"List" = 1-3 words
"State"= short statement/ phrase/ clause

UNIVERSITY HOSPITAL, GEELONG
FELLOWSHIP WRITTEN EXAMINATION
WEEK 15– 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. Complete the table to **distinguish** between the clinical features of Guillain-Barré Syndrome and Multiple Sclerosis. (4 marks)

History	Guillain-Barré Syndrome	Multiple sclerosis
Age at onset		Typical onset : 20-40 yr old
Onset	Insidious Post infection/ Sx/ Immunisation/ malignancy	Episodic, relapsing, remitting
Distribution	Ascending motor paralysis Glove & stocking loss	Random, eyes often 1st
Limb pain	Passive movement/ calf pain common	Electric shock sensations in legs, worse with neck flexion
Visual disturbance	Opthalmoplegia rare	Optic neuritis Painful eye movements VA/ field defects
Cerebral Fx		Intellectual demise Seizures
Natural course	> 90% recovery	Stabilise & improve Progressive
Sex		Female : male 2:1

b. Complete the table to distinguish between the examination features of Guillain-Barré Syndrome and Multiple Sclerosis. (4 marks)

Examination	Guillain-Barré Syndrome	Multiple sclerosis
CN	50% facial n or bulbar	Common, esp eyes ION, RAPD
Cerebellar signs	Rare	May be present
Gait	weakness	Spastic
Tone	↓	↑ , clonus
Reflexes	↓ / flaccid (LMN)	↑ (UMN)
Autonomic	Common	Rare- sensory - Bladder dysfunction
Respiratory compromise	↓ FEV1 Respiratory support may be required	Rare

c. List the two (2) investigations of choice to assist with the diagnosis of Multiple Sclerosis. State two (2) diagnostic findings that are supportive of Multiple Sclerosis for each investigation. (6 marks)

Investigation of choice 1: **CSF examination**

Supportive findings:

- (90%) **< 10 cells/ml- T lymphocyte predominance**
- **Normal protein**
- **Iggy** (↑ in 80%)
    - **Oligoclonal bands** (85-90% of clinical MS)

Investigation of choice 2: **MRI Brain**

Supportive findings:

- **Subcortical and periventricular plaques** (50%)
- **Enhancement indicates activity/ resolves with remission**

d. Assuming the diagnosis of Guillain-Barré Syndrome, which drug must not be given if intubation is required? (2 marks)

- **Sux**
- **Precipitation of life threatening hyperkalaemia (**absolutely contraindicated in patients with GBS. There have been a number of case reports of severe hyperkalaemia, life threatening arrhythmias, and cardiac arrest after its administration in GBS)

e. List the two (2) options for treatment of Guillain-Barré Syndrome. (2 marks)

- **IV Immunoglobulin**
- **Plasmaphoresis (usually not both together, it's an either/ or)**

Guillain Barre Syndrome

- Commonest cause of rapid onset paralysis in previously healthy person.
- Both sexes. All ages
- Acute polyneuropathy 1-4 weeks post:
  - 70% post viral URTI/ gastro
  - Post operative
  - Post immunisation
  - Intercurrent malignancy
- Pathology→ neuronitis with myelin destruction and ∴ Wallerian degeneration of neurones

Clinical features

Sensory

- Initial paraesthesia in hands and feet → minor glove and stocking loss (sensory neuropathy is usually minimal)
- Posterior column vibration/ proprioception > spinothalamic

Motor

- Progressive ascending motor weakness affecting > 1 limb → distal mm weakness without atrophy (25% prox >distal)
- Areflexia/ marked hyporeflexia
- Limb pain on passive movement/ calf pain
- CN in ~ 50% → usually facial nn or bulbar (all except I, II, VIII, extra ocular mm rarely involved)
  - Miller Fischer variant has predominant CN involvement

Other

- No fever/ neck stiffness, normal mental state
- Autonomic dysfunction
  - Bad prognostic indicator
  - Very sensitive to cardiac drugs → may arrest on intubation
  - Ileus, retention, assoc. SIADH

Investigations

Dx

- CSF protein ↑ in 90% > 0.4g/l
- CSF count normal
- FET → monitor progress

Tx

- ABG
- RFT
- Exclude other causes

Management

- CVS, Resp support
- SUXAMETHONIUM ASSOCIATED WITH SUDDEN DEATH
- Nutrition → enteral, parenteral
- Plasmaphoresis
  - Superior to supportive alone
  - Best if commenced < 7 days after onset
  - ↑ speed of recovery
  - No change to ultimate mortality
- Immunoglobulin Rx
  - Probably as useful as plamaphoresis

Prognosis

- Good → most full recovery
- Worse prognosis if : - autonomic involvement
  - deficit not ↓ in 3/52
- 2% mortality → resp. failure
- 10% major residual deficit

DDx of acute ascending motor paralysis

- Rhabdomyolysis
- Tick/snake bite
- Diphtheria/ polio/ botulism
- PAN

DDX autonomic neuropathy

- DM
- ETOH
- Amyloid

Multiple sclerosis

- Commonest chronic neurological condition
- Onset 30- 40's, 60% F
- 20% asymptomatic through life
- Higher incidence in Tas, lower as go north in Aus
- Pathology → Extensive white matter plaques, loss of oligodendrocytes, axonal sparing
  Conduction disturbed by fever, stress, electrolyte imbalance (loss of suppressor T cells b4 attacks)

Clinical features

- Episodic attacks of focal neurological deficit → sensory, motor or sphincter
- Predilection for spinal cord, brain, optic nerves
- Over 2- 14/ 7 then remission
- ~ ½ present as single sign or symptom
- Common → limb weakness, optic neuritis (pain wit eye movements, ↓ VA), sensory symptoms, diplopia

1. **Spinal cord** → **commonest manifestation**
   - limb weakness in 40%, UMN signs (spastic gait,↑ tone, clonus, ↑ reflexes), post column loss
   - painful spasms
   - bladder dysfunction, constipation
   - Lhermittes sign → painful electric shocks down legs ↑ by neck flexion
2. **Optic neuritis** → 40% at some stage, presenting symptom in 20%
   Significant pain with eye movement is present in nearly every case of demyelinating optic neuropathy
   - VA over days, central scotoma, usually unilateral
   - disturbed colour perception early sign
   - visual field defects
   - pain on eye movement
   - Ex: 50% papillitis on fundoscopy, relative afferent pupilliary defect
   - 40% go onto MS
   - 1/3 completely recover, partially, not at all
   - Uhthoff's phenomenon → ↓ vision dt exercise, hot meal/ bath
3. **Brainstem** → common
   - Diplopia, III, IV, VI CN lesions
   - Internuclear opthalmoplegia almost Dx of MS or SLE
     Abno of MLF → ipsilateral adduction inability, contralateral lat. gaze nystagmus
   - Bell's palsy
   - Vestibular neuronitis → vertigo, vomiting, nystagmus
   - Cerebellar signs
4. **Cerebral** → Intellectual demise
   - Depression
   - Seizures ~ 5%
   - Rare → dysphasia, hemiparesis, homonymous hemianopia

