The Weekly Probe

13th January 2017 **Volume 20 Issue 1**

Measles- there has been an alert from the MoH regarding a number of measles cases throughout NSW and Australia apparently related to patients who had been too young for vaccination (< 12 months) or incompletely vaccinated and come in contact with unvaccinated tourists or returning travellers.
In summary measles has 2-4 days of a prodromal illness on 2-4 days with the fever, and the 3 Cs - cough, coryza, and conjunctivitis.
This is followed by a maculo-papular rash then typically begins on the face and neck and descends to become generalised.
Patients are infectious from the day before the prodrome illness to 4 days after the onset of rash.
Any patient presenting with Fever, rash and respiratory symptoms ***MUST*** be suspected of measles until proven otherwise.

All patients where measles is suspected ***MUST***:

- Be isolated in a single room
- Have a surgical mask applied
- NUM & Senior medical officer notified

Full respiratory PPE precautions are required for *any* member of staff in contact with or involved in the management of the patient.
Notify the PHU via switch, and organise further testing (blood for measles serology, nasopharyngeal swab or aspirate and first pass urine sample for measles PCR .

Hydromorphone – after a recent incident (and a number at other hospitals) there are some requirements when prescribing HYDROmorphone
1. New prescription of HYDROmorphone or recharting of HYDROmorphone for any reason – the medical officer must document the following in the medical record in addition to prescribing on the medication chart:
a. Indication, drug, dose, route and for PRN a maximum daily dose (chart this as number of doses to be given e.g. x 3)
b. When converting the dose:

i. Current drug, dose and route

ii. New drug, dose and route

iii. The mathematical calculations of how the conversion dose was calculated (use the conversion table attached)

c. The medication order must be legible and clear indicating full name of doctor, role and contact number.
d. The medical record entry must be checked and countersigned by another doctor. One of the doctors must be a **registrar or above**. A pharmacist can verify the medical record as a second check on the dose **during business hours**.
e. When prescribing hydromorphone the generic and tradenames must be written to distinguish between the slow release and immediate release versions. E.g. Hydromorphone slow release – Jurnista; Hydromorphone immediate release –Dilaudid
f. The medication chart prescription must also be countersigned by another doctor. If a pharmacist has been the second check, they will verify the dose and they will annotate the medication chart in the pharmacy section to say '**dose verified'**

2. Nursing Staff will not be allowed to administer HYDROmorphone if these requirements are not met. Any concerns will be escalated to the prescribing doctor. If this fails to resolve the issue please escalate to the NUM or AHNM. It will then be escalated to the Consultant Medical Officer to resolve.

Steps to perform conversion to HYDROmorphone
1. Calculate the **total** current narcotic dose required **in 24 hours**
2. Chose route of HYDROmorphone you are going to prescribe

3. Divide or multiply this dose by conversion factor in the table (Dark Blue = divide; Light Blue = multiply). This gives a total dose over 24 hours
4. Divide the 24 hour amount of HYDROmorphone **by 6 to get the 4th hourly dose**

For example - patient on 30mg subcutaneous morphine is recharted for subcutaneous HYDROmorphone. To calculate equivalent HYDROmorphone dose using the conversion table below:
1. 30 mg SC morphine is the **total** amount of narcotic being given **over 24 hours**
2. It will be converted to SC hydromorphone
3. Divide the morphine dose by the conversion factor of 5. HYDROmorphone **total dose** will be 6mg **over 24 hours**
4. Divide 6mg by 6 = 1 mg HYDROmorphone **4th hourly**

Narcotic Conversion Table

From \ To		Codeine	Morphine		Hydromorphone		Oxycodone
		PO Mg/day	PO Mg/day	SC Mg/day	PO Mg/day	SC Mg/day	PO Mg/day
Codeine Mg/day	PO		÷8	÷16	÷40	÷80	÷12
Morphine Mg/day	PO	x8		÷2	÷5	÷10	÷1.5
Morphine Mg/day	SC	x16	x2		÷2	÷5	÷0.6
Hydromorphone Mg/day	PO	x40	x5	x2.5		÷2	÷0.3
Hydromorphone Mg/day	SC	x80	x10	x5	x2		÷0.15
Oxycodone Mg/day	PO	x12	x1.5	x0.6	x0.3	x0.15	

Multiply
current total daily opioid by conversion factor to get total milligrams per 24hrs

