

NSW TRIAL EXAM MARKING SCHEME (2018:1)

QUESTION 1 - Choking Child Question (10 marks) - Contact Person - Felicity Day

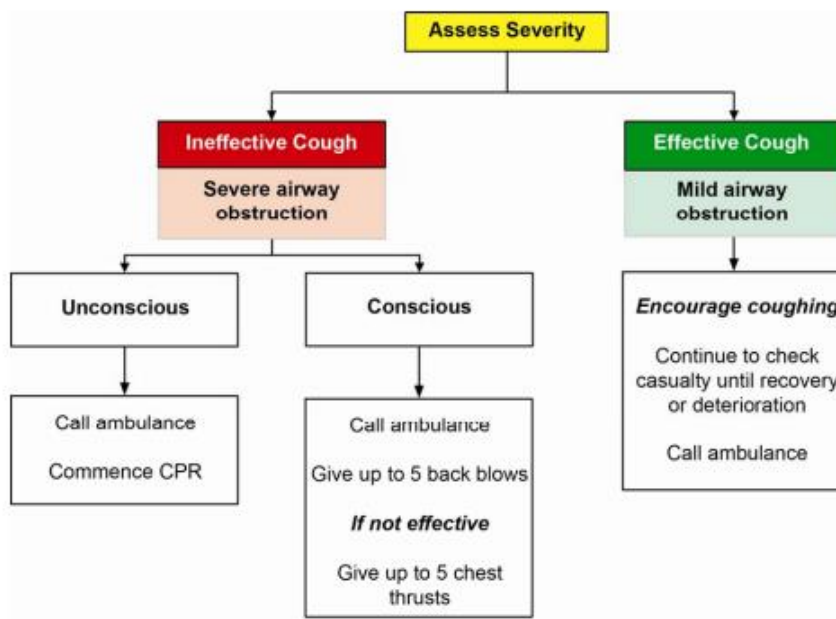
Marking Scheme

7 marks

- 1 for encourage coughing
- 1 for responsive or conscious
- 1 for unresponsive or unconscious
- 1 for 5 back blows
- 1 for 5 chest thrusts
- 1 for start CPR (15:2)
- 1 for reassess until recovery or deterioration



MANAGEMENT OF FOREIGN BODY AIRWAY OBSTRUCTION (CHOKING)



ii) 3 marks

- No signs of life / Start CPR 15:2
- Shock 4J/kg or 40 joules
- Adrenaline = 0.1ml/kg 1:10000 / 10mcg/kg / 1ml 1:10000

QUESTION 2 - Pneumothorax (13 marks) - Contact Person Kenny Yee

i) (1 mark)

- Left sided pneumothorax
 - (*Subtle pneumomediastinum present difficult to see, do not lose mark if stated)

ii) (3 marks) Accept any 3 of the following:

- Primary
- Secondary - asthma
- Trauma/Fracture Ribs
- Inhalation / insufflation / snorting and IVDU
- Collagen vascular disease, including Marfan syndrome

iii) (9 marks) table - accept any 3 of the following with reasonable advantage & disadvantage

- Conservative - this can include O₂ and observation
- Needle Aspiration
- Catheterisation
- Chest Tube

QUESTION 3 - DOUBLE - (23 marks) - Contact Person - Satish Mitter

i) (2 marks)

- **Supracondylar fracture (closed) 1 mark (mandatory)**
- Accept any of the following for 1 mark: fat pad sign / soft tissue swelling / dorsal angulation

ii) (6 marks)

	Ossification Centre	Age of Ossification
C	Capitellum	1
R	Radial Head	3
I	Internal (<i>medial</i>) Epicondyle	5
T	Trochlea	7
O	Olecranon	9
E	External (<i>lateral</i>) Epicondyle	11

iii) (2 marks)

- Ulnar n.
- Median n. (or Anterior interosseous n) - for 1 mark
- RADIAL NERVE LESS COMMON - not accepted

iv) (3 marks) - Will accept any analgesic that is used in the paediatric trauma setting as long as the route of administration and dose is correct.

Examples include but are not limited to:

Fentanyl IN or IV with correct dose (will only score 1)

Morphine IV

Oxycodone po

Codeine po etc

v) (10 marks)

	<i>Intra-muscular (i.m)</i>	<i>Intra-venous (i.v)</i>
<i>Initial dose</i>	<i>4-5 mg/kg</i>	<i>1.5-2 mg/kg</i>
<i>Top-up dose</i>	<i>2mg/kg (rarely needed)</i>	<i>0.5-1 mg/kg</i>
<i>Peak effect</i>	<i>5 min</i>	<i>1 min</i>
<i>Duration of action</i>	<i>20-30 min</i>	<i>5-10 min</i>
<i>2 Advantages Needed 1,2,3</i>	<i>IV not needed Longer effect No need for repeated doses</i>	<i>Ease of titration Shorter length of stay Lesser risk of emesis</i>

QUESTION 4 (10 marks) - Contact Person Rob Edwards and Andrew Coggins

MET-HB

i) VBG or ABG with **MetHB level (mandatory)**

- + Two of ECG, BSL, lactate, Reasonable Toxicological Blood panel
- + Mobile CXR accepted given low SATS
- + No Marks for Urine, non specific blood tests

ii) MET HB

- + G6PD Deficiency

iii) Methylene Blue IV

iv) One of Citric Acid, Exchange Transfusion or Hyperbaric O2.

High flow O2 not accepted

v) Local Anaesthetics, Nitrates, Nitrites, Aniline Dye, Dapsone, Acetone, GTN

QUESTION 5 - "Asthma Double Question" (23 marks) - Contact Person Felicity Day

Suggested answer:

Question i (4 marks)

- 1) Daytime symptoms \geq 2 days per week
- 2) Need reliever $>$ 2 days per week - increased use of bronchodilators reported by patient/carer
- 3) Any limitation of activities
- 4) Any symptoms during night or on waking
- 5) $>$ 3 or 3rd presentation to ED in 1 month
- 6) Prior ICU admission
- 7) Poor social situation / health literacy / concordance / compliance

1 mark for each point

Question ii (5 marks)

Must have asthma action plan

Should mention interpreter for full marks

1 mark for any of:

Reducing medication plan

Medications/scripts and able to buy medications

Preventer medication

Check spacer technique (with written and verbal education with interpreter) and has spacer

Education regarding asthma

Discharge instructions (medications/asthma plan/follow up and when to return to ED) with interpreter

Follow up appointment with respiratory physician

Written information if available in the appropriate language

Question iii (4 marks)

Pros and Cons of NIV in Asthma

NIV has a number of theoretical benefits in asthma:

- Extrinsic PEEP decreases the work of breathing by helping overcome Auto-PEEP
- Extrinsic inspiratory positive pressure (IPAP) may increase tidal volume by decreasing the work done against airway resistance
- Shorter inspiratory times may increase tidal volumes without causing any extra dynamic hyperinflation
- NIV may prevent intubation in a select group of patients
- Decreases WOB

NIV also has a number of theoretical disadvantages.