Diagnosis

- Involvement of different parts of nervous system, 2 separate occasions, lasting > 24/24 or slow progression over 6/12
- Requires 2 anatomically separate lesions
- Delayed visual/ auditory/ somatosensory evoked potentials
- LP → 90% < 10 cells/ml, mainly T lymphocytes, ↑ IgG, protein normal
- MRI → detects demyelinated areas, subcortical and periventricular plaques visualised in 50%
  Enhancement indicates activity of disease

DDx

Eye
- Retinal a/v occlusion
- Optic nerve glioma
- Methanol ingestion

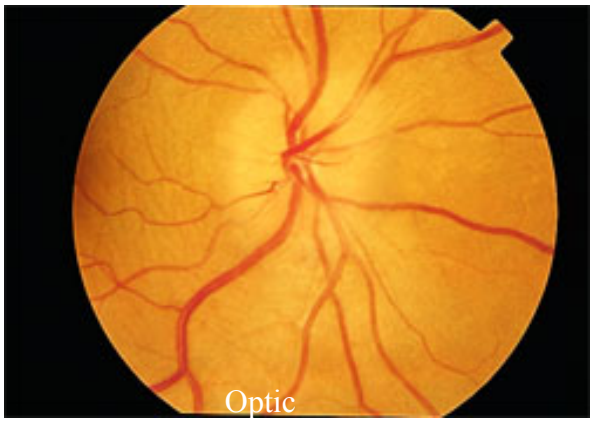
SC disease
- Cx spondylosis
- Subacute degeneration

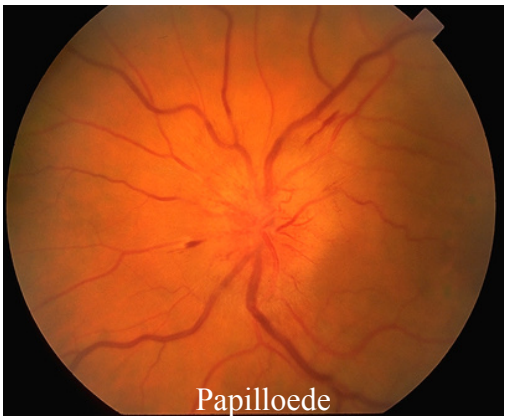
Cerbral
- Hereditary ataxias
- SC compression
- HIV
- Posterior fossa SOL
- SLE
- Sarcoid

Mx

- Acute → high dose methyl pred, ACTH 80U, PNL
- Prevent relapses → Azathioprine, cylophosphamide, interferon, plasmaphoresis
- Symptomatic → baclofen for spasms, carbamazepine for pain, urinary catheter, bowel training

Optic neuritis





- Mono-ocular vision changes, especially in a young female should prompt you to thinking about this condition.
- Optic neuritis (decreased visual acuity, relative afferent pupillary afferent defect) can easily be mistaken for papilledema (visual acuity and pupillary reflexes are normal)
- Making the diagnosis can be difficult in that the majority of patients may actually have a normal fundoscopic exam but give a classic history for "retrobulbar neuritis" (vision changes and pain especially with eye movement).

- The clinical presentation of demyelinating optic neuropathy varies.
- Patients frequently present to the ED with an acute loss of vision.
- The natural history of MS-related vision loss is rapidly progressive acuity loss for a period of 10 days, which then stabilises and improves.
- Additional ocular signs include eye pain, tenderness of the globe, dyschromatopsia, decreased brightness sense, decreased colour perception, a relative afferent pupillary defect, assorted visual field defects (altitudinal and central/cecocentral), phosphenes upon eye movement and optic disc swelling with or without vitreous cells. Often, the optic nerve is normal in appearance and the dysfunction is considered retrobulbar.
- Demyelinating optic neuropathy can damage the fibers in both the visual and pupillary pathways. This damage interrupts nerve impulses within the pathways, producing decreased vision as well as an afferent pupillary defect.

- Systemic signs and symptoms may include headache, nausea, Uhtoff's sign (decreased vision with or without limb weakness following exposure to increased temperatures i.e., a bath or exercise), Romberg's sign (patient falls when they close their eyes), Pulfrich's stereo phenomenon (beer barrel appearance to the environment) and fever.

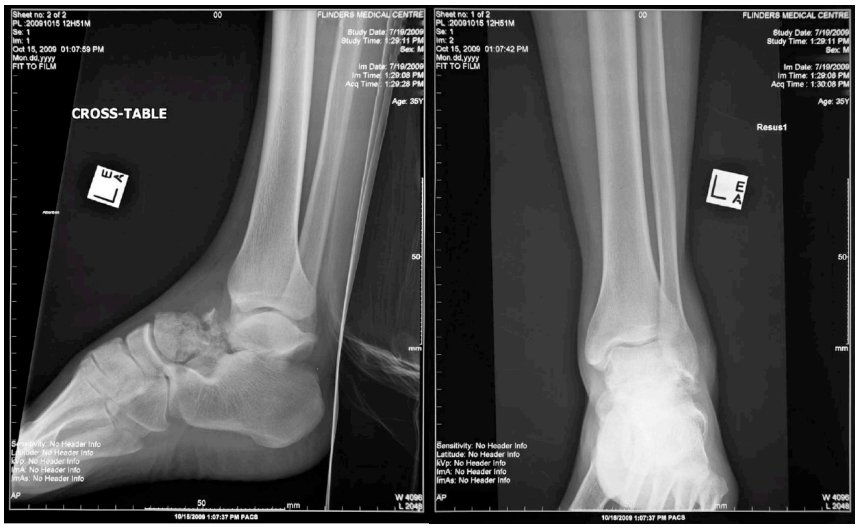
- As recorded in the three-year follow-up of patients Rx with intravenous methylprednisolone followed by oral corticosteroid regimens reduced the two-year rate of development of clinical MS, particularly in patients with signal abnormalities consistent with demyelination on MRI of the brain at the time of study entry. Serious side effects of glucocorticoid therapy are infrequent. Therefore, outpatient administration of high-dose intravenous glucocorticoids may be recommended.

Clinical Pearls

- A number of other types of demyelinating disorders have been associated with ON.
  They are: acute transverse myelitis
  Guillain-Barré syndrome
  Devic's neuromyelitis optical
  Charcot-Marie-Tooth syndrome
  multifocal demyelinating neuropathy
  acute disseminated encephalomyelitis.
- Diseases such as syphilis, toxoplasmosis, histoplasmosis, tuberculosis, hepatitis, rubella, human immunodeficiency virus (HIV), Lyme borreliosis, familial Mediterranean fever, Epstein-Barr virus, herpes zoster ophthalmicus, paranasal sinus disorder, sarcoidosis, systemic lupus erythematosus, Bechet's disease, and diabetes may cause optic neuropathy and should be considered before prematurely diagnosing demyelinating optic neuropathy.
- In cases of optic neuropathy presumably secondary to demyelinating disease, MRI can assist in systemic diagnosis by identifying both old and acute demyelinating plaques within periventricular white matter.
- Significant pain with eye movement is present in nearly every case of demyelinating optic neuropathy.
- As the visual dysfunction is due to autoimmune destruction of myelin and not direct inflammation of the optic nerve tissue, this disease entity is best termed demyelinating optic neuropathy.

