

"List" = 1-3 words

"State" = short statement/ phrase/ clause

UNIVERSITY HOSPITAL, GEELONG FELLOWSHIP WRITTEN EXAMINATION

WEEK 28– TRIAL SHORT ANSWER QUESTIONS Suggested answers PLEASE LET TOM KNOW OF ANY ERRORS/ OTHER OPTIONS FOR ANSWERS Please do not simply change this document - it is not the master copy !

Question 1 (18 marks)

A 26 year-old man is brought to the emergency department by ambulance after a stated deliberate self-poisoning. He was agitated at the scene. He required significant police presence and force to transport to hospital.

En route to ED, he suffered a brief seizure which self-terminated.

- a. Other than methamphetamine, list five (5) likely deliberate ingestions that may be involved (each to be from a different drug classification). (5 marks)

- Anticonvulsants
 - Carbamazepine
 - Topiramate
 - Tiagabine
- Antidepressants
 - Tricyclics
 - Venlafaxine
 - Citalopram
 - Bupropion
- Antiarrhythmics
 - Quinidine
- Antimalarial
 - Quinine
- Chloroquine
- Hydroxychloroquine
- Antipsychotic
 - Butyrophenones
 - Phenothiazines
 - Olanzapine
 - Quetiapine
- Isoniazid
- Hypoglycaemic
 - Insulin
 - Sulfonylureas
- Local anaesthetic
 - Lignocaine
- Nicotine
- NSAIDS
 - Mefenamic acid
- Opioids
 - Tramadol
 - Pethidine
 - Dextropropoxyphene
- Propranolol
- Salicylates
- Sympathomimetics
 - Cocaine
- Theophylline

The patient remains handcuffed and agitated.

His vital signs are:

BP	200/110mmHg	HR	140 /min	RR	22/min	Temp	38.1°C	SpO2	98%RA
GCS	14 (V4)								
pH	7.25	mmHg				(7.35-7.45)			
pCO2	23	mmHg		(35-45)					
pO2	99	mmHg				(75-100)			
HCO3-	10	mmol/l				(22.0-33.0)			
Lactate	5	mmol/l		(0.7-2.5)					
Glucose	10	mmol/l				(3.0-7.8)			
Base Excess	-16	mmol/l				(-3-+3)			

- b. Provide two (2) calculations to help you to interpret these results. (2 mark)
Derived value: **Respiratory compensation Expected pCO2 = 1.5 x HCO3 + 8 = 23**
- c. Using the scenario and the derived values, define the primary acid/base abnormality/s. (2 marks)
- **Metabolic acidosis**
- d. Using the scenario and the derived values, define the secondary acid/base abnormality/s. (2 marks)
- **Respiratory alkalosis**
 - **Compensation as expected**

The patient is sedated and has 5 point restraint employed. A friend has presented and confirms that the patient self-administered a large dose of intravenous metamphetamine. His serum CK is 80,000. He develops a broad complex bradycardia with a heart rate of 30. His BP is now 70 systolic.

- e. State your interpretation of this clinical state. (5 marks)
- **Consistent with stated large Sympathomimetic OD**
 - **Rhabdomyolysis**
 - **likely associated ↑K - life threatening**
 - leading to BC bradycardia
 - from:
 - **prolonged agitation**
 - **pronounced activity**
 - **severe dehydration**
 - **renal impairment secondary to drug use.**
- f. List three (3) specific treatments that you would institute in the next 15 minutes. (3 marks)
- **Calcium: CaCl or gluconate**
 - **NaHCO3**
 - **Insulin& dextrose**
 - **Salbutamol**
 - **IV N Saline**

Question 2 (18 marks)

You have just assessed a patient for whom you suspect subarachnoid haemorrhage as a possible diagnosis.