- May delay intubation
- Inappropriate settings may increase the effort of breathing
- Increased positive airway pressure increases risk of pneumothorax
- Barotrauma
- Addition of extrinsic PEEP which is higher than intrinsic PEEP will exacerbate dynamic hyperinflation
- NIV makes it more difficult to clear secretions if there is a strong infective component.

Question iv (6 marks)

	Setting	Rationale
Tidal Volume	6MLS/KG	Lung protective /reduce barotrauma
RR	10	Reduce gas trapping, permissive hypercapnia
I:E ratio	1:3 - 1:4	Reduce gas trapping/allow adequate time expiration

Question v (4 marks)

- **Must have dynamic hyperinflation to score full marks (or air trapping)**
- Tension pneumothorax
- Intubation drugs
- Anaphylaxis
- Myocardial depression
- Hypovolaemia

QUESTION 6 - MERS CoV - Contact Person - Geoff Mifsud (14 marks)

(i) 3 marks

(Obtained from Ministry of Health website)

Fever AND pneumonia/pneumonitis/respiratory distress AND

-Recent travel from affected countries in Middle East

-Contact within 14 days with symptomatic traveller from Middle East (fever + respiratory illness)

OR

Fever and respiratory illness AND within last 14 days

-Being in health care facility with known MERS outbreak

-Being in contact with camels within affected Middle east countries

OR

Fever OR acute symptoms of MERS and onset within 14 days of contact with confirmed MERS case

OR

Cluster of patients / healthcare workers with fever/severe acute respiratory illness of unknown aetiology

Mandatory: Must include respiratory symptoms AND recent travel/contact with suspected cases from Middle East (fever not included here as fever was included in stem. Fever will be marked correct though if listed as one of the symptoms)

Only 1 mark for any respiratory symptoms (so only 1 mark in total if mentions cough, coryzal symptoms, sore throat etc.)

Maximum 3 marks (if includes respiratory symptoms and contact with suspected cases (or camels) from Middle East)

If fails to mention respiratory symptoms and contact with cases/Middle East affected country, then maximum mark is 1

ii) 4 marks

- Disaster activation - *****MUST SAY for one mark**
- Isolate from other patients
- Negative pressure room if available
- Respiratory precautions (mask)
- Inform public health unit
- PPE protection of staff
- Contact tracing
- Prepare hospital for large numbers of potential MERS presentations (dedicated wards)
- Inform ID
- Arrange transfer to MERS facility (if available)
- Liase with lab staff to organise testing

*****MANDATORY:** Need to have at least one form of isolation (negative pressure/single room)

OR respiratory protection for other patients/staff.

Failure to note this will result in zero-mark rule apply for this section

(iii) 4 marks:

*****MUST have 'N95 mask'**

Plus three of the following:

- Appropriate hand hygiene
- Gown
- Gloves
- Airborne transmission precautions / Mucous membrane protection (respiratory / eye)
- Safe handling of waste and sharps
- Goggles
- Single Room / Barrier Nursing

(iv) 3 marks

*****Must have 'duty of care' or equivalent statement**

Potential infected with communicable disease - Public health risk until diagnoses confirmed

Assess for competency (hypoxia, hypoglycaemia, delirium from sepsis) à if compromised, restrain as

Duty of Care

Attempt verbal de-escalation

QUESTION 7 - Contact Person Amith Shetty - Sepsis (13 marks)

i) (3 marks)

qSOFA	
RR > 22bpm	0 = Mortality < 1%
sBP < 100mmHg	1 = Mortality 2-3%
Altered GCS	≥2 = Mortality ≥10%
Screening for outcome rather than diagnosis	

ii) (4 marks)

- A. **Time to antibiotics** within 60 minutes for patients with Sepsis (SOFA≥2), septic shock patients which essentially implies anyone with qSOFA and/or organ dysfunction
***** (Mandatory)**
- B. **Lactate** measurement and targeting lactate reduction in those who have an elevated as a serial marker
- C. **Blood cultures** before antibiotics (unless significant delay)
- D. **Governance** – Use of ‘sepsis management programs’ (“*Sepsis performance improvement programs should optimally have multi-professional representation (physicians, nurses, affiliate providers, pharmacists, respiratory therapists, dietitians, administrators) with stakeholders from all key disciplines represented in their development and implementation. Successful programs should include protocol development and implementation, targeted metrics to be evaluated, data collection, and ongoing feedback to facilitate continuous performance improvement*”)
- E. Early Empiric broad spectrum **Antibiotic** therapy for all sepsis patients (refer to local guidelines)
- F. **Procalcitonin (PCT)** in the Emergency Department (ED) finally gets look in. (From an ED perspective, patients who improve quickly after first dose of antibiotics and PCT normalises – antibiotics could be potentially be stepped down – great role for the sepsis workflow in winter and flu season).
- G. No mention of C-reactive protein anywhere in document
- H. **Fluid Challenge** for fluid resuscitation (rather than ‘drip’ method)
 - What fluid? The usual crystalloids first, albumin next (NO ‘GEL’ and NO SPECIAL COLLOIDS)
- I. **Fluid Volume** – up to 30ml/kg
- J. What about **Inotropes**? – Norepinephrine – Vasopressin – Dobutamine OR Adrenaline in that order...
- K. No routine use Steroids unless specific other indication(s)
- May need to check for other ‘reasobable answers’ – wide spread of responses

	History Features	Investigation Results
Finding 1	Age	Lactate *** (Mandatory)
Finding 2	Malignancy	Certain Blood Culture Results
Finding 3	Female Gender	Renal Failure (<eGFR)
	CCF	MRSA
	Recent Admissions	>INR
	Cirrhosis	<Plt
	Ventilated Patient	Rise in Bilirubin

NB Accept - comorbidities &/or immunosuppression (from any cause)

Table 1. Predictors of Increased Mortality in Sepsis Patients

- Cancer
- Heart failure
- Immunosuppression
- Cirrhosis
- MRSA infection
- Primary bloodstream infection
- Abdominal infection
- Pseudomonas* spp
- Enterococcus* spp
- Acinetobacter* spp
- Candida albicans*
- Older age
- Female gender
- Medical admission
- Greater disease severity
- Septic shock
- Mechanical ventilation
- Renal replacement therapy

MRSA: methicillin-resistant Staphylococcus aureus; spp: species.
 Source: References 1-3, 21.