Question 2 (11 marks)

A 35 year old man is brought into your emergency department after an isolated injury to the left ankle sustained in a motor cycle accident. His obs are: BP 160/50 mmHg supine HR 110/min GCS 15



a. State (4) features shown on this xray that suggest a severe injury. (4 marks)
   - **Complete # through the neck of talus**
   - **Severe comminution of talus**
   - **Separation of the major fragments > 1 cm**
   - **Marked anterior displacement of distal fragment**

   NB: not dislocation/ subluxation as ankle joint is intact

He is delivered by ambulance and has received only penthrane enroute. He does not have intravenous access on arrival. He is extremely distressed with pain. He last ate 2 hours ago. His weight is 70 kg.

b. List seven (7) analgesic options for this patient while he is in the emergency department. Include doses and routes where applicable. Include initial doses and route where appropriate. (7 marks)
   - **Initial options:**
     - **IM ketamine 3-5 mg/kg**
     - **IN fentanyl 1 mcg/kg**
     - **N20**
   - **IV morphine- 5-10mg**
   - **Sedation for reduction:**
     - **IV ketamine 1-1.5 mg/ kg**
     - **IV midazolam 3-5 mg**
   - **Reduction/ immobilisation**
   - **Elevation**
   - **Ankle block 10-20ml x 0.5% plain bupivacaine**
   - **PCA**
   - **Oral oxycodone/paracetamol**

Question 3 (12 marks)

A 65 year old female, non- English speaking, Italian lady presents with about 1 cup of haemoptysis. You are unable to obtain any medical history. Her observations are: BP 135/65 mmHg HR 80/min GCS 15

a. List four (4) likely differential diagnoses for this presentation. (4 marks)
   - **TB**
   - **PE**
   - **Pneumonia - severe with infarction**
   - **Lung Ca- primary/ secondary**
   - **Pulmonary abscess**
   - **Coagulopathy/ over anticoagulation**
   - **Thrombocytopaenia**
   - **Pulmonary contusion**
   - **Inhaled FB**

b. Other than a CXR, list three (3) key investigations that you would consider ordering in the emergency department. (3 marks)

NB: list only- no qualification needed
   - **INR**
   - **Sputum- AFB, MCS**
   - **CT Chest**
   - **CTPA**
   - **ECG, FBE, UE, LFT, Quanteferon Gold, ECHO**

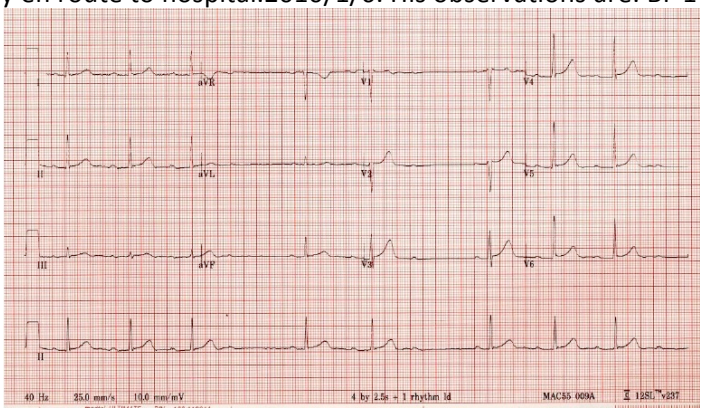
A Chest Xray shows unilateral changes.
She experiences a large volume haemoptysis (estimated blood loss 500 ml).

c. List five (5) key steps in the treatment of this patient over the next 30 minutes. (6 marks)
   NB: 500ml is massive/ life threatening haemoptysis
   - **Communication- Interpreter- obtain focussed Hx/ explain to pt**
   - **Nurse with affected side down - Preserve unaffected lung**
   - **Ventilation support- Mainstem intubation or combitube/ dual lumen tube to non affected side only (anaesthetic assistance)**
   - **Circulation- Volume replacement- blood- massive transfusion if indicated**
   - **Reverse anticoagulation- FFP/ VitK/ Prothrombinex/ Tranaxemic acid**
   - **Rx underlying conditions- Pneumonia IV abs/ PE- anticoagulation**
   - **Isolation- If Tb expected**

   NB: Refer interventional XR- If bleeding persists will probably be after 30 min

Question 4 (17 marks)

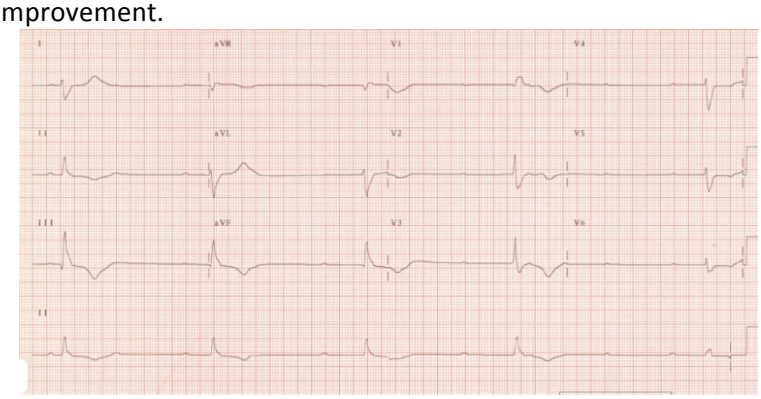
A 64 year old man is being evaluated in your emergency department after an episode of chest pain which has now resolved. He is given aspirin only en route to hospital.2010/1/6. His observations are: BP 140/85 mmHg RR 20/min O2 saturation 97% room air



a. State four (4) abnormal findings shown in this ECG. (4 marks)
   - **Bradycardia ~ 48 bpm**
   - **Mobitz type 1 (Wenchebach) 2nd degree HB**
   - **STE 1mm II, V2- V6**
   - **Biphasic TW III Vi**

b. List four (4) likely causes for these findings. (4 marks)
   - **Ischaemia**
   - **Drugs- -ve chronotropes (BB, CCB, Digoxin)- therapeutic**
   - **Drugs- OD eg same as above**
   - **Cardiomyopathy**
   - **Myocarditis**

The patient becomes suddenly unwell. He is lightheaded with no chest pain. His BP is 70/50 mmHg. He is given a 500ml fluid bolus with no improvement.



