Optimizing the peri-operative management of neurosurgical patients

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The National Hospital for Neurology and Neurosurgery
UCL
HOSPITALS

Optimizing peri-operative management of neurosurgical patients

- aims to
  - to obtain best possible clinical outcome
  - improve patient experience
  - reduce costs
  - maximise efficiency

Optimizing peri-operative management of neurosurgical patients

- remember that patients are people , not numbers!

Optimizing peri-operative management ... introduction

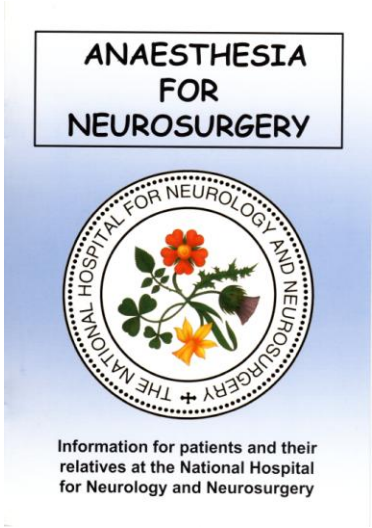
- craniotomy patients

Optimizing peri-operative management …

- patient journey begins in …
- Pre-admission Clinic
- attend 1-2 weeks before planned surgery

Optimizing peri-operative management ...
Pre-admission Clinic

- medical history and examination by doctor
- pre-operative blood analysis
- blood group and save
- MRSA screening
- further referral if necessary (cardiologist)
- Patient Information Booklet



Optimizing peri-operative management ... Pre-admission Clinic

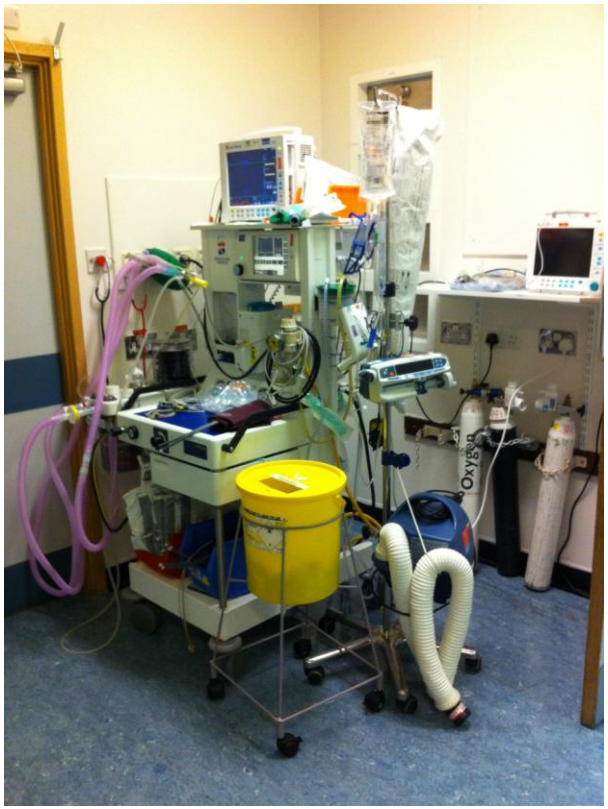
- set up at The National Hospital - 2009
- very effective
- no cancellations of operations for health reasons
- 60% all craniotomy patients seen in pre-admission


The patient's
journey …
Admission – day 1

Optimizing peri-operative management ... pre-operative treatment

- on day of surgery
  - all patients assessed by anaesthetist
  - no pre-medication
  - if possible patient walks to theatre (patient preference / more efficient)

Optimizing peri-operative management ...
anaesthetic room



WHO Surgical Safety Checklist

(adapted for England and Wales)

NHS
National Patient Safety Agency
National Reporting and Learning Service

SIGN IN (To be read out loud)

Before induction of anaesthesia

Has the patient confirmed his/her identity, site, procedure and consent?
- ☐ Yes

Is the surgical site marked?
- ☐ Yes/not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway/aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and adequate IV access/fluids planned

TIME OUT (To be read out loud)

Before start of surgical intervention
for example, skin incision

Have all team members introduced themselves by name and role?
- ☐ Yes

Surgeon, Anaesthetist and Registered Practitioner verbally confirm:
- ☐ What is the patient's name?
- ☐ What procedure, site and position are planned?

Anticipated critical events

Surgeon:
- ☐ How much blood loss is anticipated?
- ☐ Are there any specific equipment requirements or special investigations?
- ☐ Are there any critical or unexpected steps you want the team to know about?

Anaesthetist:
- ☐ Are there any patient specific concerns?
- ☐ What is the patient's ASA grade?
- ☐ What monitoring equipment and other specific levels of support are required, for example blood?

Nurse/ODP:
- ☐ Has the sterility of the instrumentation been confirmed (including indicator results)?
- ☐ Are there any equipment issues or concerns?