Severe Sepsis	Septic Shock
All three must be met within 6 hours: 1. Documentation of a suspected source of infection 2. Two or more manifestations of SIRS criteria: a. Temperature >38.3 C/101 F or <36 C/96.8 F b. Heart rate >90 c. Respiratory rate >20 d. WBC >12 or <4 or >10% bands 3. Organ Dysfunction , evidenced by any one of the following: a. SBP < 90 or MAP <65, or a SBP decrease of more than 40 pts b. Cr >2.0 or urine output < 0.5 cc/kg/hour for 2 hours c. Bilirubin >2 mg/dL (32.4 μmol/L) d. Platelet count < 100 e. INR >1.5 or PTT > 60 f. Lactate >2 mmol/L 4. Or if a provider documents severe sepsis, r/o sepsis, possible sepsis, or septic shock	1. There must be documentation of septic shock present and 2. Tissue hypoperfusion persisting in the hour after crystalloid fluid administration, evidenced by: a. SBP < 90 b. MAP < 65 c. Decrease in SBP by >40 points from the patient's baseline d. Lactate ≥4 3. Or if the criteria are not met, but there is provider documentation of septic shock or suspected septic shock

QUESTION 8 - Wrist Fracture - Contact Person Hua Chang (14 marks)

i) Picture Description (2 marks)

- Grossly **deformed, swollen** left wrist consistent with **Colle's fracture** of distal radius +/- ulnar
- Obvious **dorsal angulation** of distal radius suggestion significant **fracture angulation and displacement** requiring urgent reduction
- **Skin breach with bleeding** over site of maximal swelling indicating **compound fracture** (accept any answer including highlighted words)

ii) Management priorities? (6 marks)

- **Analgesia**
(Specific treatment of the likely open Colle's fracture)
- Assess for **neurovascular** compromise, particularly median nerve
- XR followed by **urgent reduction** to minimise neurovascular compromise
- **IV A/B**, tetanus immunisation
- Splint/ immobilisation (dorsal & volar splint/ sugar tong splint)
- Referral to orthopedics for early ORIF in OT
(Causes and other complications of fall)
- Assess for precipitant/ contributing factors of fall- causes for syncope, ECG
- Management of open fracture:
 - Prophylactic Antibiotics
 - Tetanus Shot

NB - Reduction & Antibiotics are mandatory Mx priorities

iii) Complications (4 marks)

Acute

- median nerve injury
- compartment syndrome

Long term

- Malunion, radioulnar, radiocarpal instability
- Arthritis > weak, stiff and painful joint

iv) What are the signs of median nerve injury (2 marks)

- **SHORT TERM**
Pain, paraesthesia, numbness in median nerve distribution (first 3 digits and radial half of 4th digit)
- **LONG TERM**
Wasting of thenar eminence and weakness in thumb abduction

QUESTION 9 - Contact Person Jo Koryzna (12 marks)

i) 3 marks

	Causes of pneumomediastinum
MOST LIKELY	Oesophageal Perforation (Must be first)
Other cause 1	Valsalva / drug use
Other cause 2	Asthma / other lung disease (interstitial)
Other cause 3	Chest Trauma
	'Idiopathic'
	Carcinoma (Oesophageal), or other significant esophageal pathology

ii) 4 marks

- Aggressive management of septic shock with targeted antibiotics to cover sepsis from likely oesophageal/ git source. Need to include antibiotics and doses. Needs a betalactam + aminoglycoside combo. Examples include ampicillin 2g + gentamycin 7mg/kg OR Tazocin 4.5g + gent / or other combo like cef
- Fluid resuscitation to treat septic shock and restore haemodynamics ie 10-20ml/kg bolus / crystalloid targeted to some kind of end points like falling lactate or UO 0.5mg/kg/hr at a minimum
- Appropriate referral to surgical specialty such as Cardiothoracic for management of possible mediastinitis. (ie Source Control which will need Cardiothoracic team)
- Symptom control : antiemetics and analgesia. Doses please. Fentanyl drug of choice in view of septic shock and hypotension

iii) 5 marks

EDUCATION

- Use as educational opportunity for the individual and the group ie through quality / m & m meetings. **MUST INCLUDE POINT ABOUT SENIOR REVIEW IN SHORT STAY FOR ONE MARK**

REPORTING – To organisation – to patient

Use a mandatory reporting system for missed Xrays eg IIMS etc, TEL-RAD 'immediate reporting'

- **QUALITY** : address any systems issues - in terms of radiology reporting and the failure to communicate to ED critical results in a timely fashion

ED PROCESSES

Ensure x-ray reports are followed up & actioned routinely by ED. Roster for staff to review X-rays

- **EMR/TECHNOLOGY**

Explore capability in electronic medical record for notification of abnormal results with stakeholders from pathology and radiology

- **JMO SUPERVISION**

Ensure adequate senior supervision on the ED floor and implement real time review of imaging in the ED by a senior re CXRs

Question 10 - Dr Daya Jeganathan (14 marks)

Diagnosis	Clinical Examination Finding	Investigation
Myaesthesia Gravis	Fatigability (any) Ptosis	CT Thymus Tensilon Test Resp Monitoring
GBS	Hyporeflexia Ascending Weakness Miller Fisher Eye signs	Mostly Clinical by LP would show raised protein on most occasions
MS	Cerebellar Signs Hyperreflexia Optic Neuritis	MRI LP
Toxins accidental (Lead)	Evidence of other ingestions	Lead Level FBC and Film (Basophilic Stippling)
CVA (less likely NOT sudden onset)	Unilateral / Localising Signs	CT B MRI
DSH - Toxins	Various Toxins (Neuro)	Tox Bloods
Cord Problems - Syrxinx - Transverse Myelitis	Hyperreflexia Central Cord Findings Spasticity	MRI
Infection - Botulism	Global Weakness	Cultures

ii) Resp Monitoring

- Sats are incorrect - (less reliable)
- Serial Gases
- CO2
- Spirometry
- Peak Flow

QUESTION 11 - Blood Gas (Toxicology) - Double Question - Contact Dr Gopi Mann (22 marks)

i) 2 marks

- HAGMA
- Cannot calculate Osmolality
- Respiratory Alkalosis

Sodium	136	mmol/L ↕
Chloride	99	mmol/L ↕
Bicarbonate	14	mmol/L ↕
Albumin	40	g/L ↕

23.0 mmol/L Anion Gap	1.1 mmol/L Delta Ratio Suggests pure Anion Gap Acidosis Delta Gap: 11.0	23 mmol/L Corrected Anion Gap for Albumin High anion gap acidosis
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ii) 1 mark

WINTERS = Expected $\text{Co}_2 = 1.5 \times \text{HCO}_3 + 7 \pm 3$ - need to calculate - not just write 'Winters'

iii) State the three (3) MOST likely causes of the abnormal blood gas in this case (3 marks)

ACCEPTABLE

Methanol, Eth Glycol, Aspirin

Other reasonable toxins accepted (below) - Paraldehyde, Prop. Glycol, Isoniazid, Ibuprofen, Paracetamol, Iron

Qualified statement about 'atypical' sepsis accepted

Causes of a widened anion gap: CAT MUDPILES.