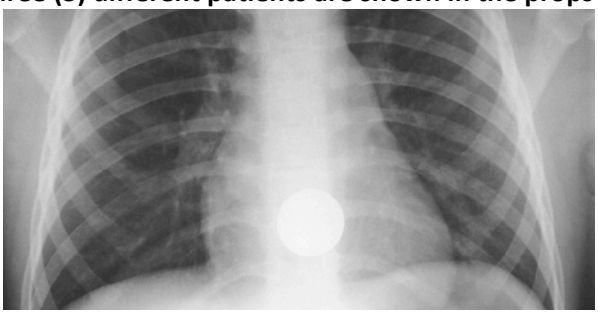
c. State five (5) abnormal findings shown in this ECG. (5 marks)
   - **Rate 25-30**
   - **CHB**
   - **Ventricular/ Idioventricular escape or QRS prolongation**
   - **RAD**
   - **TWI II, III, V1-V3**
     (For Q waves to be significant they need to be: > 40 msec & > 2 mm deep & > 25% depth of QRS)

d. List in order of escalation, your choice of drug treatment for this patient. Specify dose and route. (4 marks)

	Drug treatment	Dose
1st line	**Isoprenaline or Adrenaline**	**Bolus 20-40 mcg IV Followed by infusion 0.5- 20 mcg/min**
2nd line	**Atropine**	**300mcg-600mcg IV** *(rarely effective)*

Question 5 (14 marks)

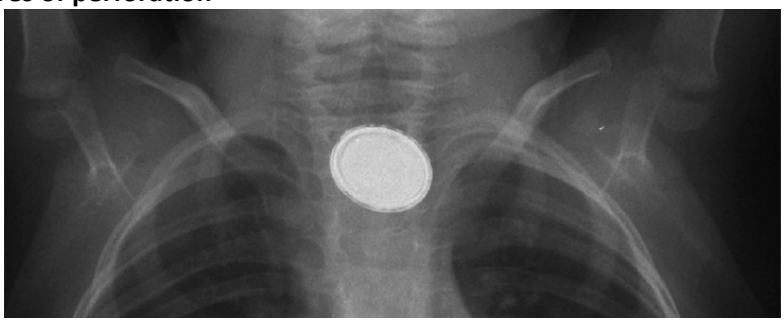
A series of three (3) Xrays from three (3) different patients are shown in the props booklet



a. For Xray 1, state where the foreign body lies. (1 mark)
   - **Lower oesophagus at the gastro-oesophagus junction.**

b. For Xray 1, list two (2) options for the nature/composition of the foreign body. (2 marks)
   - **Coin**
   - **Round metal object**

c. List two (2) factors that would mandate urgent removal of the foreign body. (2 marks)
   - **Excessive symptoms**
     - **Unable to swallow**
     - **Severe pain**
   - **Complications**
     - **Haematemesis**
     - **Features of perforation**

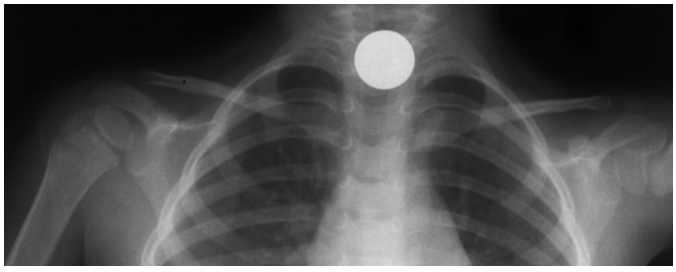


d. For Xray 2, where the foreign body lies. (1 mark)
   - **Oesophagus- upper**

e. For Xray 2, what is the nature/composition of the foreign body? (1 mark)
   - **Button battery**

f. For Xray 2, state your disposition. Provide two (2) points of justification for this choice. (2 marks)
   - Disposition: **Theatre - Admit Gastro/ ENT**
   - Justification: **Immediate removal required (MANDATORY) (< 2/24)**
     Extensive surrounding tissue damage commences < 30 min
     Too large to allow wait and see if passage occurs spontaneously

g. For Xray 3, where does the foreign body lie? (1 mark)
   - **Upper oesophagus**



h. For Xray 3, state your disposition. Provide two (2) points of justification for this choice. (3 marks)

Disposition: **Admit Gastro/ ENT**

Justification: **Too large to pass spontaneously**
Timing of removal depends on symptoms

Question 6 (12 marks)

A 45 year old man with type 1 diabetes mellitus is brought in by ambulance with an altered conscious state.
His observations are: BP90/7 0mmHg HR120 bpm Temperature 36.8 °C Oxygen saturation 97% on 8L by Hudson mask
GCS12E4, V3, M5

FIO_2	0.50		
pH	7.05		7.35-7.45
pCO_2	66	mmHg	35-45
pO_2	247	mmHg	80-95
Bicarbonate	18	mmol/L	22-28
Base excess	-14		-3 - +3
O_2 saturation	99	%	> 95
Na^+	131	mmol/L	134-146
K^+	5.0	mmol/L	3.4-5
Cl^-	92	mmol/L	98-106
Urea	15	mmol/L	3-8
Creatinine	227	micromol/L	45-90
Glucose	50.9	mmol/L	3.5-5.5

a. Provide three (3) calculations to help you to interpret these results. (3 marks)

1. **Corrected Na** (Need to correct Na prior to AG calculation)
   - **True Na = measured Na+ + glucose- 10/3**
     Or measured Na+ + glucose- 7/ 3.5
     Or measured Na+ + glucose/4
2. **Anion Gap = 21 ∴ ↑**
3. **Delta gap Δ ratio: ~ 1.7 ∴ Pure HAGMA**
4. **Others:**
   - **Expected CO_2**
   - **A-a gradient 274-247 = 27 ∴ normal for age**
   - **Se Osmo**

b. Provide a unifying explanation for this clinical picture based on these results. (3 marks)
- **HAG Metabolic acidosis- Likely DKA**
- **1° respiratory acidosis- Likely hypoventilation**
- **Renal impairment- slightly increased Ur:Cr likely partly prerenal from dehydration**

c. Complete the following table demonstrating three (3) key specific treatment tasks in the first 2 hours of the emergency department stay. State how you would achieve each of these tasks.

	Key treatment task	How will you achieve the task?
1	**Establish U/O/ correct hypovolaemia**	**Fluid** **1 L NS Stat** **~ 250 ml/hr for next 4/24** **Monitor U/O with FBC (avoid IDC)** **CVP monitoring**
2	**Correct hypoglycaemia**	**Fluids** **Insulin 0.1 U/kg/hr (max 15 U/hr)** **Follow local protocol** **3-5 U/hr**
	K balance	**Replace K as glucose falls and K falls**
	Airway protection	**Careful observation given altered conscious state**
	Treat precipitant	**Eg Sepsis**

Delta ratio

This Delta Ratio is sometimes useful in the assessment of metabolic acidosis. As this concept is related to the anion gap (AG) and buffering, it will be discussed here before a discussion of metabolic acidosis. The Delta Ratio is defined as:

Delta ratio = (Increase in Anion Gap / Decrease in bicarbonate)

How is this useful?

In order to understand this, consider the following:

If one molecule of metabolic acid (HA) is added to the ECF and dissociates, the one H^+ released will react with one molecule of HCO_3^- to produce CO_2 and H_2O. This is the process of buffering. The net effect will be an increase in unmeasured anions by the one acid anion A^- (ie anion gap increases by one) and a decrease in the bicarbonate by one.