Has the surgical site infection (SSI) bundle been undertaken?
- ☐ Yes/not applicable
  - Antibiotic prophylaxis within the last 60 minutes
  - Patient warming
  - Hair removal
  - Glycaemic control

Has VTE prophylaxis been undertaken?
- ☐ Yes/not applicable

Is essential imaging displayed?
- ☐ Yes/not applicable

SIGN OUT (To be read out loud)

Before any member of the team leaves the operating room

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Surgeon, Anaesthetist and Registered Practitioner:
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PATIENT DETAILS

Last name:

First name:

Date of birth:

NHS Number:*

Procedure:

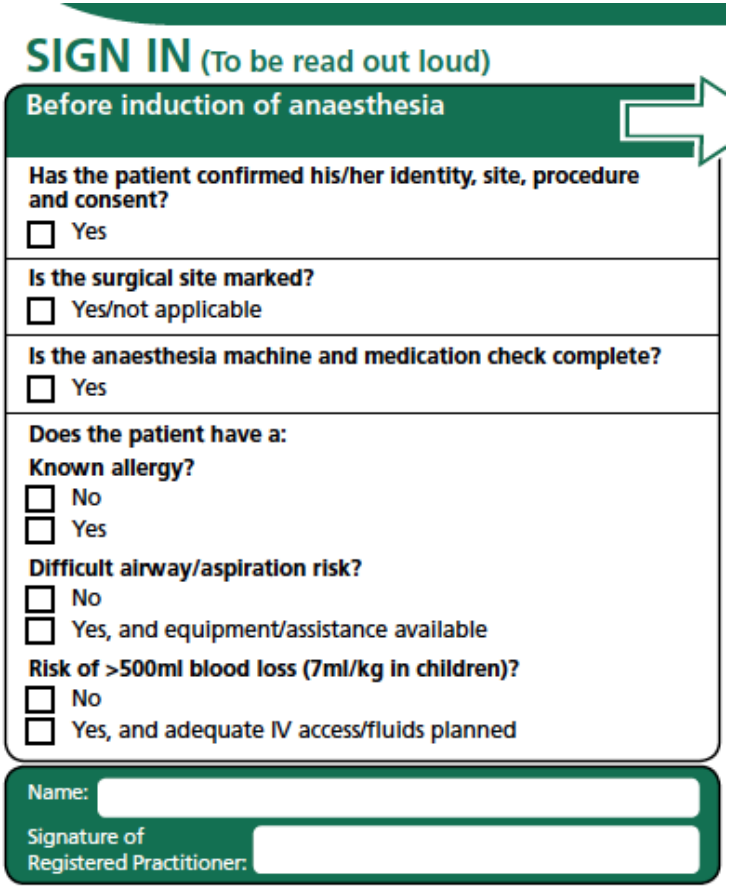
*If the NHS Number is not immediately available, a temporary number should be used until it is.

This checklist contains the core content for England and Wales

www.npsa.nhs.uk/nrls

0861 January 2009

Optimizing peri-operative management ... anaesthetic room



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Known allergy?

☐ No

☐ Yes

Difficult airway/aspiration risk?

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Risk of >500ml blood loss (7ml/kg in children)?

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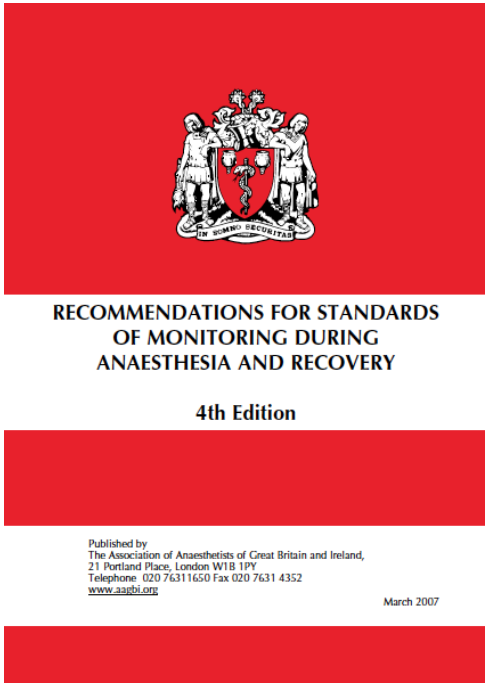
Name:

Signature of Registered Practitioner:

Optimizing peri-operative management … standard anaesthetic technique

- ‘minimal monitoring’ for all patients



Optimizing peri-operative management ... standard anaesthetic technique

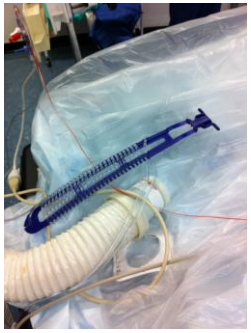
- ‘minimal monitoring’ for all patients
  - pulse oximeter
  - non-invasive blood pressure
  - ECG
  - airway gases: oxygen, carbon dioxide and vapour
  - airway pressure

Optimizing peri-operative management ... standard anaesthetic technique

- ‘minimal monitoring’
  +
  arterial line
  nasopharyngeal temperature probe
  +/- urinary catheter
  +/- fine bore nasogastric tube