Cyanide or carbon monoxide
Acetaminophen (massive), aspirin, or alcoholic ketoacidosis
Toluene
Methanol, metformin, or massive overdoses
Uremia
Diabetic ketoacidosis
Paraldehyde or propylene glycol
Iron, isoniazid, or ibuprofen (massive)
Lactic acidosis
Ethylene glycol
Salicylates

UNACCEPTABLE

Unlikely - sepsis (without qualifier), CO, uraemia, DKA

iv) Textbook answer:

- The high lactate can 'mimic' ethylene glycol
- Lactate gap (difference between gas and lab values)
- Osmolar Gap

We can also accept ethylene glycol levels or ETOH levels (as they are not available on the gas)

v) 8 marks

Investigation	Justification
(1) Osmolality	(1) OG Calculation /Contribution
(2) Ethanol Level	(2) AS PER (1)
(3) Calcium	(3) Oxalic Acid COMplexes interacting with calcium leading to hypocalcaemia
(4) Creatinine	(4) Renal Failure from above, acid
Urine for Crystals	Oxalate Crystals

vi) 6 marks

Management	Justification
Ethanol via NGT 3-4 SD loading 1 SD per hour Aim 0.1% ETOH level	ADH inhibition Slow metabolism
Dialysis - CRRT - Intermittent Dialysis	Removes Toxic Metabolites Definitive Management Rx of Acidosis, Renal failure and Hyperkalaemia
Pyridoxine 50mg IV QID for 2 days	Cofactor in metabolism of glyoxylic acid
Thiamine 100-300mg IV TDS-QID for 2 days	As Pyridoxine
Fomepizole (ethanol substitute) 15mg/kg loading 10mg/kg every 12 hours maintenance for 4 doses	ADH inhibition (as ETOH)

QUESTION 12 - Contact Person Dr Rachel Boddy (15 marks)

I)

MUST SAY FOR ONE MARK - Hypoglycaemia

OTHER ANSWERS

- Hypoxia
- Intercurrent febrile illness eg CNS infection
- Head trauma
- Toxins
- Other Metabolic Causes

II)

Bedside –

BSL, ABG/VBG, ECG UA

– exclude hypoglycaemia, metabolic, toxin cause

Lab –

EUC, CMP, FBC ETC. – exclude metabolic and infective causes

Note - accept LP – if no focal neurology or altered mental status – and dx meningitis

Cultures

Imaging –

Neuroimaging – MRI – if focal neurology to suggest SOL or encephalitis

- versus's CTB (ALARA) if TBI

III)

Minimum to pass: administer an anticonvulsant (benzo or Dextrose (if hypoglycaemic))

- **Seek and treat the cause** – IV abi if meningitis, correct electrolytes etc
- **Stop the seizure** – terminate seizure with IV BDZ (midazolam 0.1mg/kg)
- correct hypoglycaemia with 2ml/kg 10% Dextrose
- IV phenytoin 20mg/kg over 20mins (will accept Leviteracetam)
- ABC - supporting airway and breathing, O2
 - Stop / prevent complications –ABCDE cares – avoid hypoxia, hypercapnia

QUESTION 13 - O and G - Contact Person - Dr Danielle Unwin

i) 3 marks:

1. Call for help – ‘O&G, paed’s’, either/or (**MUST SAY CALL FOR HELP)
2. Place patient in resus bed
3. Urgent assessment of patient (gather information, examination, USS)
4. Analgesia (Judicious)
5. Prepare for delivery - PPE, trolley, resus equipment

ii) 3 marks

Prematurity

- Uterine malformations
- Fibroids
- Polyhydramnios

- Placenta Praevia
- Foetal abnormalities
- Multiple gestations

iii) 2 marks

- Dry the baby - Provides stimulation to the baby to initiate respiratory effort
- Provide warmth to the baby
- Suction the baby’s mouth under direct vision, especially for meconium
- Provide positive pressure ventilation – avoid high concentrations of O₂ if possible
- Commence CPR if HR remains below 60

iv) 8 marks

Equipment Category	CANDIDATE SELECTION (2 marks per box)
Mother and Foetus – delivery	Episiotomy - LA, Scissors, cord clamps
Neonate resuscitation - General	<ul style="list-style-type: none">• Firm, horizontal, padded resuscitation surface• Overhead warmer• Light for the area• Clock with timer in seconds• Warmed towels or similar covering• Polyethylene bag or sheet, big enough for a baby less than 1500g birth weight• Stethoscope, neonatal size preferred• Pulse oximeter plus neonatal probe
NEONATAL RESUS A Equipment for airway management	<ul style="list-style-type: none">• Suction apparatus and suction catheters (6F, 8F, and either 10F or 12F)• Oropharyngeal airways (sizes 0 and 00) Intubation equipment: <ul style="list-style-type: none">o Laryngoscopes with infant blades (00, 0, 1)o Spare bulbs, and batterieso Endotracheal tubes (sizes 2.5, 3, 3.5, and 4 mm ID, uncuffed, no eye)o Endotracheal stylet or introducero Supplies for fixing endotracheal tubes (e.g. scissors, tape) <ul style="list-style-type: none">• End-tidal carbon dioxide detector (to confirm intubation)• Meconium suction device (to apply suction directly to endotracheal tube)• Magill forceps, neonatal size (optional)• Laryngeal Mask airway, size 1

<p>NEONATAL RESUS B Equipment for supporting breathing</p>	<ul style="list-style-type: none">• Face masks (range of sizes suitable for premature and term infants)• Positive-pressure ventilation device, either:<ul style="list-style-type: none">o T-piece device,or;o Flow-inflating bag with a pressure safety valve and manometer; ando Self-inflating bag (approximately 240 ml) with a removable oxygen reservoir• Medical gases:<ul style="list-style-type: none">o Source of medical oxygen (reticulated and/or cylinder, allowing flow rate of up to 10 L/min) with flow meter and tubingo Source of medical air plus air/oxygen blender• Feeding tubes for gastric decompression (e.g. size 6 & 8F)
<p>NEONATAL RESUS C Equipment for supporting the circulation</p>	<ul style="list-style-type: none">• Umbilical venous catheter (UVC) kit (including UVC size 5F)• Peripheral IV cannulation kit• Skin preparation solution suitable for newborn skin• Tapes/devices to secure UVC/IV cannula• Syringes and needles (assorted sizes)• Intraosseous needles
<p>Drugs and fluids</p>	<p>oxytocinon/syntocin IM/IV</p> <ul style="list-style-type: none">• Adrenaline (epinephrine): 1:10 000 concentration (0.1 mg/mL)• Volume expanders<ul style="list-style-type: none">· Dextrose• Normal saline