- a. List the six (6) requirements for the correct application of the Ottawa Subarachnoid haemorrhage rule. (6 marks)
- **Alert**
 - **> 15 yrs old**
 - **New HA**
 - **Severe HA**
 - **Non traumatic HA**
 - **Maximum intensity < 1/24**
- b. List three (3) exclusion criteria for the application of the Ottawa Subarachnoid haemorrhage rule. (3 marks)
- **New neurologic deficit**
 - **Previous aneurysm**
 - **Previous SAH**
 - **Previous brain tumour**
 - **Hx recurrent HA (≥ 3 episodes over ≥ 6 months)**
- c. With regard to the Ottawa Subarachnoid haemorrhage rule, list four (4) high risk variables that suggest investigation is required. (4 marks)
- **Age ≥ 40**
 - **Neck pain/stiffness**
 - **Witnessed LOC**
 - **Onset during exertion**
 - **Thunderclap HA (instant peak to HA)**
 - **Limited neck flexion on examination**
- d. Under what circumstances (if any) can a negative CT Brain be used to exclude Subarachnoid Haemorrhage? . (5 marks)
- NB: see 2 pages over for explanation*
- **Alert/ GCS 15**
 - **Non traumatic headache**
 - **Peak intensity < 1/24**
 - **CTB performed < 6/24 from onset**
 - **CTB interpreted as normal by a Neuro radiologist**

SAH:

Development of a SAH Clinical Decision Rule

- 0. Use / Yield of Current Testing (N=891)
CJEM 2002
- I. Development of the Rules (N=1,999)
BMJ 2010
- IIa. Sensitivity of Early CT for SAH (N=3,123)
BMJ 2011
- IIb. Validation with Refinement (N=2,131)
JAMA 2013
- IIc. Distinguishing SAH from Traumatic Tap (N=1,739)
BMJ 2015
- III. Validation of Ottawa SAH Rule (N=1,140)
SAEM 2014

The Ottawa SAH rule

Phase 1 - 3 different rules were developed after looking at the clinical variables associated with SAH

Phase IIa establishment of the sensitivity of early CT for SAH and then

Phase IIb The Ottawa SAH rule was generated out of a derivation study which looked at the initial 3 different rules. Each rule (defined by the Ottawans in Phase I and utilising different variables- don't bother learning) was assessed for accuracy, reliability and acceptability to clinicians in a validation cohort of consecutive pts who were

≥16 yrs old + non traumatic HA + maximal intensity < 1/24

After comparing these 3 rules, the investigators refined the decision tool to combine 6 factors that were most predictive of SAH. The presence of any one of these 6 factors indicates that SAH is possible and ∴ → CTB

Classification Performance of The Ottawa SAH Rule
132 SAH Cases (N=2,131)

Rule	SAH	
	Yes	No
High Risk	132	1,694
Low Risk	0	305
Sensitivity	100%	(97.2-100)
Specificity	15.3%	(13.8-16.9)
NPV	100%	(98-100)
Investigate	85.7%	

Box 2. The Ottawa SAH Rule

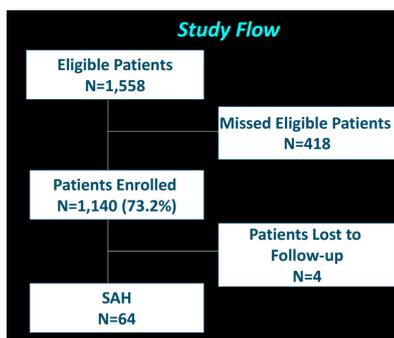
For alert patients older than 15 y with new severe nontraumatic headache reaching maximum intensity within 1 h

Not for patients with new neurologic deficits, previous aneurysms, SAH, brain tumors, or history of recurrent headaches (≥3 episodes over the course of ≥6 mo)

Investigate if ≥1 high-risk variables present:

1. Age ≥40 y
2. Neck pain or stiffness
3. Witnessed loss of consciousness
4. Onset during exertion
5. Thunderclap headache (instantly peaking pain)
6. Limited neck flexion on examination

Phase III Given that the final rule was a derivation tool (developed post analysis in Phase IIb), it required prospective validation- see the 2 left hand slides below. They then added the results from Phase IIb + III to get the final results in the right hand slide below.