Optimizing peri-operative management ... standard anaesthetic technique

- patient warming before induction
  - intra-venous fluids



  - forced-air patient warming blanket

Optimizing peri-operative management ... standard anaesthetic technique

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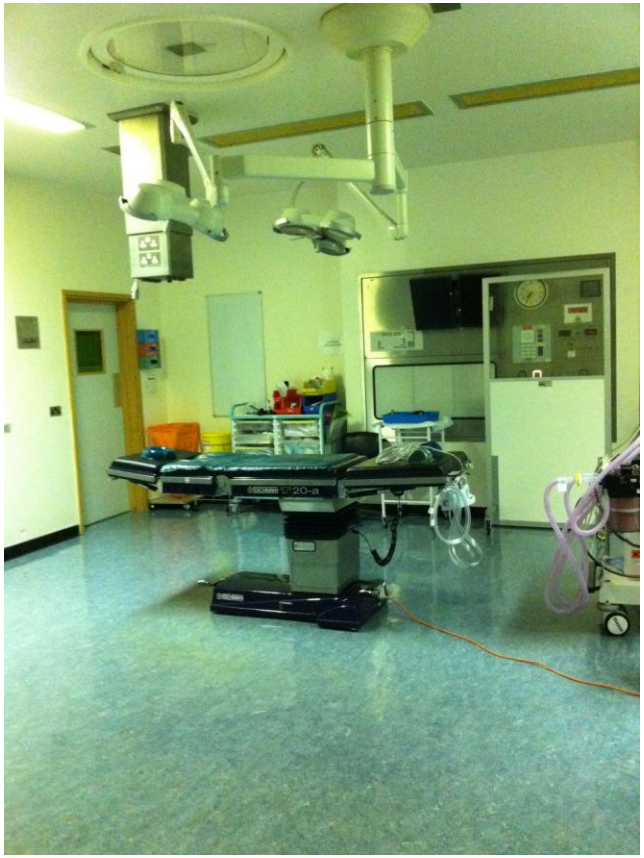
- induction
  - midazolam (1-2 mg)
  - fentanyl (3- 4 μg/kg)
  - propofol
  - vecuronium or atracurium
  - O_2

Optimizing peri-operative management ... standard anaesthetic technique

- maintenance
  - O_2 and air
  - sevoflurane (closed-circuit)
  - remifentanil 0.1-0.15 μg/kg/min

Optimizing peri-operative management ...
entry to operating theatre



Optimizing peri-operative management ... entry to operating theatre

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- before positioning patient in theatre …
  - ‘Time Out’

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0861 January 2009

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Optimizing peri-operative management ... standard anaesthetic technique

- parameters
  - normotension
  - normocapnia ($PaCO_2$ 4.5-5.0 kPa)
  - normovolaemia
  - normothermia (36 - 37 º C)
  - haemoglobin > 8 g/dl
  - normoglycaemia (4-10 mmol/l)

Optimizing peri-operative management ... standard anaesthetic technique

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- analgesia
  - 45 minutes before end-procedure
  - intravenous paracetamol 1g
  - intravenous morphine 5 -10 mg
- continue remifentanil 0.1-0.15 μg/kg/min

Optimizing peri-operative management ... standard anaesthetic technique

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- end of operation
  - ‘Sign Out’

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Optimizing peri-operative management ... standard anaesthetic technique

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- wherever possible extubate patient
  - ‘awake’ patient
  - provides best quality neurological observation
  - Glasgow Coma Score (GCS)

Optimizing peri-operative management ... standard anaesthetic technique

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- preparing for extubation
  - discontinue remifentanil
  - spontaneous ventilation
  - sevoflurane → $\geq$ E_T 2.3%
- extubation (deep)