Now, if all the acid dissociated in the ECF and all the buffering was by bicarbonate, then the increase in the AG should be equal to the decrease in bicarbonate so the ratio between these two changes (which we call the delta ratio) should be equal to one. The delta ratio quantifies the relationship between the changes in these two quantities.

Example

If the AG was say 26 mmols/l (an increase of 14 from the average value of 12), it might be expected that the HCO_3^- would fall by the same amount from its usual value (ie 24 minus 14 = 10mmols/l). If the actual HCO_3^- value was different from this it would be indirect evidence of the presence of certain other acid-base disorders (see Guidelines below).

Problem

A problem though: the above assumptions about all buffering occurring in the ECF and being totally by bicarbonate are not correct. Fifty to sixty percent of the buffering for a metabolic acidosis occurs intracellularly. This amount of H^+ from the metabolic acid (HA) does not react with extracellular HCO_3^- so the extracellular [HCO_3^-] will not fall as far as originally predicted. The acid anion (ie A^-) however is charged and tends to stay extracellularly so the increase in the anion gap in the plasma will tend to be as much as predicted.

Overall, this significant intracellular buffering with extracellular retention of the unmeasured acid anion will cause the value of the delta ratio to be greater than one in a high AG metabolic acidosis.

Caution: Inaccuracies can occur for several reasons, for example:

- Calculation requires measurement of 4 electrolytes, each with a measurement error
- Changes are assessed against 'standard' normal values for both anion gap and bicarbonate concentration.

Sometimes these errors combine to produce quite an incorrect value for the ratio. As an example, patients with hypoalbuminaemia have a lower 'normal' value for anion gap so using the standard value of 12 to compare against must lead to an error. Do not overinterpret your result and look for supportive evidence especially if the diagnosis is unexpected.

Guidelines for Use of the Delta Ratio

Some general guidelines for use of the delta ratio when assessing metabolic acid-base disorders in provided in the table below.

Overall Advice: **Be very wary of over-interpretation** - Always check for other evidence to support the diagnosis as an unexpected value without any other evidence should always be treated with great caution.

Delta Ratio	Assessment Guideline
< 0.4	Hyperchloraemic normal anion gap acidosis
0.4 - 0.8	Consider combined high AG & normal AG acidosis BUT note that the ratio is often <1 in acidosis associated with renal failure
1 to 2	Usual for uncomplicated high-AG acidosis Lactic acidosis: average value 1.6 DKA more likely to have a ratio closer to 1 due to urine ketone loss (esp if patient not dehydrated)
> 2	Suggests a pre-existing elevated HCO_3 level so consider: • a concurrent metabolic alkalosis, or • a pre-existing compensated respiratory acidosis

***Warning:** Be very wary of over-interpretation - Always check for other evidence to support the diagnosis as an unexpected value without any other evidence should always be treated with great caution.*

A high ratio

A high delta ratio can occur in the situation where the patient had quite an elevated bicarbonate value at the onset of the metabolic acidosis. Such an elevated level could be due to a pre-existing metabolic alkalosis, or to compensation for a pre-existing respiratory acidosis (ie compensated chronic respiratory acidosis). With onset of a metabolic acidosis, using the 'standard' value of 24 mmol/l as the reference value for comparison when determining the 'decrease in bicarbonate' will result in an odd result.

A low ratio

A low ratio occurs with **hyperchloraemic (or normal anion gap) acidosis**. The reason here is that the acid involved is effectively hydrochloric acid (HCl) and the rise in plasma [chloride] is accounted for in the calculation of anion gap (ie chloride is a 'measured anion'). The result is that the 'rise in anion gap' (the numerator in the delta ration calculation) does not occur but the 'decrease in bicarbonate' (the denominator) does rise in numerical value. The net of of both these changes then is to cause a marked drop in delta ratio, commonly to < 0.4

Lactic acidosis

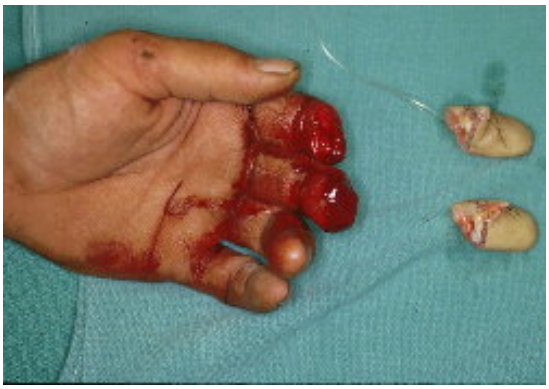
In **lactic acidosis**, the average value of the delta ratio in patients has been found to be is 1.6 due to intracellular buffering with extracellular retention of the anion. As a general rule, in uncomplicated lactic acidosis, the rise in the AG should always exceed the fall in bicarbonate level.

Diabetic ketoacidosis

The situation with a pure **diabetic ketoacidosis** is a special case as the urinary loss of ketones decreases the anion gap and this returns the delta ratio downwards towards one. A further complication is that these patients are often fluid resuscitated with 'normal saline' solution which results in a increase in plasma chloride and a decrease in anion gap and development of a 'hyperchloraemic normal anion gap acidosis' superimposed on the ketoacidosis. The result is a further drop in the delta ratio.

Question 7 (12 marks)

A 65 year old man presents with a left hand injury.



a. List two (2) factors that arise from this image, that would suggest a poor prognosis for successful reimplantation. (2 marks)
   - **Site - through middle phalanyx or DIP**
   - **Tendon avulsion**
   - **Maceration of edges**
   - **(Pale tip or avulsed parts not stored appropriately at present- clutching straws)**

b. List six (6) historical factors that would suggest a poor prognosis for successful reimplantation. (6 marks)
   - **Time of injury/ delay to repair Warm ischaemia > 6 bad and cold ischaemia time > 12 bad**
   - **Age**
   - **Smoking Hx**
   - **PVD**
   - **Diabetes**

   Most important

   - **Steroid use**
   - **Delay/ incorrect cooling of amputated parts**
   - **Hypotension**
   - **Proximal injury to arm/forearm**

c. How would you store the amputated parts pending a decision for potential reimplantation? List two (2) points in your answer. (2 marks)
   - **Double sealed bag (or bottom shelf fridge)**
   - **Ice slurry**

d. What is the most appropriate regional anaesthesia technique for this patient? (1 mark)
   - **Combined radial and median nn block**
   - **or US guided scalene block**
   - **or volar plate block**

NB: Not ring block- may prang an artery

Amputations

Care of amputated parts

Xray

Wash gross contamination with sterile N S → wrap in sterile gauze lightly soaked in NS → double plastic bag in ice/water