Phase III: Prospective Validation of The Ottawa SAH Rule
64 SAH Cases (N=1,140)

Rule	SAH	
	Yes	No
High Risk	64	922
Low Risk	0	154
Sensitivity	100%	(94.3-100)
Specificity	14.3%	(11.7-15.6)
Investigate	86.5%	
Baseline CT Rate	87.1%	

Combined Validation of The Ottawa SAH Rule
196 SAH Cases (N=3,271)

Rule	SAH	
	Yes	No
High Risk	196	2616
Low Risk	0	459
Sensitivity	100%	(97.9-100)
Specificity	16.7%	(15.3-18.2)

My bottom line:

1. **This tool appears safe as a screenings tool (which remember is utilised for ruling out a serious diagnosis).** The absence of all 6 factors in an alert pt/ > 15 yrs / non traumatic HA/ maximum intensity < 1/24- effectively rules out SAH and they don't need a CTB.
2. **No change to scan rate:** It ONLY ↓ scan rate from 87.1% baseline to 86.5% (come on you can't tell me that's significant)...but maybe it helps you sleep at night or maybe it gives you a defence if you follow and don't CT and the pt has a subsequent SAH

SAH: -ve CTB only vs -ve CTB + -ve LP

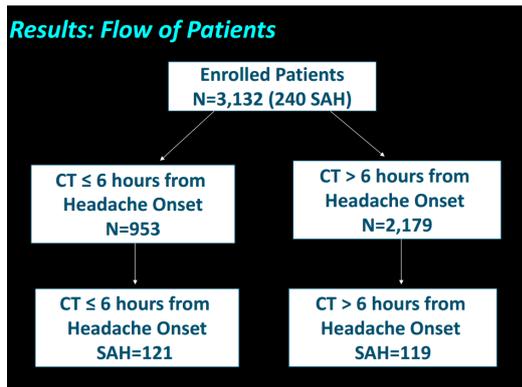
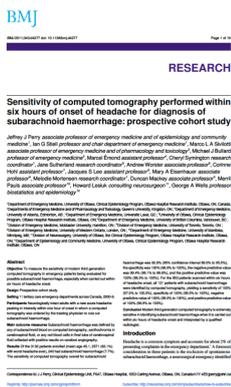
Much of the evaluation for SAH focuses on the non-contrast head CT, which has demonstrated increasing accuracy due to improved technology. Fifth generation scanners have sensitivities ranging from 93% to 100% depending on time from headache onset.

The diagnostic accuracy of head CT is limited in several scenarios. CT scanner quality, the interpreter, and image artifacts may limit the study. Patients with hematocrit < 30% may have blood that appears isodense. Patients with normal exams and smaller hemorrhages may not demonstrate visible bleeding on the non-contrast CT.

Ref BMJ 2011; Jul 18;343:d4277 Sensitivity of CT performed within 6/24 of onset of HA fo Dx of SAH: a prospective study

This newish literature has evaluated the non-contrast head CT scan alone in evaluating for SAH within 6 hours of headache first occurrence. The study evaluated > 3000 patients and the sensitivity of non-contrast CT within the first 6 hours of symptoms. This study included patients who were: > 15 yrs old/ alert= GCS 15/ HA atraumatic/ peaking < 1/24 and the use of at least third generation CT scanners. Final diagnoses were all made by neuro-radiologists.

The results of this study showed non-contrast head CT to have a sensitivity and specificity of 100% for acute SAH within 6 hours of headache onset. However, after 6 hours of onset of symptoms, the sensitivity of non-contrast CT fell to 85.7%.



Classification Performance Overall for 240 SAH Cases (N=3,132)

CT Positive	SAH	
	Yes	No
Yes	223	0
No	17	2,892
Sensitivity	92.9% (89.0-95.5)	
Specificity	100% (99.9-100)	

Classification Performance with CT≤6 Hours from Headache Onset for 121 SAH Cases (N=953)

CT Positive	SAH	
	Yes	No
Yes	121	0
No	0	832
Sensitivity	100% (97.0-100)	
Specificity	100% (99.5-100)	

Classification Performance with CT>6 Hours from Headache Onset for 119 SAH Cases (N=2,179)

CT Positive	SAH	
	Yes	No
Yes	102	0
No	17	2,060
Sensitivity	85.7% (78.3-90.9)	
Specificity	100% (99.8-100)	

NB: 3 Cts initially misDx by the ED as normal
 1 CT initially misDx by the XR as normal
 Timing of the 15 cases with negative CT & +ve LP were from 8/24 to 8 days
 Of these 15 cases, 5 required surgery

Similarly, a 2012 study found an initial non-contrast head CT within 6 hours of headache onset to have a sensitivity of 98.5% but excluding one atypical patient, the sensitivity of non-contrast head CT was 100%.³⁵ Presentations later than 6 hours should still receive a lumbar puncture if initial head CT is negative, as non-contrast head CT has only a sensitivity of 90% in these situations.³⁵

The **Bottom line:**

1. Large prospective study showed the sensitivity of CT in alert acute headache ED patients of ~ 93% (lower than expected)
2. Experienced neuro-radiologists (ie at least a Consultant radiologist here) should interpret all scans in real time
3. If CTB > 6/24 from HA onset → LP is required to R/O SAH
4. If CTB < 6/24 from HA onset → CT is sensitive enough to exclude SAH without an LP if normal neuro exam and as long as CTB reviewed by a Consultant radiologist. This pt has < 1% risk for SAH which is acceptable to stop investigation.