Divide
current total daily opioid dose by conversion factor, this will give the dose per 24hrs

For other equivalent drug dosages see ETG

Approximate relative potencies of various opioids used in chronic pain (Table 1.14) [NB1]

Opioid	Approximate relative potencies compared to 50 mg/day of oral morphine
morphine oral	50 mg/day
buprenorphine transdermal patch	20 micrograms/hour [NB2]
fentanyl transdermal patch	12 micrograms/hour
hydromorphone oral	10 mg/day
methadone oral	[NB3]
oxycodone oral	35 mg/day

NB1: When changing from one opioid to another, commence with 50% to 75% of the calculated equianalgesic dose and then titrate to response.
NB2: The maximum dose of transdermal buprenorphine should be 20 micrograms/hour unless under specialist advice.
NB3: When changing from morphine to methadone, conversion ratios vary considerably depending on the morphine dose. Methadone should only be prescribed for chronic pain by practitioners experienced in its use.

Editor: Peter Wyllie

THIS WEEK

Hyperthermia
Quote / Joke of the Week

HYPERTHERMIA

After a couple of really hot days so far and some guaranteed hot Jan and Feb days ahead, this is worth looking at again. First , a case..

46yo man riding motorbike all day in warm conditions whilst wearing full protective gear. He got off the bike and collapsed – confused with vomiting ? aspirated – intubated prehospital – on arrival T 39.4C, SBP 75, sats 89% PR 100 – bloods showed K 5.7 , Cr 350, lactate 5.5 pH 7.08 mixed resp and metabolic), INR 3.5 APTT > 200sec – supportive Mn yet further multiorgan failure with rhabdo (CK to 45 000) , hepatic injury AST 1400, DIC (d-dimer > 10, INR > 12, APTT > 200 Fibrinogen <0.1) , renal failure (Cr 430)- deceased later that night.

What is heat stroke and what can we do for this illness?

There is a spectrum of heat related diseases – from minor illnesses, such as heat oedema, heat rash (ie, prickly heat), heat cramps, and local tetany, as well as heat syncope and heat exhaustion.

Heatstroke is the most severe form of the heat-related illnesses and is defined as a body temperature higher than 41.1°C associated with neurologic dysfunction. Excessive heat denatures proteins, destabilizes phospholipids and lipoproteins, and liquefies membrane lipids, leading to cardiovascular collapse, multiorgan failure, and, ultimately, death.
In the US heat related illnesses kills more people than other climate related events combined (hurricanes, tornadoes, floods, and earthquakes)- Persons older than 65 years accounted for at least 44% of cases

Acclimatization - earlier / more sweating, less sodium, volume expansion. Takes 7-10/7

Prevention - Recognition of host risk factors and modification of behaviour (eg, limiting alcohol and drug intake, avoiding use of medications and drugs that interfere with heat dissipation) and physical activity also can prevent heatstroke.

PREDISPOSING FACTORS- Rosen describes the body's temperature control like that of a car. The engine generates heat – the heat is dissipated by the coolant which is carried to the radiator, which loses the heat largely by convention (fan + passing air). When the ambient temperature is hot or humid there is less evaporation and convection, so keeping the temp down is more difficult. The heat loss is controlled by a thermostat.
To experience heat illness there is a problem with 1 or more of these components- this culminates heat generation > heat loss.

- Increased heat production -
  - exercise
  - drugs (sympathomimetcs, LSD, salicylates) / withdrawal
  - sepsis
  - thyrotoxicosis
  - malignant hyperthermia
  - neuroleptic malignant syndrome
  - Serotonin Syndrome
  - status epilepticus
  - strychnine / tetanus
- Pump malfunction
  - heart disease
- Low coolant levels
  - dehydration
- Damaged conducting system
  - diabetes / atherosclerosis
- Radiator malfunction
  - drugs esp. anticholinergics
  - skin disease
  - occlusive clothes
- Thermostat malfunction

Editor: Peter Wyllie

- hypothalamic disease
- sepsis

- Environmental
  - high temperature, high humidity, strong direct / reflected heat, min air movement.

esp. at extremes of age (elderly & neonates)