Optimizing peri-operative management … post-craniotomy destination

- decided on day before surgery
- guidelines

POST- OPERATIVE DESTINATIONS AT NHNN

Post-operative Destination	Standard Recovery Time *(hours)*	Discharge
Recovery		
CRANIAL SURGERY		*Patient under care of surgical team*
Craniotomy	6	
Acoustic Neuroma *(< 2cm)*	6	
Mini-craniotomy	4	
Carotid Endarterectomy *(Unilateral)*	4	
Temporal Lobectomy	4	
Deep Brain Stimulator *(DBS)*	3	*Standard recovery times are set as a **general rule***
Burrhole Evacuation / Biopsy	2	
Cranioplasty	2	
Microvascular Decompression *(MVD)*	2	*The Consultant Anaesthetist may reduce the recovery time for individual patients and document in the medical records*
Transphenoidal Hypophysectomy *(TSH)*	1	
Foramen Magnum Decompression *(FMD)*	No minimum time	
Ventriculo-peritoneal Shunt	No minimum time	
External Ventricular Drain *(EVD)*	No minimum time	*These patients can be discharged to the ward provided the Recovery Discharge Criteria are met*
SPINAL SURGERY		
Anterior Cervical Discectomy (ACD) / Decompression	No minimum time	
Posterior Cervical Decompression	No minimum time	
Lumbar Discectomy	No minimum time	
Microdiscectomy	No minimum time	
RADIOLOGICAL PROCEDURES		*Wards will be contacted **30 minutes** prior to discharge for most patients*
CRANIAL		
Glue Embolisation of Arterio-venous Malformation *(AVM)*	3	*For minor procedures requiring <1 hour in recovery the ward may be given **15 minutes** notice to collect the patient*
Coiling of Aneurysm *(unruptured / recoiling)*	2	
Embolisation Intracranial Tumour	2	
Diagnostic Angiogram	1	
SPINAL		
Arterio-venous Malformation *(AVM)*	1	
Dural Fistula	1	
OTHER		
Nerve Stimulator *(occipital / vagal /sacral / spinal)*	No minimum time	
Ulnar Nerve Decompression	No minimum time	
Lumbar Drain	No minimum time	
Battery Change	No minimum time	
Thermo-coagulation	No minimum time	
Overnight Recovery (OR)		
Elective post-operative patients who have undergone procedures that require overnight *observation only* *(no intravenous infusions, e.g. morphine, inotrope)*	**Until 0600 – 0700 the following morning**	*Patient under care of surgical team* *Nurse-led discharge to ward by 0700 the following morning provided patient meets Recovery Discharge Criteria*
High Dependency Unit (HDU)		
CRANIAL SURGERY		*Patient under combined care of surgical team and critical care team* *Patient reviewed on HDU ward round the following morning prior to discharge* *Receiving ward should expect patient to return by 1030 -1100*
Craniotomy *(requiring invasive arterial pressure monitoring for 12-24 hours)*	**12 – 24 hours**	
Subdural Grid Insertion		
Carotid Endarterectomy *(Bilateral)* / EC/IC Bypass		
Clipping of Cerebral Aneurysm *(Elective)*		
Acoustic Neuroma *(> 2cm)*		
SPINAL SURGERY		
Complex Spinal Surgery		
Thoracotomy		
Multi-level procedure		
Complex post-operative pain management		
RADIOLOGICAL PROCEDURES		
Coiling of Cerebral Aneurysm *(Acute rupture / rupture within past few weeks)*		
Cerebral Angioplasty / Intracerebral therapy		
Balloon Occlusion		
Carotid Stent / Vertebral Stent		
OTHER		
Patients with co-morbidity		
Surgical ITU (SITU)		
CRANIAL SURGERY		*Patient under combined care of surgical team and critical care team* *Patient reviewed on SITU ward round the following morning prior to discharge* *Receiving ward should expect most patients to return by 1030 -1100* *SITU will advise if patient requires extended recovery in SITU*
Craniotomy for large tumour	**12 – 24 hours for most patients**	
Posterior Fossa Craniectomy		
Clipping of Cerebral Aneurysm *(SAH)*		
SPINAL SURGERY		
Transoral Approach / Maxillotomy		
Complex Spinal Surgery		
RADIOLOGICAL PROCEDURES		
Coiling of Cerebral Aneurysm *(Acute)*		
OTHER		
Patients with co-morbidity		
* Thymectomy patients are recovered in Medical ITU		

Optimizing peri-operative management ... post-craniotomy destination

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- at all stages patients cared for by neurosurgically-trained nurses

Optimizing peri-operative management ... post-craniotomy destination

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- ‘low risk’ craniotomy (glioma, biopsy)
  → Recovery Ward

- if no problems < 6h - return to neurosurgical ward

WAS Taylor et al

Journal of Neurosurgery 1995; **82**: 48-50

  - hospital audit has shortened Recovery Ward times

Optimizing peri-operative management ... post-craniotomy destination

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- ‘higher risk’ craniotomy
  (VIII neuroma, meningioma, aneurysm clipping)
  → HDU

- return to neurosurgical ward next day

Optimizing peri-operative management ... post-craniotomy destination

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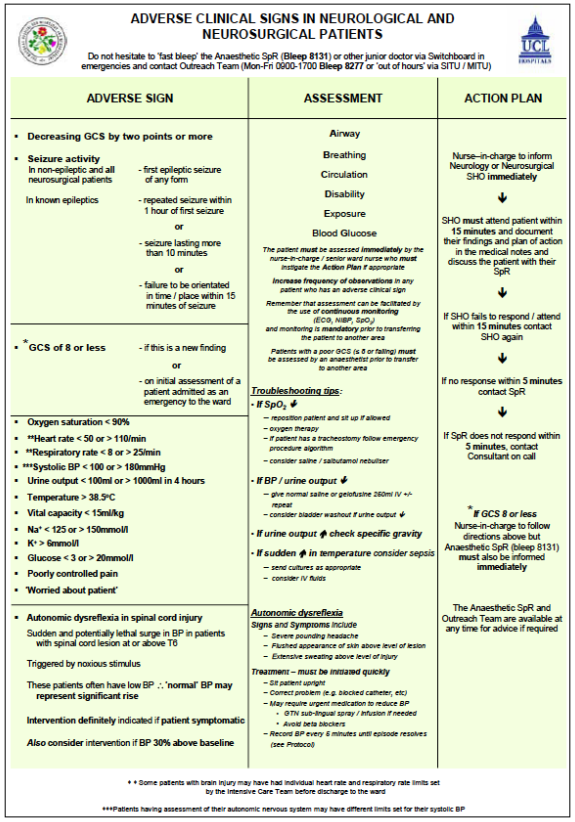
- very complex cases
  (brainstem lesion, ventilated before surgery)
  → ITU

- discharge to HDU when appropriate

Optimizing peri-operative management … post-craniotomy destination

- ‘early warning system’ used throughout hospital
- ‘Adverse Clinical Signs Action Plan’