QUESTION 14 (15 marks) - Contact Person - Dr Khanh Nguyen

i) 2 marks

- Foul smelling rhinorrhoea / purulent discharge
- Unilateral epistaxis
- Unilateral nasal obstruction / mouth breathing
- Pressure necrosis
- Septal necrosis especially with battery or paired disc magnet foreign bodies
- Less specific – facial swelling and fever

ii) 3 marks

- Topical anaesthetic and vasoconstrictor applicator
- Suction (Frazier's)
- Airway trolley in the event of airway obstruction from bleeding or inadvertently pushing foreign body deeper*
- Optimise lighting with headlamp
- Nasal speculum
- Equipment necessary for removing object
- Appropriate PPE

iii) 1 mark

- Posterior FB not easily visualised
- Chronic or impacted FB with marked inflammation
- Penetrating or hooked FB
- Failure to remove in emergency due to poor cooperation, bleeding, limited instrumentation

iv) 9 marks

Technique	Advantage	Disadvantage
Direct instrumentation <ul style="list-style-type: none">- Forceps/ wire loops / right angle hooks / balloon catheter	<ul style="list-style-type: none">- Can be useful if object easily visualised and lying in anterior nares	<ul style="list-style-type: none">- May not be able to grasp object- May lodge object deeper especially if attempting to pass behind and remove from behind- May cause bleed / mucosal trauma

<p>Suction catheter</p>	<ul style="list-style-type: none">- Can assist in retracting object more anteriorly- Can remove blood/mucous	<ul style="list-style-type: none">- Noise from suction catheter can scare children- Suction may not be strong enough to remove lodged object
<p>Positive pressure technique</p> <ul style="list-style-type: none">- Occluding unaffected nostril and blowing - Air blown into mouth by parent - Oxygen applied at flow rate of 10-15L/min in unaffected nostril	<ul style="list-style-type: none">- Easy technique if child can cooperate, minimal risk of bleeding or trauma due to lack of instrumentation - Can be comforting for child “parent’s kiss” - Lack of instrumentation of affected side – less likely to push object in further	<ul style="list-style-type: none">- Child may not cooperate or understand instructions - Theoretical risk of disease transmission - Oxygen can be drying to nasal mucosa at high flow rates
<p>Miscellaneous</p> <ul style="list-style-type: none">- Cyanoacrylate glue - Magnets	<ul style="list-style-type: none">- Can be used on rounded structures e.g. beads - Can guide metallic objects out of nasal cavity	<ul style="list-style-type: none">- Mess with glue - Limited success with these techniques

QUESTION 15 (12 marks) - Contact Person - Dr Khanh Nguyen

i) 4 marks

- Immunisation status and pre-travel vaccination
- History related to the holiday: location of travel, high-risk activities such as diet, mosquito bites, sick contacts
- Occupation (child care worker, food handling)
- Elaborate on symptoms: pattern of fever, height of fever, night sweats, quality and quantity of stools, rash, petechiae or bleeding from any site, myalgia, headache, abdo pain etc.

ii) 2 marks

- Cultures: blood, stool, urine
- Malaria / Dengue
- CXR

iii) 2 marks

- IV ceftriaxone 2g daily OR
- IV ciprofloxacin 400mg q12h
- Patient has underlying bacteraemia, therefore IV therapy warranted
- Will accept PO azithromycin 1g on day 1 then 500mg daily for day 2-6 OR PO ciprofloxacin 500mg BD for 5-7days

iv) 2 marks

- Faecal oral route
- Requires isolation as may still have shedding in stools

v) 2 marks

- Ileal perforation due to inflammation of Peyer's patch. Will require surgical intervention and broader antibiotic cover for peritonitis.
- Relapse of typhoid fever 2-3 weeks post resolution of fever. Will require further course of antibiotics guided by susceptibility testing.
- Chronic carriage: excretion of organism in stool for more than 12 months after acute infection

NOTES for Question 15

EMERGENCY DEPARTMENT PRESENTATIONS OF TYPHOID FEVER

Hoffner, R.J., et al, J Emerg Med 19(4):317, November 2000

BACKGROUND: Typhoid fever is endemic in India, Asia, the Middle East, and Central and South America, and is caused by ingestion of food or water contaminated with *S. typhi*. Its relative obscurity in the U.S., coupled with nonspecific clinical findings, make it difficult to diagnose in this setting. The classic findings of fever with relative bradycardia (Faget's sign) and rose spots are encountered in fewer than half of cases. The efficacy of available vaccines has been reported to be variable. In the U.S., treatment of choice includes a ten- day course of a fluoroquinolone or a five-day course of a third-generation cephalosporin. High-dose dexamethasone is recommended by most experts for severe cases.

METHODS: The authors, from Los Angeles County/USC Medical Center, report on findings in a retrospective series of 21 patients aged 2-60 who were hospitalized with a final diagnosis of typhoid fever.

RESULTS: The U.S. was the country of origin for only three patients, and 14/21 reported recent travel to an endemic area. The most common findings included fever (15), headache (10), abdominal pain (9) and diarrhea (6). Only one patient exhibited rose spots. Associated bradycardia (less than 80/minute) was noted in 12/15 patients with fever. Initial WBC counts were normal in twelve patients. Transaminases were elevated in 10/17 patients tested, and 5/8 urine samples demonstrated proteinuria. Only three patients had an ED diagnosis of presumed typhoid fever. The diagnosis was confirmed by blood culture in 17/21 cases. The Widal antibody test was positive in 7/11 cases. Seven patients were started on a third-generation cephalosporin in the ED.

CONCLUSIONS: Typhoid fever should be considered in the differential diagnosis of febrile patients from Latin America or reporting recent travel to an endemic area

QUESTION 16 (12 marks) - Contact Person - Dr Kavita Varshney

i) In the following table state how the four (4) types of blast injury are caused (4 marks)

	Description
Primary	DIRECT FROM BLAST SHOCKWAVE
Secondary	FRAGMENT IMPACT (SHRAPNEL)
Tertiary	BODY THROWN INTO AIR BY WAVE/BLAST
Quaternary	ENVIRONMENTAL CONTAMINATION FROM DEVICE

ii) List four (4) important actions you would take, prior to arrival of the victims. (4 marks).