PHYSIOLOGICAL EFFECTS- multisystem effects

- CVS - cutaneous vasodilatation, increased CO +HR, (myocardial damage in heat stroke)
- Resp - increased RR with respiratory alkalosis.
- Dehydration, decreased plasma volume, Na^+ and K^+ losses in sweat. Hypo / hyper Ca, Mg, Po4- may be exacerbated by replacement fluids if hypo or hypertonic fluids are used
- Splanchnic and renal v/c (with haematuria, casts, myoglobinuria, casts), (tubular necrosis)
- Decreased liver function, prolonged PT, (hepatic necrosis, cholestasis, fulminant hepatic failure)- GI bleeding (via blood redistribution / vasoconstriction)
- Haem - Increased WCC, impaired coagulation, (DIC, small vessel thrombi)
- Increased CK and CKMB fraction (Rhabdomyolysis- seen in almost all of exertional HS and 86% of classic)
- Increased metabolism with subsequent increased heat production.- hypo or hyperglycaemia
- Cerebral oedema, petechiae.

FEVER VRS HYPERTHERMIA

Fever is caused by pyrogens acting on the anterior hypothalamus, resulting in a reset thermal set point (the body alters heat production / loss to keep the temperature as close as possible to this set point.
Temperature only a problem in this case if the body is unable to cope with the physiological changes. External measures not helpful, use agents to adjust the set point.

MINOR HEAT ILLNESS

- Heat cramps
- Heat oedema
- Heat syncope

MAJOR HEAT ILLNESS
Heat exhaustion
Heat stroke - further classified as classic or exertional

yet
- margins blurred
- no absolute temperature cut off
- may have both elements of exertional or classic heat stroke
- management similar

- **Heat exhaustion** - poorly defined syndrome of mild hyperthermia and systemic symptoms leading to “prostration” or weakness.
  - Temperature usually less than 38-40°C, often normal
  - Thermoregulatory mechanisms remain intact
  - No evidence of significant end-organ dysfunction or damage,
  - In particular, aside from minor irritability and poor judgment, **cerebral function is unimpaired (the only distinction from heat stroke)**

  Symptoms and signs include -
  fatigue and weakness
  myalgias
  frontal headache / vertigo, nausea and vomiting
  impaired judgment, slight confusion, amnesia, unusual behaviour (not significant neurological symptoms eg seizures)
  Orthostatic hypotension, tachycardia and syncope

- **Heat stroke** - acute thermoregulatory failure with core temps often >40°C- no diagnostic cut off temperature
  - features of multisystem tissue damage and organ dysfunction
  - must have **CNS dysfunction**

  Symptoms and signs include -

- CNS dysfunction - any abnormality esp. delirium, decreased LOC, cerebellar or focal neurologic symptoms
  Convulsions common.
- **Vitals** - tachycardia, hypotension, normotension with a wide pulse pressure, tachypnoea.
- CVS - usually hyperdynamic yet if severe or delayed may see myocardial dysfunction
- **Sweating may be present or absent**
- No specific single diagnostic temperature
- Rigidity and hypertonia in NMS, MH and Serotonin Syndrome

Classic heat stroke - most common in elderly and infants.
- tends to develop over few days in those unable to obtain fluids or a cooler environment
- c/w exertional, rhabdo unusual, less ARF, DIC uncommon, hypoglycaemia more common

Exertional heat stroke - usually young athletes
- rapid onset and dehydration not usually severe

TREATMENT

Airway - intubate if airway compromised by coma, convulsions or other reasons for mechanical ventilation

Breathing - supplemental oxygen. Observe for pulmonary complications (ARDS, pulmonary oedema)- use PEEP

Circulation- hypotension is common and is often due to vasodilatation with a variable degree of dehydration- rehydration should be individualised.
- hypotension usually responds well to cooling
- overly aggressive fluid administration may result in pulmonary oedema, especially in patient with classic heat stroke - use 250-500ml boluses and reassess (esp. if elderly and with renal failure)- if If shock persists after rehydration, inotropes may be necessary yet remember that alpha-adrenergic drugs (adrenaline or noradrenaline)- can cause vasoconstriction and may interfere with heat loss.- dobutamine may be useful with hypodynamic circulation states
- fluids are also the keystone for the treatment of rhadbo (+/- alkalinisation esp if hyperkalaemic)- treat other assoc electrolyte abnormalities- consider fasciotomy when required
- prognosis in arrest secondary to heat stroke is poor

Disability - convulsions are frequent and often recurrent - use standard antiepiletics ? phenytoin as effective