ADVERSE CLINICAL SIGNS IN NEUROLOGICAL AND NEUROSURGICAL PATIENTS

Do not hesitate to 'fast bleep' the Anaesthetic SpR (**Bleep 8131**) or other junior doctor via Switchboard in emergencies and contact Outreach Team (Mon-Fri 0900-1700 **Bleep 8277** or 'out of hours' via SITU / MITU)

ADVERSE SIGN	ASSESSMENT	ACTION PLAN
• **Decreasing GCS by two points or more** • **Seizure activity** In non-epileptic and all neurosurgical patients - first epileptic seizure of any form In known epileptics - repeated seizure within 1 hour of first seizure **or** - seizure lasting more than 10 minutes **or** - failure to be orientated in time / place within 15 minutes of seizure • *GCS of 8 or less - if this is a new finding **or** - on initial assessment of a patient admitted as an emergency to the ward • **Oxygen saturation < 90%** • **Heart rate < 50 or > 110/min • **Respiratory rate < 8 or > 25/min • ***Systolic BP < 100 or > 180mmHg • **Urine output < 100ml or > 1000ml in 4 hours** • **Temperature > 38.5ºC** • **Vital capacity < 15ml/kg** • **Na^+ < 125 or > 150mmol/l** • **K^+ > 6mmol/l** • **Glucose < 3 or > 20mmol/l** • **Poorly controlled pain** • **'Worried about patient'** • **Autonomic dysreflexia in spinal cord injury** Sudden and potentially lethal surge in BP in patients with spinal cord lesion at or above T6 Triggered by noxious stimulus These patients often have low BP ∴ **'normal' BP may represent significant rise** **Intervention definitely** indicated if **patient symptomatic** ***Also* consider** intervention if **BP 30% above baseline**	**Airway** **Breathing** **Circulation** **Disability** **Exposure** **Blood Glucose** *The patient must be assessed **immediately** by the nurse-in-charge / senior ward nurse who must instigate the **Action Plan** if appropriate* ***Increase frequency of observations** in any patient who has an adverse clinical sign* *Remember that assessment can be facilitated by the use of **continuous monitoring** (ECG, $NIBP$, SpO_2) and monitoring is **mandatory** prior to transferring the patient to another area* *Patients with a poor GCS (≤ 8 or falling) must be assessed by an anaesthetist prior to transfer to another area* ***Troubleshooting tips**:* ***- If SpO_2 ↓*** *– reposition patient and sit up if allowed – oxygen therapy – if patient has a tracheostomy follow emergency procedure algorithm – consider saline / salbutamol nebuliser* ***- If BP / urine output ↓*** *– give normal saline or gelofusine 250ml IV +/- repeat – consider bladder washout if urine output ↓* ***- If urine output ↓ check specific gravity*** ***- If sudden ↓ in temperature consider sepsis*** *– send cultures as appropriate – consider IV fluids* ***Autonomic dysreflexia*** ***Signs and Symptoms** include* *– Severe pounding headache – Flushed appearance of skin above level of lesion – Extensive sweating above level of injury* ***Treatment – must be initiated quickly*** *– Sit patient upright – Correct problem (e.g. blocked catheter, etc) – May require urgent medication to reduce BP • GTN sub-lingual spray / infusion if needed • Avoid beta blockers – Record BP every 5 minutes until episode resolves (see Protocol)*	Nurse–in–charge to inform Neurology or Neurosurgical SHO **immediately** ↓ SHO **must** attend patient within **15 minutes** and document their findings and plan of action in the medical notes and discuss the patient with their SpR ↓ If SHO fails to respond / attend within **15 minutes** contact SHO again ↓ If no response within **5 minutes** contact SpR ↓ If SpR does not respond within **5 minutes**, contact Consultant on call **If GCS 8 or less* Nurse-in-charge to follow directions above but Anaesthetic SpR (bleep 8131) **must** also be informed **immediately** The Anaesthetic SpR and Outreach Team are available at any time for advice if required

* * Some patients with brain injury may have had individual heart rate and respiratory rate limits set by the Intensive Care Team before discharge to the ward

***Patients having assessment of their autonomic nervous system may have different limits set for their systolic BP

January 2009 *(for review January 2010)*

Optimizing peri-operative management ... post-craniotomy destination

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- particularly useful on wards
  - abnormal signs (↓GCS, seizure, ↓SpO_2, ↑TºC …)

  → urgent attendance of doctor (≤ 15minutes)
  → urgent attendance of Outreach Nurse

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Do not hesitate to 'fast bleep' the Anaesthetic SpR (**Bleep 8131**) or other junior doctor via Switchboard in emergencies and contact Outreach Team (Mon-Fri 0900-1700 **Bleep 8277** or 'out of hours' via SITU / MITU)