Or lower tray fridge

Aim to keep cool avoid freezing

Care of stump

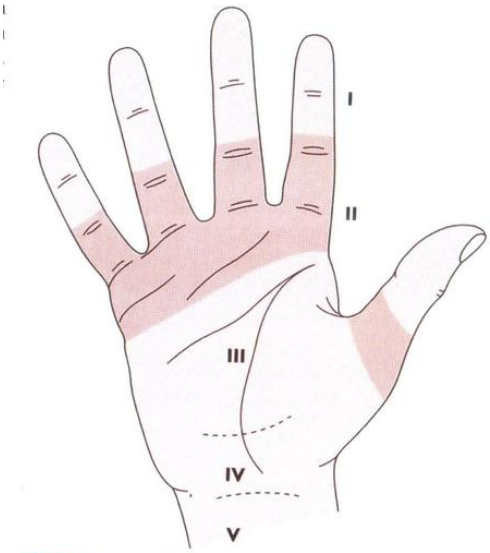
Remove any torniquet applied by MAS

Direct pressure with sterile dressings - combine

No vascular clamping

Directed temporary tourniquet

- only if uncontrollable bleeding en route to theatre



28.13 The zones of injury (I) Distal to the insertion of flexor digitorum superficialis. (II) Between the opening of the flexor sheath (the distal palmar crease) and the insertion of flexor superficialis. (III) Between the end of the carpal tunnel and the beginning of the flexor sheath. (IV) Within the carpal tunnel. (V) Proximal to the carpal tunnel.

Time to reimplantation- ishaemia time

Warm 6-8 hrs

Cool 12 hrs (up to 24 hrs)

Prognostic factors for favourable outcome

Amputated part factors

Clean cut vs crush/ shear/ degloving

Duration of time between injury and surgery

Minimal contamination/ infection

Minimal water/ shrinkage effect at edges

Site/ muscle content → wrist better than forearm → tendons repair better than muscle

→ fingers do well if amputated distal to FDP or prox FDS insertion (worst bet DIP & PIP)

→ worst if two level injury

Patient factors

Age → children do better

Pre existing health (DM, PVD, steroids do worse)

→ smokers poor success rate

Relative contraindications to implantation

Long duration between time of injury → Sx (> 6/24 warm, > 12 cold ischemia time)

Crush with extensive STI

Peripheral vascular disease

Grossly contaminated/ infected wound

Devitalised tissue

Other life- threatening injuries which take precendence

Site of amputation in presence of significant neurological injury (eg BP disruption)

Don't forget

IV Abs

Tetanus prophylaxis- toxoid +/- TIG

Analgesia

Splint

Fast

Management of other injuries- Secondary survey

Question 8 (12 marks)

A 6 year old boy presents with a left supracondylar humeral fracture.

a. List two (2) type of pain scoring systems that you could apply to this child. (2 marks)
   - **Wong Baker Faces** (3- 18)
   - **FLACC** (2/12- 18)
   - **Visual analogue** (6-18)

   NB: Numerical *(8+ yrs)*

b. List two (2) reasons why a pain score is used. (2 marks)
   - **Objective assessment of pain is poor**
   - **Allows assessment of efficacy of analgesia**

c. List four (4) indications for GAMP in this patient. (4 marks)
   - **Distal neuro compromise**
   - **Distal vascular compromise**
   - **Skin compromise**
   - **Capitellum posterior to anterior humeral line (dorsal angulation > 10°)**
   - **< 50% bony contact**
   - **Medial/lateral angulation Esp if > 10°**
   - **Anterior displacement**

d. List four (4) pieces of advice that you would give to this boy's parent if the patient is able to be discharged from the emergency department. (4 marks)
   - **Post sedation advice**
   - **Post POP advice**
     - **Indications to return for review**
   - **POP check plan**
   - **Analgesia advice**
   - **Follow up arrangements**

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DON'T FORGET THE BUBBLES

Sticks and stones may break some bones

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Introduction

Up to a quarter of the paediatric population of the UK present to an ED annually[1] with a large number being due to falls.[2] High-risk activities such as scooter riding, climbing on monkey bars and backyard trampolines are partially to blame, although the implementation of safety netting for trampolines has led to a reduction in injuries.[3]

In this article, we seek to explore how a child with a simple forearm fracture is treated. We focus on how we look after their pain, how we make the diagnosis and how we might manage their fracture once it has been diagnosed.

Providing pre-emptive analgesia

A recent study found that only 76% of children with significant upper limb fractures received any analgesia within their first hour in hospital.[4] Appropriate analgesia can begin in the prehospital phase.[5] Both intravenous opiates and inhalational analgesia such as methoxyflurane have been trialled without serious adverse effects.[6]

Assessment of pain can be challenging in children so it is often under-recognised. The Wong-Baker faces pain scale[7] may be used in children over 3 years old, but use of this scale is unreliable in pre-verbal children, in whom the Faces, Legs, Activity, Cry, Consolability (FLACC) score may be more helpful.[8] Subjective measures such as changes in physiological parameters (pulse, respiratory rate or blood pressure) can add to nurse or physician gestalt. Despite these tools, children are routinely under-treated.[9]

The World Health Organization analgesia ladder is an appropriate starting point[10] with rapid escalation as required. While it suggests the addition of mild opioids for moderate to severe pain, the use of codeine as an adjunctive agent has been linked with fatalities in patients subsequently found to be rapid or ultra-rapid metabolisers.[11] Given that it is also ineffective in 10% of the population, its use should be de-emphasised. Children with moderate to severe pain may be more effectively treated with an alternative agent such as intranasal fentanyl.

Intranasal medication obviates the need for potentially distressing intravenous access. A Cochrane Collaborative analysis suggested that there was little evidence to suggest that intranasal fentanyl was any better, or worse, than intravenous morphine, and it was well tolerated by patients.[12] Use of a specific intranasal fentanyl pathway could speed up the delivery of analgesia.[13]

Other agents such as sub-dissociative doses of ketamine have also been trialled as an opioid sparing measure.[14] The PICHFORK trial compared intranasal fentanyl at doses of 1.5 mcg/kg with intranasal ketamine at 1mg/kg in children aged 3–13 years with isolated limb injury and found similar reduction in pain scores 30 min post-treatment.[15] With children increasing in size, one should be aware that a number of agents such as paracetamol and morphine should be dosed according to ideal rather than actual bodyweight. Generally, if the ideal weight is more than 40 kg, then an adult dosing regime can be used. The exception to this is paracetamol (acetaminophen), with which 15 mg/kg should be used up to 65 kg to avoid toxicity.[16]

Non-pharmacological options

Weight-based doses of analgesia are the mainstay of treatment, but a number of non-pharmacological approaches may also be used to reduce both pain and anxiety. If the limb has not been immobilised in a splint, it may help to do so prior to imaging.

We know that distraction therapy such as bubbles, music and television screens can also allay some anxiety.[17] It is easy to put an iPad with an episode of a popular children's television programme in front of a crying child in an attempt to distract them, but these passive distraction techniques are less effective than using more interactive games.[18]

Making the diagnosis

If the limb is obviously deformed, then making the diagnosis is easy. When there is enough clinical suspicion to suspect a fracture, the majority of clinicians instinctively reach for the X-ray request form. In children, we use the

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Don't Forget the Bubbles (www.DontForgetTheBubbles.com) is a paediatric educational website providing free online content aimed at healthcare professionals.

