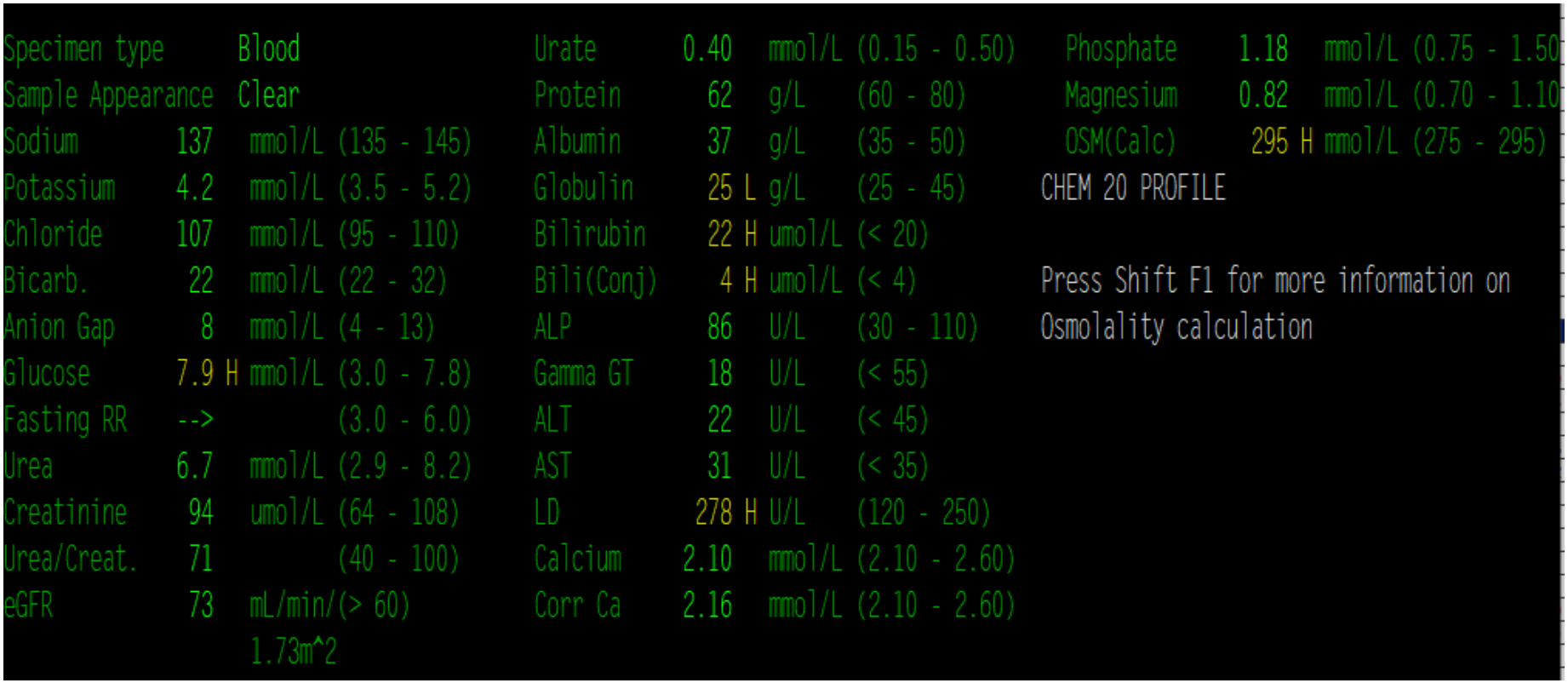
FBC

```
Diff: Automated    Specimen: Blood
Hgb :  113       WBC    :  5.8
PLT :  260               :
RBC : 4.16       HCT    : 0.37
MCV :   89       MCH    : 27.2 L
RDW :            MCHC   :          Press shift-insert to view reference ranges
Neut  ( 64  %):  3.68
Lymph ( 22  %):  1.27
Mono  ( 12  %):  0.66
Eosin (  2  %):  0.10
Baso  (  1  %):  0.04
NRBC          /100 WBC
```

Coagulation profile



Chem20



Specimen type		Blood		Urate	0.40	mmol/L	(0.15 - 0.50)	Phosphate	1.18	mmol/L	(0.75 - 1.50
Sample Appearance		Clear		Protein	62	g/L	(60 - 80)	Magnesium	0.82	mmol/L	(0.70 - 1.10
Sodium	137	mmol/L	(135 - 145)	Albumin	37	g/L	(35 - 50)	OSM(Calc)	295 H	mmol/L	(275 - 295)
Potassium	4.2	mmol/L	(3.5 - 5.2)	Globulin	25 L	g/L	(25 - 45)	CHEM 20 PROFILE			
Chloride	107	mmol/L	(95 - 110)	Bilirubin	22 H	umol/L	(< 20)				
Bicarb.	22	mmol/L	(22 - 32)	Bili(Conj)	4 H	umol/L	(< 4)	Press Shift F1 for more information on			
Anion Gap	8	mmol/L	(4 - 13)	ALP	86	U/L	(30 - 110)	Osmolality calculation			
Glucose	7.9 H	mmol/L	(3.0 - 7.8)	Gamma GT	18	U/L	(< 55)				
Fasting RR	-->		(3.0 - 6.0)	ALT	22	U/L	(< 45)				
Urea	6.7	mmol/L	(2.9 - 8.2)	AST	31	U/L	(< 35)				
Creatinine	94	umol/L	(64 - 108)	LD	278 H	U/L	(120 - 250)				
Urea/Creat.	71		(40 - 100)	Calcium	2.10	mmol/L	(2.10 - 2.60)				
eGFR	73	mL/min/	(> 60)	Corr Ca	2.16	mmol/L	(2.10 - 2.60)				
		1.73m^2									

Debriefing guide

Scenario objectives

- Recognition and management of severe TBI.
- Reversal strategy for anticoagulant therapy with TBI.
- Neuroprotective measures in TBI.

Example questions

Exploring diagnosis

- What clinical features were suggestive that intracranial pathology was present?
- What blood tests are useful to detect presence and effect of anticoagulants?
- Can discuss use of INR/PT, TT, aPTT, ECT, factor Xa levels.
- How does timing of dose affect management strategy? (If anticoagulant taken orally < 2 hours and patient able to swallow, may be a role for activated charcoal.)

Exploring management

- What are the indications for hypertonic therapy?
- What targets for blood pressure should be maintained in this scenario (BP 120-140mmHg)
- What specific reversal agents are available for Vitamin K antagonists (VKA) or DOACs (Direct Oral Anticoagulant)?
    - VKA- warfarin: Vitamin K, 4 factor Prothrombin complex concentrate (PCC) 50units/kg IV aiming INR <1.3 within 4 hours
    - DOAC: Rivaroxaban/Apixaban: Prothrombin complex concentrate (PCC) 25-50units/kg IV
    - DOAC: Dabigatran: Idarucizumab (Praxbind®) 2 x 2.5g IV bolus dose/ haemodialysis
    - Role of TXA less clear (Crash3), DDAVP may be helpful for platelet dysfunction
    - No role for Factor VII

Discussing teamwork / crisis resource management

- How was the decision regarding intubation made?
- What team members did you utilise for this process? How did you assign roles?
- What management priories/targets did you address with the team prior to intubation?

Acronyms and abbreviations

Term	Definition
TBI	traumatic brain injury
VKA	vitamin K antagonist
DOAC	direct oral anticoagulant
RSI	rapid sequence induction
INR	international normalised ratio
PT	prothrombin time
TT	thrombin time
aPTT	activated partial thromboplastin time
ECT	ecarin clotting time

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