ADVERSE SIGN	ASSESSMENT	ACTION PLAN
▪ **Decreasing GCS by two points or more** ▪ **Seizure activity** In non-epileptic and all neurosurgical patients – first epileptic seizure of any form In known epileptics – repeated seizure within 1 hour of first seizure **or** – seizure lasting more than 10 minutes **or** – failure to be orientated in time / place within 15 minutes of seizure	**Airway** **Breathing** **Circulation** **Disability** **Exposure** **Blood Glucose** *The patient **must** be assessed **immediately** by the nurse-in-charge / senior ward nurse who **must** instigate the **Action Plan** if appropriate* ***Increase frequency of observations** in any patient who has an adverse clinical sign* *Remember that assessment can be facilitated by the use of **continuous monitoring** (ECG, NIBP, SpO_2) and monitoring is **mandatory** prior to transferring the patient to another area* *Patients with a poor GCS (≤ 8 or falling) **must** be assessed by an anaesthetist prior to transfer to another area*	Nurse–in-charge to inform Neurology or Neurosurgical SHO **immediately** ↓ SHO **must** attend patient within **15 minutes** and document their findings and plan of action in the medical notes and discuss the patient with their SpR ↓ If SHO fails to respond / attend within **15 minutes** contact SHO again ↓ If no response within **5 minutes** contact SpR ↓ If SpR does not respond within **5 minutes**, contact Consultant on call
▪ **GCS of 8 or less* – if this is a new finding **or** – on initial assessment of a patient admitted as an emergency to the ward		**If GCS 8 or less* Nurse-in-charge to follow directions above but Anaesthetic SpR (bleep 8131) **must** also be informed **immediately**
▪ **Oxygen saturation < 90%** ▪ ****Heart rate < 50 or > 110/min** ▪ ****Respiratory rate < 8 or > 25/min** ▪ *****Systolic BP < 100 or > 180mmHg** ▪ **Urine output < 100ml or > 1000ml in 4 hours** ▪ **Temperature > 38.5ºC** ▪ **Vital capacity < 15ml/kg** ▪ **Na^+ < 125 or > 150mmol/l** ▪ **K^+ > 6mmol/l** ▪ **Glucose < 3 or > 20mmol/l** ▪ **Poorly controlled pain** ▪ **'Worried about patient'**	***Troubleshooting tips:*** • ***If SpO_2 ↓*** – *reposition patient and sit up if allowed* – *oxygen therapy* – *if patient has a tracheostomy follow emergency procedure algorithm* – *consider saline / salbutamol nebuliser* • ***If BP / urine output ↓*** – *give normal saline or gelofusine 250ml IV +/- repeat* – *consider bladder washout if urine output ↓* • ***If urine output ↑ check specific gravity*** • ***If sudden ↑ in temperature** consider sepsis* – *send cultures as appropriate* – *consider IV fluids*	
▪ **Autonomic dysreflexia in spinal cord injury** Sudden and potentially lethal surge in BP in patients with spinal cord lesion at or above T6 Triggered by noxious stimulus These patients often have low BP ∴ **'normal' BP may represent significant rise** **Intervention definitely** indicated if **patient symptomatic** ***Also consider*** intervention if **BP 30% above baseline**	***Autonomic dysreflexia*** ***Signs and Symptoms** include* – *Severe pounding headache* – *Flushed appearance of skin above level of lesion* – *Extensive sweating above level of injury* ***Treatment – must be initiated quickly*** – *Sit patient upright* – *Correct problem (e.g. blocked catheter, etc)* – *May require urgent medication to reduce BP* • *GTN sub-lingual spray / infusion if needed* • *Avoid beta blockers* – *Record BP every 5 minutes until episode resolves (see Protocol)*	The Anaesthetic SpR and Outreach Team are available at any time for advice if required

* * Some patients with brain injury may have had individual heart rate and respiratory rate limits set by the Intensive Care Team before discharge to the ward

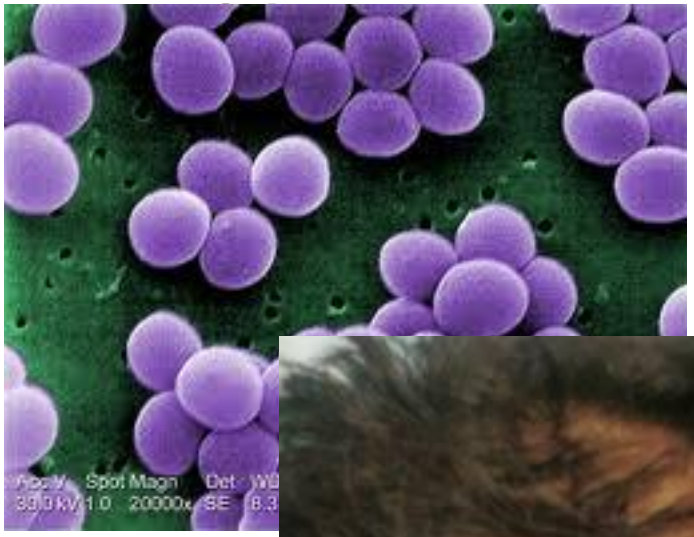
***Patients having assessment of their autonomic nervous system may have different limits set for their systolic BP