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PAEDIATRIC EMERGENCY MEDICINE

The epidemiology of pain in children treated by paramedics

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Abstract

Objectives: The present study aimed to describe paramedic assessment and management of pain in children in a large state-wide ambulance service.

Methods: A retrospective cohort study included paediatric patients (aged less than 15 years) treated and transported by paramedics in the Australian state of Victoria between 1 January 2008 and 31 December 2011. Primary outcome measures were the frequency of analgesic administration and odds of receiving any analgesic (morphine, fentanyl or methoxyflurane). Data were analysed by descriptive statistics, χ^2-test and logistic regression to test the association between analgesic administration and the explanatory variables.

Results: There were 38 167 cases that included a description of pain and where any pain scores were >0. Median age was 10 years (IQR 5–12), 59.2% were male and 15 090 (39.5%) received any analgesic. Of patients reported to have severe pain (verbal numeric rating scale 8–10), only 45% (n = 6084) received any analgesia. In unadjusted analysis, patients aged >9 years were more likely to receive analgesia than those aged <3 years (unadjusted odds ratio 4.39, 95% confidence interval 4.01–4.80). Multiple regression analysis found that significant predictors of analgesic administration were patient's sex, patient age, type of pain, initial pain score and case year.

Conclusion: Disparities in analgesic administration based on age and the low rate of pain scores documented in very young children identified in the present study should inform strategies that aim to improve the assessment and management of pain in children.

Key words: *analgesia, child, pain, pain management, preschool.*

Key findings

- Pain was found to be a common complaint in children transported by ambulance. Independent predictors of analgesic administration include patient's sex, patient age, type of pain, initial pain score and year of enrolment in the study.
- Younger patients were less likely to receive analgesia after controlling for initial pain score, sex and type of pain.
- More than half (55%) of patients with severe pain (VNRS 8–10) did not receive any analgesia.

Introduction

Pain management is an important component of paramedic practice, and analgesic options include pharmacological and non-pharmacological therapies to alleviate pain in accordance with evidence-based guidelines. The paramedic's scope of practice includes the management of pain in vulnerable populations, such as those at extremes of age. However, children experiencing pain are at risk of inadequate analgesia because of age-related communication problems, inadequate paramedic education in pain management and lack of experience in assessing and caring for the child experiencing pain.[1]

Although children experiencing illness or injury represent a proportion of the paramedic caseload, there is scant evidence of the incidence, nature and management of pain in children treated and transported by paramedics. The lack of data is acknowledged by a consensus report that ranked pain in children as an important research priority for EMS.[2]

One study that investigated the characteristics of paediatric patients treated by EMS in the USA found that 26% of cases transported by EMS involved a traumatic injury. Pain (including abdominal and cardiac) was recorded as the chief complaint in 16.1% of cases. However, just 0.3% of the children in the present study received pain medication.[3] The findings are consistent with earlier studies that describe inadequate analgesia in the setting of trauma.[4] Other studies that describe the management and outcomes of children transported by EMS confirm that trauma is the most common case type.[5–7] While these

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ORIGINAL RESEARCH

Variables associated with parent satisfaction with their child's pain management

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Abstract

Objective: The provision of 'adequate analgesia' (which reduces the pain score by ≥2 and to <4 [0–10 scale]) is significantly associated with high levels of satisfaction with pain management among adult patients. We aimed to determine the variables (including 'adequate analgesia') associated with parent satisfaction with their child's pain management.

Methods: We undertook an observational, pilot study in a mixed, metropolitan ED. Patients aged 4–16 years with a triage pain score of ≥4 were enrolled. Data included demographics, presenting complaint, pain scores every 30 min, analgesia administered, time to first analgesia, provision of nurse-initiated analgesia (NIA), and 'adequate analgesia', and parent satisfaction 48 h post-discharge (6 point scale: very unsatisfied – very satisfied).

Results: Complete data were collected on 185 patients: mean (SD) age 10.4 (3.6) years, weight 41.9 (17.8) kg; 93 (50.3%) were male. One hundred and ten (59.4%) parents were very satisfied with their child's pain management. Children of very satisfied parents had shorter times to analgesia than those who did not (median [interquartile range] 14 (33) *vs* 33 (46) min, respectively, P = 0.003). Parents whose children received NIA or 'adequate analgesia' were more often very satisfied than those whose children did not. However, the differences were not significant (difference in proportions: 13.2% [95% CI −1.9, 28.3], P = 0.07 and 10.2% [95% CI −5.02, 25.34], P = 0.16, respectively).

Conclusion: Short times to analgesia are associated with parent satisfaction. There were non-significant trends towards high levels of satisfaction following the provision of NIA and 'adequate analgesia'. These findings will inform a well-powered study to confirm this association.

Key words: *analgesia, children, emergency department, paediatrics, pain, satisfaction.*

Key findings

- The majority of parents were very satisfied with their child's pain management.
- Short times to analgesia are associated with high levels parent satisfaction with their child's pain management.
- There are non-significant trends towards high levels of parent satisfaction following the provision of nurse-initiated analgesia and 'adequate analgesia' to the child.

Introduction

Paediatric patient presentations to Australian EDs are common, with more than one-fifth of presentations by patients aged less than 15 years.[1] Among patients aged 5 to 18 years, six of the 10 most frequent diagnoses are painful: viral gastroenteritis, croup, abdominal pain, fracture, laceration and otitis media.[2]

As well as diagnosis and treatment, relief of pain is a duty of the heathcare provider. However, one multi-centre audit of paediatric pain management reported a notable lack of pain assessment documentation and delays to analgesia.[3] Children are less likely to receive analgesia than adults presenting with acutely painful conditions.[4] Furthermore, reports indicate that provision of analgesia to paediatric patients presenting with pain occurs at rates as low as 50%.[4–6] Also, times to analgesia are often lengthy.[3] In one mixed adult/paediatric sample, only 29% of patients received analgesia within 1 h of presentation.[7]

With the aim of improving the satisfaction of adult ED patients with their pain management, the concept of 'adequate analgesia' was developed. Adequate analgesia was defined as that which reduces the triage pain score by a clinically significant amount (≥2 on a 10 point numerical rating scale [NRS])[8] *and* to a level that is mild (<4).[9] Two recent studies have demonstrated that adult ED patients who receive adequate analgesia (as defined) are significantly more likely to be very satisfied with their pain management than patients who do not.[10,11]

It is not known if the clear association between adequate analgesia provision and patient satisfaction also exists for paediatric patients. This study aimed to explore whether the provision of 'adequate analgesia' is

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DON'T FORGET THE BUBBLES

Making a difference: Pragmatic paediatric pain management

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One of the great rewards of paediatric emergency medicine is the opportunity to manage the pain of a suffering child and in doing so provide welcome relief to a family in distress. Although there is no single analgesic recipe that is appropriate for all clinical situations, there is a toolbox of interventions that allows us to reduce the pain in the vast majority of illnesses, injuries and medical procedures to a level that most children and families find acceptable. The present paper aims to open that toolbox, explore its contents and demonstrate that, while many children still suffer from under-analgesia in EDs,[1] the solutions to this disservice are not intimidating.