1. Activate "External Disaster" Code.
2. Inform hospital administration/ director/ public relations department
3. Clear all non-urgent patients from the waiting room
Admit all stable ED patients to wards
4. Set up a casualty reception triage area outside of the ED
5. Have decontaminating showers ready for no-urgent walking casualties.
6. Prepare Resus bay for urgently injured patients
Remove all unnecessary equipment
Plastic lining for floors
Plastic waste bags - double and labelled radioactive
7. Have ready personal protective equipment
8. Notify Hospital Radiation safety officer
9. Brief all staff on specific roles.

This is asking them to consider that there could be the possibility of a dirty bomb which is of course essential

1. Activate external disaster to notify all staff members / groups e.g. anaesthesia, icu, surgery, blood bank, pathology, radiology, theatres, media unit, executive
2. Prepare the ed for the influx of patients (send admitted patients to the ward, consider the waiting room patients, brief staff, allocate roles, create teams, request equipment, prepare the resus bay)
3. Consider that there may be chemical or radiological contamination of the bombs which will require, lockdown of ed, one way traffic flow, decontamination of patients, storage and handling of waste with double bagging and labelling, line floors with plastic
4. Triage the patients using disaster triage, with consideration of who will be performing the triage, where it will take place and what system will be used. The same triage system will be used for all patients presenting at the same time

iii) List the MOST likely injuries expected for each category of blast injury (4 marks)

	Likely Injuries
Primary	BLAST LUNG, EARDRUM RUPTURE, ABDOMINAL INJURY/PERFORATION, EYE INJURY
Secondary	PENETRATING BALLISTIC, EYE INJURY
Tertiary	FRACTURE, AMPUTATION, TBI,
Quaternary	BURNS, INHALED GASES

QUESTION 17 (15 marks) - Contact Person - Dr John Shirley, Reviews by Dr Kenny Yee

i) List three (3) recognised GENERAL uses of POCUS in the assessment of an adult patient in Cardiac Arrest (3 marks)

- CARDIAC - Cardiac Output, and Cardiac Standstill
- CARDIAC - Tamponade
- LUNGS - Tension Pneumothorax
- ABDOMEN - Free Fluid in Abdomen - trauma and AAA
- CHEST - Aortic Dissection
- CARDIAC/LUNGS - DVT, PE

ii) In the following table list eight (8) readily reversible causes of Cardiac Arrest (8 marks)

<u>Hypoglycemia</u>	<u>Tablets or toxins</u>
<u>Hypovolemia</u>	<u>Cardiac tamponade</u>
<u>Hypoxia</u>	<u>Tension pneumothorax</u>
<u>Hydrogen ions (acidosis)</u>	<u>Thrombosis (myocardial infarction)</u>
<u>Hyperkalemia or hypokalemia</u>	<u>Thromboembolism</u>
<u>Hypothermia</u>	<u>(pulmonary embolism)</u>

iii) For two (2) of the caused listed in Question (ii), list two (2) sonographic findings you would look for on your POCUS (4 marks)

Cause of Cardiac Arrest	SPECIFIC Sonographic Finding on POCUS exam
Tamponade	RV diastolic collapse, Effusion size
PTx	Sliding, Comet Tails (Absence), Pearl/Bead sign
Trauma / AAA	Free Fluid in FAST locations AAA, rupture
Hypovolaemia	Kissing Ventricle, IVC collapse/size
DVT/PE	Non compressible femoral vein, RV>LV, thrombus seen

QUESTION 18 (13 marks) - Contact Person - Dr Kavita Varshney

i) 3 marks

Stay safe, Call for help (000), Assist others

Don't enter dangerous environment

Call walking patients to gather together in a safe location

Plan METHANE call

NO MARKS - call local hospital, provide treatment to patients etc.

ii) 3 marks

Electrical Wires (could be live), other trains, Cliff faces, Heavy objects loose in wreckage (cars), train itself, slope, fuel, chemicals in cars, difficult access for EMS

iii) 7 marks

M	MAJOR INCIDENT	Has a major incident or standby been declared? (Yes / No - if no, then complete ETHANE message)	<i>Include the date and time of any declaration.</i>
E	EXACT LOCATION	What is the exact location or geographical area of the incident?	<i>Be as precise as possible, using a system that will be understood by all responders.</i>
T	TYPE OF INCIDENT	What kind of incident is it?	<i>For example, flooding, fire, utility failure or disease outbreak.</i>
H	HAZARDS	What hazards or potential hazards can be identified?	<i>Consider the likelihood of a hazard and the potential severity of any impact.</i>
A	ACCESS	What are the best routes for access and egress?	<i>Include information on inaccessible routes and rendezvous points (RVPs). Remember that services need to be able to leave the scene as well as access it.</i>
N	NUMBER OF CASUALTIES	How many casualties are there, and what condition are they in?	<i>Use an agreed classification system such as 'P1', 'P2', 'P3' and 'dead'.</i>
E	EMERGENCY SERVICES	Which, and how many, emergency responder assets and personnel are required or are already on-scene?	<i>Consider whether the assets of wider emergency responders, such as local authorities or the voluntary sector, may be required.</i>

QUESTION 19 - Toxicology - Contact Person - Naren Gunja

(i) 3 marks - ***Sequelae of poisoning***

1. Coma, reduced LOC
2. Seizures
3. Vomiting
4. Aspiration

(ii) 4 marks - ***Management Priorities***

- · **Ensure airway is protected and ventilation is maintained, if not, intervene with intubation and mechanical ventilation**
- **Check blood glucose level**

Contact Toxicologist or Poisons Centre

Observe in ED for > 4 hours (or overnight)

Apply monitoring – ECG, pulse oximetry

- Examine child, particularly:
 - o Neuro exam
 - o Airway and chest auscultation
- Prevent vomiting with anti-emetics (e.g. ondansetron 0.2 mg/kg)
- Check for aspiration – CXR
- Treat seizures with benzodiazepines (e.g. midazolam 0.15 mg/kg IV)
- If no evidence of aspiration, keep NBM for minimum 2 hours; trial of oral fluids after 2h, if alert and no further vomiting
- Does not need other pathology testing unless intubated or aspirated
- Confirm history – if non-accidental, refer to child protection services

(iii) 5 marks

- | | |
|-------------------------------|--|
| ● Agent(s) | ● Clinical features and progress |
| ● Dose(s) | ● Patient factors (weight and co-morbidities) |
| ● Time since ingestion | |

- For individual examiners to ammend as necessary

QUESTION 20 - Contact Person Dr Harry Elizaga (14 marks)

Your adult tertiary emergency department is planning to purchase a mechanical chest compression device and a new waveform capnography device.