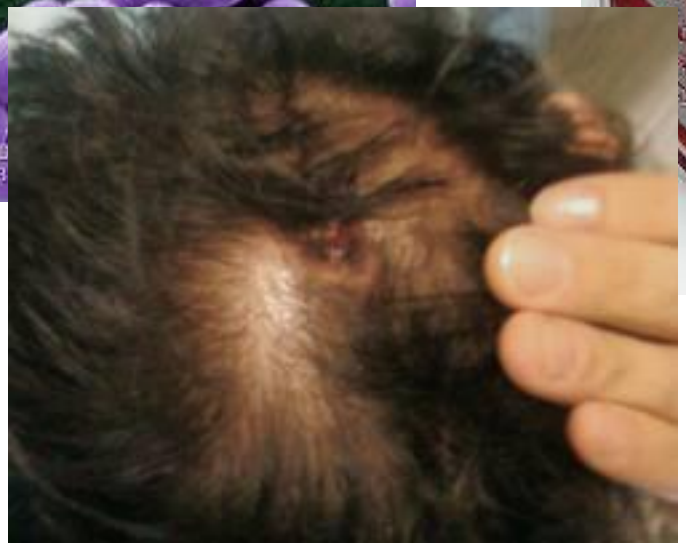
January 2009 *(for review January 2010)*

Optimizing peri-operative management ... miscellaneous

- infection control
- steroids
- mannitol
- anti-epileptic drugs (AED)
- venous thromboembolic (VTE) prophylaxis
- analgesia
- specialist teams referral

Optimizing peri-operative management … infection control

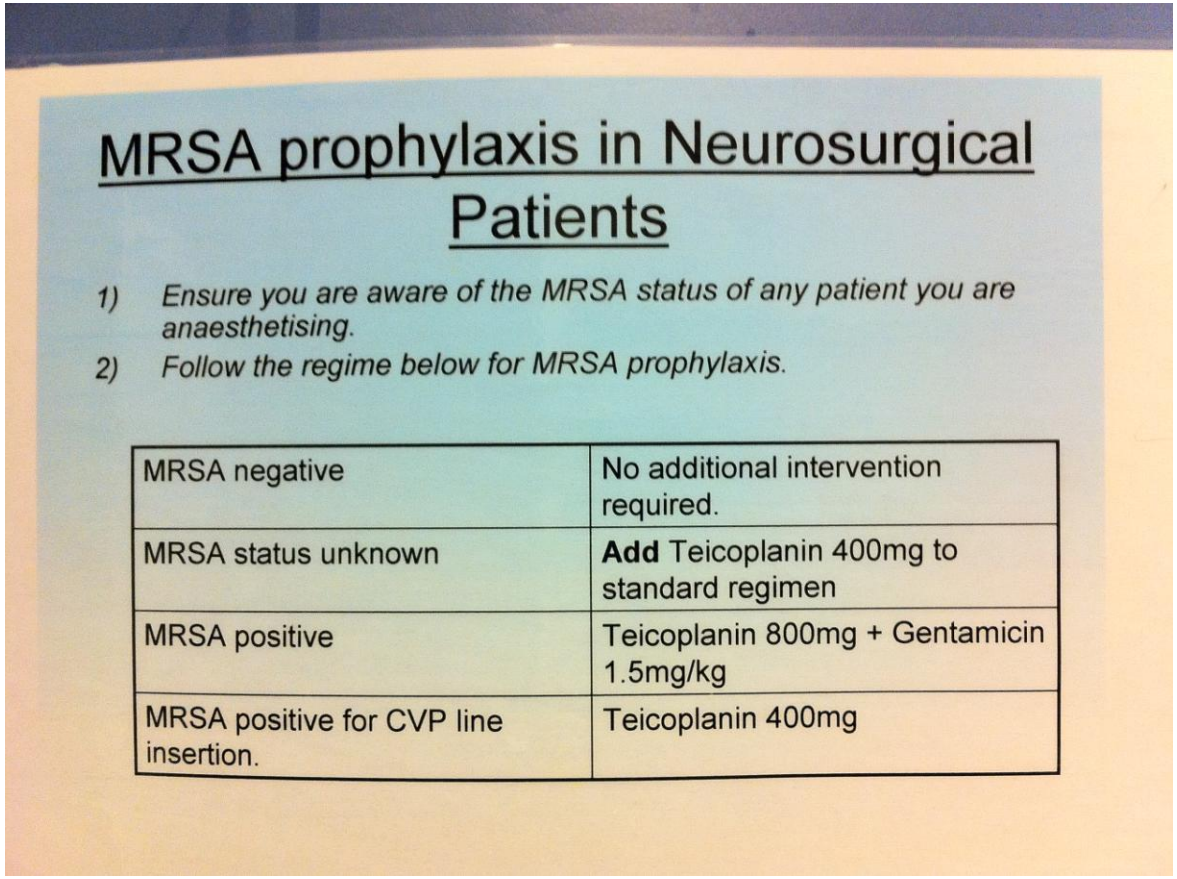
- 

Optimizing peri-operative management ... infection control

- begins with MRSA screening in Pre-admission Clinic
- de-colonisation where necessary
- strict guidelines
  - hand washing
  - aseptic technique for vascular access

Optimizing peri-operative management ... infection control



MRSA prophylaxis in Neurosurgical Patients

1) *Ensure you are aware of the MRSA status of any patient you are anaesthetising.*
2) *Follow the regime below for MRSA prophylaxis.*

MRSA negative	No additional intervention required.
MRSA status unknown	**Add** Teicoplanin 400mg to standard regimen
MRSA positive	Teicoplanin 800mg + Gentamicin 1.5mg/kg
MRSA positive for CVP line insertion.	Teicoplanin 400mg