Click on the image below to view the entire PDF (& print/save if necessary)



Question 3 (12 marks)

A 26 year-old man is brought to your Emergency department after a fall from a pushbike. After full assessment he appears to have a closed, isolated left forearm injury.



- a. State four (4) abnormal findings shown in this xray. (4 marks)
- **Distal 2/3 radius #**
 - **100% offended- distal moved in ulnar direction**
 - **Spiral, comminuted**
 - **Dorsal angulation ~ 30°**
 - **Dislocated R/U jt- post displacement of radius**
- b. List four (4) examination features that would be consistent with compartment syndrome. (4 marks)
- **Pain on passive finger/ wrist stretching**
 - **Pain on active finger/ wrist stretching**
 - **Swollen compartments**
 - **Tender compartments**
 - **Consistent sensory changes**
 - **Consistent weakness**
 - **Impaired capillary refill (*rare*)**
 - **Pulse deficit (*rare*)**
 - **Increased intracompartmental pressures ($N < 10, > 30-40 = \text{emergency fasciotomy}$)**
- c. You diagnose compartment syndrome of his forearm. List five (4) steps in your management of this condition. (4 marks)
- **Remove POP/ External pressure**
 - **Analgesia**
 - **Elevation**
 - **Urgent orthopaedic review with view to fasciotomy**

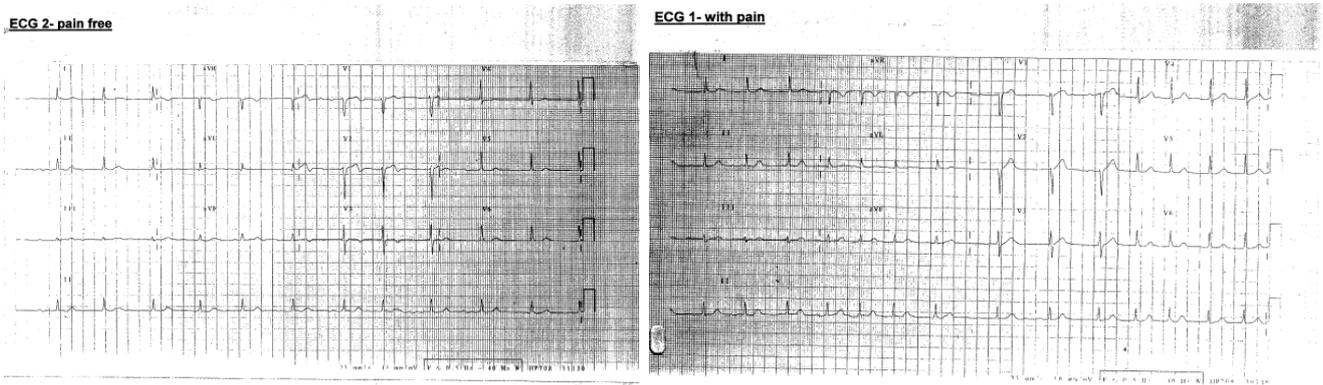
Question 4 (12 marks)

- a. List four (4) indications for the insertion of central venous line insertion in the ED. (4 marks)
- IV access- difficult/ impossible IV access
 - IV access- high volume fluid required
 - CVP monitoring
 - Infusions of irritant substances e.g. vasoactive agents
 - Renal replacement therapy, plasmapheresis and apheresis
 - Transvenous pacing
- b. List four (4) anatomical options for vascular access sites for vasopressor administration. For each site, state 2 reasons to choose this site. (8 marks)