Remember the wide differentials and precipitants, and investigate & treat these accordingly.
Including :
- **intracerebral problems –** Meningoencephalitis / SAH, ICH / cerebral malaria
- **Drugs** – withdrawal (DTs), cocaine, salicylates, speed, strychnine, NMS, serotonin Syn
- **Organ dysf'n** – uraemic or hepatic encephalopathy, DKA, hyperthyroidism

COOLING

- Simultaneous to resuscitation as outcome related to the degree and duration tissues are exposed to an elevated temperature. Optimise heat loss through (in order of priority) convection, evaporation, conduction and radiation.
- Remove clothes
- Measure progress with CORE temperature ie rectal or oesophageal probe etc.
- Rectal temperature may lag 10-15min behind core temps, so cease rapid cooling at temps of 38-39°C

- Several methods of cooling available -
  1. Evaporative methods - spray with luke **warm** water and fanned with air (cold water may cause v/c)- safe, cost effective, and currently favoured
  2. Ice water immersion - rapid cooling yet impractical
  3. Cold packs - ice packs over large veins in groin, axilla and neck

- insufficient sole method in heat stroke

4. Iced water peritoneal lavage
5. Iced water gastric lavage - adjunctive treatment
6. Cardiopulmonary bypass - most rapid cooling
7. Cold IV fluids - 1L at room temperature (23°C) reduces temperature in 70kg pt by ~0.3°C
8. Aspirin / paracetamol ineffective

Watch for rebound hyperthermia at 3-6 hours
Most patients with heat stroke have thermoregulatory instability for days or weeks.

Along with immediate active cooling, steps to stop excessive production of heat must be taken by treating the cause of increased production eg benzos with withdrawal.

Prognosis
Indicators of poor prognosis during acute episodes include the following:

- Initial temperature measurement higher than 41°C or a temperature persisting above 39C despite aggressive cooling measures
- Coma duration longer than 2 hours
- Severe pulmonary oedema
- Delayed or prolonged hypotension
- Lactic acidosis in patients with classic heatstroke
- ARF and hyperkalaemia
- ALT / AST levels greater than 1000 IU/L during the first 24 hours

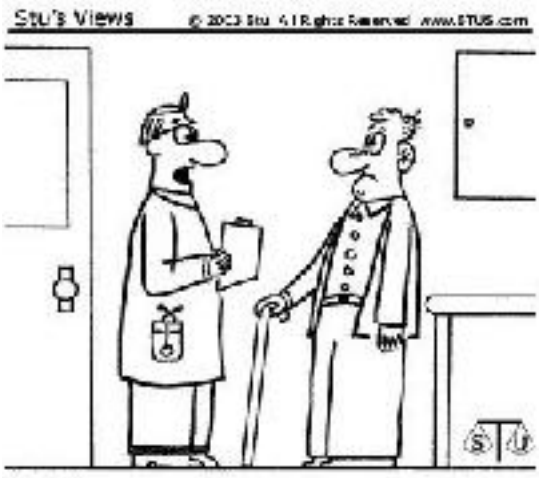
Pitfalls

- Relying on the criteria listed in the classic definition for diagnosing heatstroke
- Failure to consider the diagnosis in mildly hyperthermic patients with altered mental status: The diagnosis of heatstroke should be applied liberally to patients with altered mental status during environmental heat waves, even in the absence of severe hyperthermia.
- Failure to measure the temperature, thereby delaying the diagnosis and therapy
- Failure to initiate cooling measures in an expeditious manner
- Overcooling, thus causing iatrogenic hypothermia
- Prescribing antipyretics

Ref - Rosen, Tintinelli, medscape “Heatstroke- Helman H , Habal, M, ACEM site

JOKE / QUOTE OF THE WEEK

What not to say..



Editor: Peter Wyllie

Please forward any funny and litigious quotes you may hear on the floor (happy to publish names if you want)

THE WEEK AHEAD

Tuesdays - 14:30 – 15:30 Intern & JMO teaching -Thomas & Rachel Moore
Wednesday- 0800-0900 Critical Care Journal Club. ICU Conf Room / 14:30 – 15:30 Intern & JMO teaching -Thomas & Rachel Moore
Thursday 0730-0800 Trauma Audit. Education Centre / 0800-0830 MET Review Education centre / 1300-1400 Medical Grand Rounds. Auditorium.

Editor: Peter Wyllie