- i) List three advantages and three disadvantages of mechanical CPR devices. (8 Marks)

Advantages:

- Decreases staff utilisation
- Minimises interruptions to CPR (once attached)
- Effective and consistent chest compression
- Portability during patient transfers

Disadvantages:

- De-skills providers
- Focuses on device attachment rather than effective CPR and early defibrillation
- Device displacement during compressions
- Blunt chest and abdominal trauma
- Device malfunction

- ii) What is the ANZCOR recommendation regarding use of a mechanical CPR device?
(2 marks)

- Does not suggest routine use
- Suggest that automated mechanical CPR devices are reasonable alternatives where sustained high quality CPR are impractical or compromise provider safety.

- iii) List 4 uses of waveform capnography in the resuscitation of a cardiac arrest resuscitation. (4 marks)

Any 4 of the following:

- Adjunct for prognostication (Failure to achieve $CO_2 > 10$ mmHg in 20 min is associated with poor outcomes)
- Identifies ROSC (by an increase in CO_2 value)
- Confirms tracheal position and displacement
- Assess the quality of chest compressions
- Ventilation rate monitoring

QUESTION 21 - Contact Person Dr Greg White (13 marks) - Quoted Source - Dunn page 1002 - 1003

(i) 5 marks

- MUST say **inconsistent mechanism**
- MUST say **Inconsistent or incomplete history**
- Delayed presentation(s)
- Chronic Disease or Developmental Delay
- Failure to thrive, Age of child VERSUS inappropriate injuries (as in this case Femur#)
- Socioeconomic Status / Blended Family
- Domestic Violence
- Single Parent, Family Dynamics
- Substance Abuse
- Foster Care
- Inappropriate interactions (e.g. child to parent(s))

(ii) 3 marks

- Soft Tissue
 - Any injury in 'non mobile' child of this age is a concern
 - Various Bruises
 - Various Ages
 - Circumferential Injuries
 - Usually NOT over bony prominences
- Burns
 - Cigarette burn
 - Immersion pattern on legs
 - Buttocks
 - Genital Areas
 - Hands
- Head Injury
 - Intracranial haemorrhage(s) - various - e.g. EDH
 - Retinal heamorrhage(s)
- Abdominal
 - Perforated viscus, solid organ injury

(iii) 5 marks

Management

- Two expectations demonstrating consultant level thinking are **MANDATORY REPORTING and DUTY OF CARE** (mom and child cannot leave)

******MUST SAY BOTH FOR 2 OF THE MARKS**

- Exclude other injuries, full trauma assessment +/- trauma call activation
- Treat Femoral Fracture - analgesia and consult Orthopaedics
- Jundicious Documentation and involve Social Worker early
- Offer / allocate support person to parent
- **Documentation - concerns (MUST SAY for 1 mark)**, call Child protection (local policy) Duty of care AND Act within the law
- Open disclosure VERSUS concern for abuse VERSUS need for divulge to parents need of reporting. Other reasonable management.

QUESTION 22 - Contact Person Dr Kevin Lai - Trauma (12 marks)

(i) 2 marks

- Wide Mediastinum (must say for one mark)
- Clavicle Fracture
- Left Rib fractures and Subtle S/C emphysema
- NO MARKS FOR:
 - No Chest tubes/apparatus
 - No SC Emphysema

(ii) 3 marks

- Haemorrhage (up to 4)
 - Femoral Fracture
 - Chest
 - Abdomen
 - Pelvis
 - NO MARKS FOR SCALP LAC OR EXTERNAL
- Neurogenic Shock (less likely in view of tachycardia and stem)
- Medication
- Aortic dissection/cardiac injury
- Anaphylactoid reaction following CT

(iii) **Massive transfusion** is **defined**, in adults, as replacement of >1 blood volume in 24 hours or >50% of blood volume in 4 hours (adult blood volume is approximately 70 mL/kg).

OR

>10 u in 24 hours, or persistent losses of >150ml/hour

(iv) state 5 potential complications of a massive transfusion (from liftl):

- a. volume overload
- b. hypothermia
- c. dilutional coagulopathy
- d. TRALI
- e. hyperkalemia
- f. disease transmission
- g. excessive citrate causing m. alk and hypocalcemia

QUESTION 23 - Contact Person Dr Jo Koryzna and Dr Mee Ling - 10 marks - Admin and Bullying

(i) 3 marks

- Ensure Chest Pain patient is safe *****MUST SAY comment in regards to 'safety'**
- Ensure Department is safe, handover to NUM/most senior doctors
- Ensure privacy (discussion in private setting)
- Take (secure) notes - *****MUST SAY**
- Aim for hot debrief - not appropriate to go into detail at this time
- Unlikely to be able to commit time to this straightaway - make a risk assessment of any risk / harm and if NO RISK - contract to have a further meeting and investigate

(ii) 3 marks

- Local Uni Dean and/or divisional heads in University
- Student's Mentor
- University Management
- Director of EM
- Contact with Hospital Executive
- Any patients that have affected by the interactions between the pair
- Potentially other students
- Other reasonable' stakeholders'

(iii) 4 marks

- Acknowledge complaint and its seriousness and provide support to the student (1)
- Inform the UNI that student may be traumatised by negative experiences (2)
- Gather information about behaviour from other staff ; 360 degree. Confidential (3)
- Approach the registrar and get their side of the story (4)
- Management plan for registrar: identify triggers and put in specific strategies addressing D and A/ stress/ burnout/ time frame for review/ advise behaviour is not acceptable (5)
- Minimise Bullying in the future AND education/orientation (Various strategies) (6)
 - Ensure all staff are aware of their obligations not to engage in Unacceptable workplace behaviour
 - Promote an anti-bullying workplace environment by their own conduct and Behaviour in the workplace
 - Ensure that information about what types of behaviours do, and do not, constitute unacceptable behaviour are communicated to all staff
 - Encourage and support staff in the self-resolution of conflict by providing training in conflict resolution
 - Provide a clear process for reporting unacceptable workplace behaviour
 - Ensure there is a process to rapidly respond to complaints related to unacceptable workplace behaviour
 - Ensure orientation of new staff informs them about the no bullying culture and about the department's anti bullying policy

QUESTION 24 (12 marks) - Contact Person - Dr Mee Ling

(i) 4 marks

Features Favouring Syncope:

- Rapid Neurological Recovery / no post ictal period
- No neurological symptoms
- Postural symptoms
- Pre-syncope symptoms
- An absence of seizure like movements