Site (4 marks)	Reason to choose this site (4 marks)
Cubital Fossa	<ul style="list-style-type: none"> • Short term pending CV access • Difficult CV access
Internal Jugular vein CVC	<ul style="list-style-type: none"> • Relatively superficial large vessel compressible site • Lower infection risk than femoral line
Subclavian vein CVC	<ul style="list-style-type: none"> • More accessible than the neck • More reliable anatomy • Less likely to collapse
Femoral vein CVC	<ul style="list-style-type: none"> • More reliable anatomy • Accessible body region • Compressible site • No risk of pneumothorax • More suitable in non compliant patient
PICC line	<ul style="list-style-type: none"> • Can be placed via existing peripheral access • Relatively straight forward to insert • Probably less time consuming than central line • Lower risk of complications compared to CVC, • Can measure CVP • Can remain in situ longer term

Question 5 (12 marks)

A 64 year-old man presents to your emergency department with chest pain.



a. State five (5) points of significance of the abnormal findings in these ECGs. (5 marks)

- **Wellens' syndrome pattern**
- **Highly specific for a critical stenosis of the left anterior descending artery(LAD)**
- **Extremely high risk for extensive anterior wall MI within the next few days to weeks**
- **Due to the critical LAD stenosis:**
 - **invasive therapy required**
 - **do poorly with medical management**
 - **may suffer MI or cardiac arrest if inappropriately stress tested**

First described in 1982 by Professor Hein J. J. Wellens. The significance of it in a population that could otherwise be sent home from the emergency department is that stress testing as part of your further risk stratification is probably a bad idea. This ECG pattern is strongly associated with a widow maker lesion – with 100% of 180 patients with the pattern having >50% stenosis of the left anterior descending coronary artery (mean = 85%), with complete or near complete occlusion in almost 60%

Stress testing may prove fatal as there is usually minimal collateral circulation to a large part of the anterior myocardium. Once identified these patients need urgent / emergent angiography and intervention.

b. State the seven (7) diagnostic features of this condition. (7 marks)

- **Recent history of angina**
- **ECG pattern present in pain-free state**
- **Deeply-inverted or biphasic T waves in V2-3 (may extend to V1-6)**
- **Isoelectric or minimally-elevated ST segment (< 1mm)**
- **No precordial Q waves**
- **Preserved precordial R wave progression**
- **Normal or slightly elevated serum cardiac markers**

Question 6 (12 marks)

A 42 year old woman presents following a deliberate suicide attempt using carbon monoxide as a sole agent.

- a. List three (3) clinical features of carbon monoxide toxicity that you may observe in this patient. (3 marks)

- Headache
- Nausea/ V
- Dyspnoea
- SOB
- Angina
- Weakness
- Altered higher mental functions/ confusion
- Visual disturbance
- Tachycardia
- Seizures
- Arrhythmia
- coma
- Death

- b. List four (4) possible indications for the use of hyperbaric oxygen for this patient. (4 marks)

Any of the following if also can be commenced < 6/24 from exposure

- **COHB > 20%** (> 15% if pregnant or in children/ elderly)
- **Altered mental state not explained by another reason**
- **Unexplained metabolic acidosis (BE< -2)**
- **ECG evidence of myocardial toxicity**

NB: Dunn has a good summary of this topic/ these papers.

- c. State the major finding from the “Alfred Hyperbaric Oxygen study”. (1 mark)

- **HBO has no benefit in reducing cognitive deficit/ neuropsychological performance (and may cause harm)**

(MJA 1999 DBRCT prospective Hyperbaric vs normobaric oxygen)

- d. State two (2) criticisms of the “Alfred Hyperbaric Oxygen study”. (2 marks).

- **Specific Neuropsychological techniques used**
- **50% patients lost to follow up**
- **Group were severely poisoned**
- **Very high incidence of neurological toxicity cf other studies**
- **Practical limitations of 48/24 continuous 100% Oxygen**

- e. State the major finding from the “Salt Lake City Hyperbaric Oxygen study”. (1 mark)

- **Strong, significant benefit of HBO**

(NEJM 2002 DBRCT Prospective Hyperbaric vs normobaric oxygen)

- *Very vigorous methodology*
- *Very high follow up levels*
- *Trial stopped early by the safety monitoring committee after strong, significant benefit of HBO cf NBO cognitive complications at 6/52 25% vs 46% 6/12 21% vs 38%*

- f. State two (2) criticisms of the “Salt Lake City Hyperbaric Study”. (2 marks)