First do no harm

Some procedures undertaken in the ED provide low diagnostic yield. These include blood cultures and inflammatory markers being used for risk stratification of well-looking, immunised, febrile children[2] as well as blood tests to exclude appendicitis in children presenting with less than 24 h of abdominal pain.[3] In these circumstances, venepuncture could reasonably be replaced with a period of observation.

Other procedures have less painful alternatives – venepuncture is less painful for neonates than heel lancing.[4] Venepuncture is well known to be less painful than arterial puncture and will provide equivalent information in many circumstances.[5] Tissue adhesive is an option for repair of clean, simple, linear, low-tension wounds negating the need for sutures.

We have previously written[6] about non-pharmacologic methods of reducing distress but emphasise here the importance of active distraction, deliberate communication strategies and caregiver involvement.

Sweet as…

Although its mechanism of action and dosing regimen remain unsettled, the efficacy of oral sucrose in the young infant is well demonstrated.[7] It may work through both opioid and non-opioid receptor pathways. Dosing recommendations vary from 0.5 to 5 mL of 24% sucrose given 2–5 min before the procedure with repeat doses as required.[7]

Just a little prick

Topical anaesthesia has a role in most transcutaneous procedures, including venepuncture, lumbar puncture and laceration repair. For application to unbroken skin prior to a procedure, options include eutectic mixture of local anaesthetics (lignocaine 2.5% and prilocaine 2.5%; EMLA), amethocaine (tetracaine/Ametop) and liposomal lignocaine (e.g. LMX4). EMLA has a recommended application time of 60 min before venepuncture and carries the risk of methaemoglobinaemia in larger doses, limiting safe use to children over 3 months of age and 5 kg in weight.[8]

Amethocaine and liposomal lignocaine need be applied only 30 min prior and do not carry the same risk of methaemaglobinaemia, allowing their use in term babies. It is possible to develop local anaesthetic toxicity from all topical anaesthetics, so these agents should be used with care in infants. Amethocaine was more efficacious than EMLA in a Cochrane review of six studies.[9] Some erythema was noted after amethocaine use and this is commonly seen in practice. It is not an allergy. Liposomal lignocaine and amethocaine are equivalent in effect.[10] The short duration of onset, efficacy and low cost of liposomal lignocaine has led to more hospitals selecting LMX4 as their topical analgesic of choice. We have had recurrent difficulties getting cannula dressings to stick to skin treated with LMX4, although washing the area prior to cannulation does seem to help.

With broken skin, combinations of local anaesthetic and adrenaline (e.g. LAT, Laceraine) can be used by saturating gauze and instilling it directly into the wound. This provides analgesia, haemostasis and also an insight into whether the child will tolerate wound closure without

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Question 9 (12 marks)

A 46 year man is brought to your emergency department with suspected alcohol withdrawal.

a. List seven (7) of the 10 scale domains that form the Alcohol Withdrawal Assessment Scale (7 marks)
   - **N&V**
   - **Tactile disturbance**
   - **Tremor**
   - **Paroxysmal sweating**
   - **Auditory disturbance**
   - **Visual disturbance**
   - **Anxiety**
   - **Agitation**
   - **Headache**
   - **Orientation and clouding of sensorium**

A 35 year old male is identified as having "very severe" alcohol withdrawal.

b. State five (5) key management steps for this patient over the next 1 hour. (5 marks)
   - **Non stimulating environment**
   - **Provide adequate hydration**
   - **Rx Thiamine & multivitamins**
   - **Rx hypoglycaemia**
   - **IV diazepam 5mg - repeat to 4x over 1st 30 min then 30 minutely as required**

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November 2017

CIWA-Ar (ALCOHOL WITHDRAWAL SCALE)

Nausea & vomiting Ask "Do you feel sick to your stomach? Have you vomited?" Observation.
0 no nausea and no vomiting
1 mild nausea with no vomiting
2
3
4 intermittent nausea with dry heaves
5
6
7 constant nausea, frequent dry heaves and vomiting

Tremor Arms extended and fingers spread apart. Observation.
0 no tremor
1 not visible, but can be felt fingertip to fingertip
2
3
4 moderate, with patient's arms extended
5
6
7 Severe, even with arms not extended

Paroxysmal sweats Observation.
0 no sweat visible
1 barely perceptible sweating, palms moist
2
3
4 beads of sweat obvious on forehead
5
6
7 drenching sweats

Anxiety Ask "Do you feel nervous?" Observation.
0 no anxiety, at ease
1 mildly anxious
2
3
4 moderately anxious, or guarded, so anxiety is inferred
5
6
7 equivalent to acute panic states as seen in severe delirium or acute schizophrenic reactions

Agitation Observation.
0 normal activity
1 somewhat more than normal activity
2
3
4 moderately fidgety and restless
5
6
7 paces back and forth during most of the interview, or constantly thrashes about

Tactile disturbances Ask "Have you any itching, pins and needles sensations, any burning, any numbness or do you feel bugs crawling on or under your skin?" Observation.
0 none
1 very mild itching, pins and needles, burning or numbness
2 mild itching, pins and needles, burning or numbness
3 moderate itching, pins and needles, burning or numbness
4 moderately severe hallucinations
5 severe hallucinations
6 extremely severe hallucinations
7 continuous hallucinations

Auditory disturbances Ask "Are you more aware of sounds around you? Are they harsh? Do they frighten you? Are you hearing anything that is disturbing you? Are you hearing things you know are not there?" Observation.
0 not present
1 very mild harshness or ability to frighten
2 mild harshness or ability to frighten
3 moderate harshness or ability to frighten
4 moderately severe hallucinations
5 severe hallucinations
6 extremely severe hallucinations
7 continuous hallucinations

Visual disturbances Ask "Does the light appear to be too bright? Is its colour different? Does it hurt your eyes? Are you seeing anything
that is disturbing you? Are you seeing things you know are not there?" Observation.
0 not present
1 very mild sensitivity
2 mild sensitivity
3 moderate sensitivity
4 moderately severe hallucinations
5 severe hallucinations
6 extremely severe hallucinations
7 continuous hallucinations

Headache, fullness in head Ask "Does your head feel different? Does it feel like there is a band around your head?" Do not rate for dizziness or lightheadedness. Otherwise, rate severity.
0 not present
1 very mild
2 mild
3 moderate
4 moderately severe
5 severe
6 very severe
7 extremely severe

Orientation & clouding of sensorium Ask "What day is this? Where are you? Who am I?"
0 orientated and can do serial additions
1 cannot do serial additions or is uncertain about the date
2 disorientated for date by no more than 2 calender days
3 disorientated for date by more than 2 calender days
4 disorientated for place and/or person

TOTAL CIWA-Ar SCORE /67

Date:

Time (24hr):

Rater's initials:

(Max possible score is 67)