(ii) 8 marks

A. **MUST Say ECTOPIC PREGNANCY**

-positive FAST

B. Pericardial effusion +/- tamponade (autoimmune stuff can happen in the younger population

-bedside echo showing fluid/RA diastolic collapse

C. Aortic dissection (marfans in young)

bedside echo showing intimal flap

Bedside abdo u/s showing aortic hematoma

CT aortogram, CXR

D. PE

-bedside echo, ecg, ABG, CTPA

E. anything else that the marker thinks is reasonable

Other answers (BOLD FOR ACCEPTABLE)

- Cardiac - **MI, Dissection, Pericardial Effusion, Arrhythmia** (Brady or Tachy)
- Respiratory - **PE**
- Abdominal - Ovarian Torsion, AAA (unlikely)
- Neurological (CVA, **SAH**, Seizure)
- Other - Vasovagal, **Vertebral Dissection**/insufficiency, carotid sinus

QUESTION 25 - Measles with Prop - Contact Person Dr Shalini Arunanthy

(i) RASH differentials (3 marks)

- No marks for Measles, SLE, Dermatomyositis, HIV or Syphilis
- REASONABLE ANSWERS:
 - Rubella (Rubivirus)
 - Roseola (HHV 6)
 - Primary Herpes
 - Varicella (Chicken Pox)
 - Erythema Infectiosum (5th Disease) Parvo B19
 - Kawasaki Disease
 - Scarlet Fever
 - Drug Reactions, EM, SJS
 - Non specific Viral exanthem
 - Mycoplasma
 - Rickettsial Infection

LINK - <http://www.aafp.org/afp/2010/0315/p726.html>

(ii) History and Exam (6 marks)

History
Rash on D 3 – 5 of fever
Starts on face and spreads to rest of body
Unimmunised Contact history Outbreak of measles cough

Examination
Koplik's spots – D3
Conjunctival injection Coryza Looks toxic
Maculopapular rash cephalocaudal

(iii) 3 marks

*****MUST SAY "NOTIFY PUBLIC HEALTH"** or equivalent

- Check rest of family – contact and **immunisation status** / offer MMR/IG where appropriate
- History - Check for any **pregnant staff / high risk contacts**
- High risk contacts may need to be admitted and treated in a **single room** with **Measles IG**
- **Notify staff** who had contact with patient- immunisation if required/Staff Health/Infection control . Ensure we have all the appropriate **contact numbers** for family and staff
- **Educate** staff- patient should not have been in W/R, should have had resp isolation
- Advice to family about **isolation** - how long?
- Advice to family about **how to get help** after they leave the ED today

QUESTION 26 - Wound Care with Prop (14 marks) - Contact Person Dr Andrew Coggins

(i) 1 mark - Wound Dehiscence (Significant) - midline/paramedian laparotomy wound

(ii) 6 marks

Patient	Surgical
Age > 65	Too much wound tension
Infection	Inappropriate knot/technique
Diabetes/anaemia/malnutrition	Inappropriate suture material
Obesity /steroid use	Hematoma at surgical site
Increased abdominal pressure/coughing/vomiting	Foreign body
Emergency laparotomy	Knot was tied loosely
Perforated viscous /contamination	

(iii) 2 marks - should be fairly straight forward marks

- FBC
- PCT
- CRP
- Wound Swab
- Blood Cultures
- BSL / HBA1c

(iv) Wound Closure - 5 marks

Method	Pros	Cons
Tissue adhesive	Cosmetic results are as good as suturing. No difference in infection rate compared to suture Quick	Risk of Wound dehiscence Can not use deep or irregular wound or increased wound tension
Suture	Good wound approximation/less wound dehiscence	Time consuming/need local anesthetics/need suture removal
Steristrips	Easy to apply Quick Simple wound need approximation Allow drainage	Risk of Wound dehiscence Can't apply where tension/movement Need to keep dry 72 hrs
Staple	Speed	Cosmetic

Question 27 - Hypothermia - Contact Person Dr C De Alwis (13 marks)

(i) 3 marks - NO MARKS FOR J WAVES OR OSBORN WAVES

- 2nd Degree HB - Mobitz 2 (**MUST say for ONE mark**)
- LVH (severe)
- Borderline Wide QRS Complexes ?LBBB pattern
- LAD/ fascicular block
- Possible inf Q waves

(ii) 3 marks

- Ambient Temperature Increase and 'BARE hugger'
- Warm Humidified gas with ventilator
- Warm fluids (**MUST BE SPECIFIC ABOUT TYPE AND TEMPERATURE**)
- VA ECMO
- Bladder, Chest irrigation with warm fluids

(iii) 3 marks

- Depending on rhythm spend up to one min checking for signs of life (controversial)
- Change in the adrenaline interval, may withhold until temperature >30, double duration between drug if temp is 30-35 degrees
- Intubate sooner, rather than later
- Chest may be stiff -makes compressions harder, consider using LUCAS
- Prolonged CPR is indicated
- Early call for ECMO CPR

(iv)

Swiss Staging System

Table 2. Staging and Management of Accidental Hypothermia.^a

Stage	Clinical Symptoms	Typical Core Temperature [†]	Treatment
HT I	Conscious, shivering	35 to 32°C	Warm environment and clothing, warm sweet drinks, and active movement (if possible)
HT II	Impaired consciousness, not shivering	<32 to 28°C	Cardiac monitoring, minimal and cautious movements to avoid arrhythmias, horizontal position and immobilization, full-body insulation, active external and minimally invasive rewarming techniques (warm environment; chemical, electrical, or forced-air heating packs or blankets; warm parenteral fluids)
HT III	Unconscious, not shivering, vital signs present	<28 to 24°C	HT II management plus airway management as required; ECMO or CPB in cases with cardiac instability that is refractory to medical management
HT IV	No vital signs	<24°C	HT II and III management plus CPR and up to three doses of epinephrine (at an intravenous or intraosseous dose of 1 mg) and defibrillation, with further dosing guided by clinical response; rewarming with ECMO or CPB (if available) or CPR with active external and alternative internal rewarming

^a Hypothermia may be determined clinically on the basis of vital signs with the use of the Swiss staging system.³⁰ CPB denotes cardiopulmonary bypass, CPR cardiopulmonary resuscitation, and ECMO extracorporeal membrane oxygenation.

[†] Measurement of body core temperature is helpful but not mandatory. The risk of cardiac arrest increases as the core temperature drops below 32°C and increases substantially if the temperature is less than 28°C.^{12,13} To convert values for temperature to degrees Fahrenheit, multiply by 9/5 and add 32.

Brown DJ, Brugger H, Boyd J, Paal P. Accidental hypothermia. N Engl J Med. 2012;367(20):1930-8.

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