- **Unmatched groups at entry**
- **Only 1/3 were suicide attempts**
- **Many had prolonged CO exposure (eg wood heaters)**
- **Different patient population to Aus EDs**

Question 7 (12 marks)

A 50 year old man presents to your emergency department complaining of a red, hot, swollen, painful left knee. There is no history of trauma. He is systemically well. He has no significant past history and takes no medications.

a. List five (5) LIKELY differential diagnoses for this presentation. (5 marks)

- **Acute gout**
- **Effusion a/w OA**
- **Spontaneous haemarthrosis- 2° undiagnosed coagulopathy/ ↓Plt**
- **Septic arthritis**
- **Seronegative arthritis eg Psoriatic**

b. State two (2) reasons why you would perform arthrocentesis of this man's knee. Provide one (2) justification for each reason. (4 marks).

	Reason to perform arthrocentesis	Justification
1.	Diagnostic	<ul style="list-style-type: none"> • Only way to reliably exclude septic arthritis other than surgical exploration • Organisms- suggestive of bacterial septic arthritis • Urate crystals - gout • Other crystals- seronegative arthritis
2.	Therapeutic	<ul style="list-style-type: none"> • Removal of fluid will ease pain

c. List three (3) contraindications to performing arthrocentesis of this man's knee joint. (3 marks)

NB: Don't ignore "no significant PHx"- so he will not have had a TKR

- **Pt refusal**
- **Cellulitis overlying**
- **INR > 1.4 ("he takes no medications"- so he will not be on warfarin!)**

Question 8 (12 marks)

A 62 year old woman with a history of atrial fibrillation and hypertension presents with acute shortness of breath.

Her observations are: BP 65/34 mmHg HR 140 bpm Temp 36° C SaO2 not recordable

An image from her bedside ultrasound of the heart is shown below.



- a. List three (3) abnormal findings in this ultrasound in the setting of this scenario. (3 marks)
- **Large pericardial effusion**
 - **RV collapsed (As static image may be in diastole)**
 - **Thickened LV wall**
- b. List five (5) LIKELY causes for this problem for this patient. (5 marks)
- **Bleed secondary to anticoagulation**
 - **Malignant pericardial effusion**
 - **Traumatic pericardial effusion**
 - **Post pericarditis**
 - **Viral**
- c. List four (4) KEY steps in the management of this condition in this patient in the next 10 minutes. (4 marks)
- **Oxygen**
 - **Fluid bolus**
 - **Pericardiocentesis**
 - **Reverse anticoagulation**
 - **Notify cardiothoracics**

Question 9 (12 marks)

An 84 year old woman presents with a new onset left hemiparesis.

- a. State the two (2) therapeutic options that utilise interventional radiology. (2 marks)
- **Intra-arterial thrombolysis**
 - **Thrombectomy- “clot retrieval”**
- b. List three (3) possible indications for the use of interventional radiology for this patient. (3 marks)
- **Large vessel occlusion (especially basilar, internal carotid artery, M1 occlusion) as tPA poorly effective in large vessel lesion**
 - **Evidence of salvageable tissue on perfusion imaging within 4.5hrs after onset stroke**
 - **Functional independence before onset of stroke (modified Rankin Score < 2, NIH stroke scale between 4 - 24)**
 - **Thrombolysis contraindicated**

The patient undergoes thrombolysis. Standard consent procedures are followed. Shortly after thrombolysis is commenced, the patient suffers a haemorrhagic stroke that is confirmed on CT.

- c. List four (4) options for the reversal of thrombolysis.(4 marks)
- **Cryoprecipitate (10U IV)**
 - **Platelets**
 - **FFP**
 - **Aminocaproic acid**
 - **Tranexamic acid**
- d. List three (3) considerations/ factors that may lead to a decision to not reverse thrombolysis in this case. (3 marks)
- **Medical POA/ NOK/ patients wishes**
 - **Very large bleed with significant mass effect**
 - **GCS 3**
 - **Arrest**

This resource is produced for the use of University Hospital, Geelong Emergency staff for preparation for the Emergency Medicine Fellowship written exam. All care has been taken to ensure accurate and up to date content. Please contact me with any suggestions, concerns or questions.

Dr Tom Reade (Staff Specialist, University Hospital, Geelong Emergency Department)

Email: tomre@barwonhealth.org.au

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