Optimizing peri-operative management ... infection control - antibiotics

- MRSA –ve
  - cefuroxime x 1.5 g
  - < 60 min before skin incision
  - repeat 3 hourly intra-op
  - no post-operative antibiotics

Optimizing peri-operative management ... infection control - antibiotics

- MRSA unknown
  - cefuroxime x 1.5 g
    +
  - teicoplanin 400 mg
  - < 60 min before skin incision
  - no post-operative antibiotics

Optimizing peri-operative management ... infection control - antibiotics

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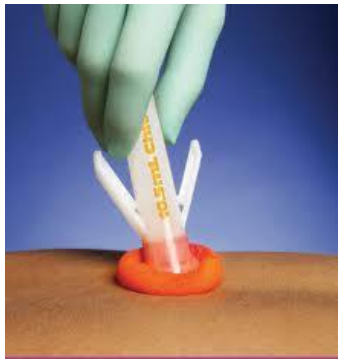
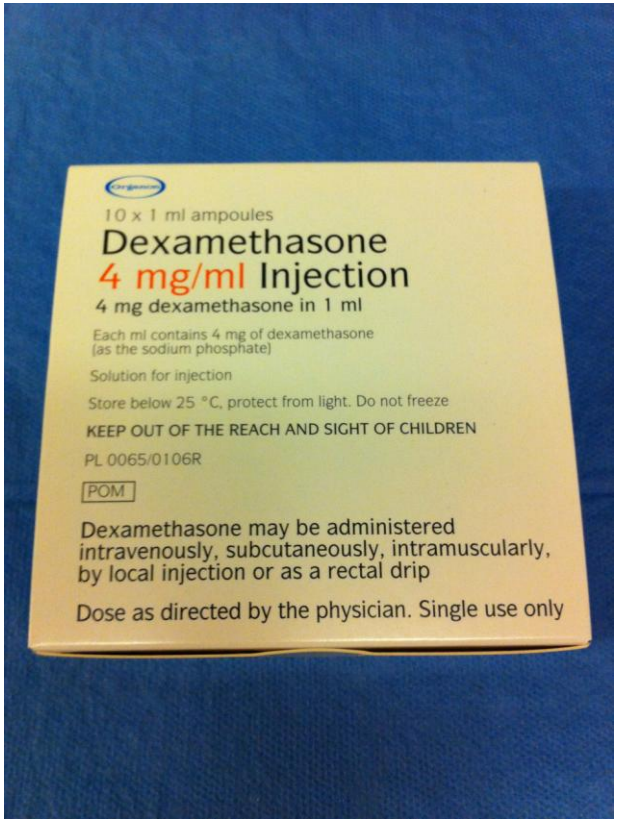
- MRSA +ve
  - ideally 5 day decolonisation (operate day 6 or 7)
  - teicoplanin 800 mg
    +
  - gentamicin 1.5mg/Kg
  - < 60 min before skin incision
  - no post-operative antibiotics

Optimizing peri-operative management ... infection control

- surgical site preparation
  - no hair shaving – clipping instead
  - individual stick anti-septic
  - 2% chlorohexidine + 70% alcohol + dye
  - not multi-use bottle anti-septic
- maintain normothermia

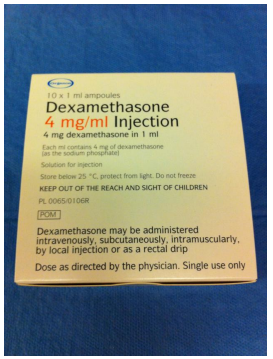


Optimizing peri-operative management … steroids



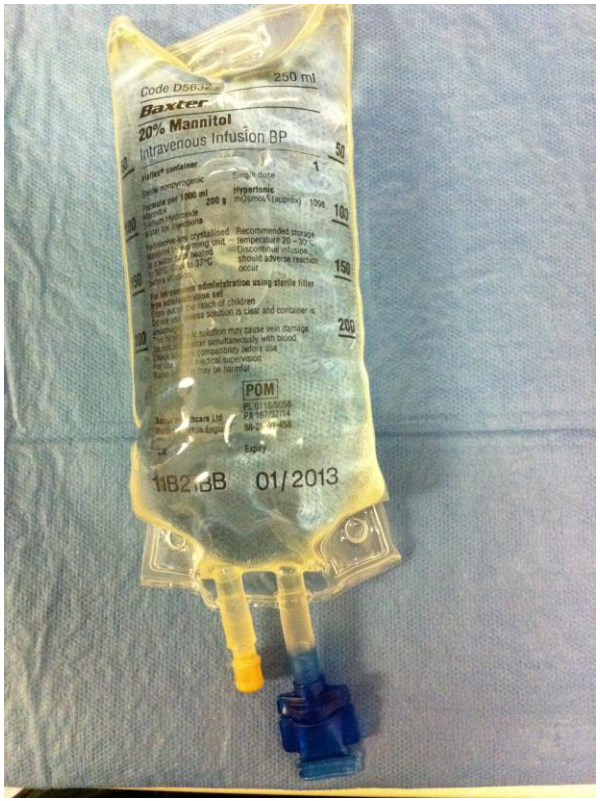
Optimizing peri-operative management ... steroids

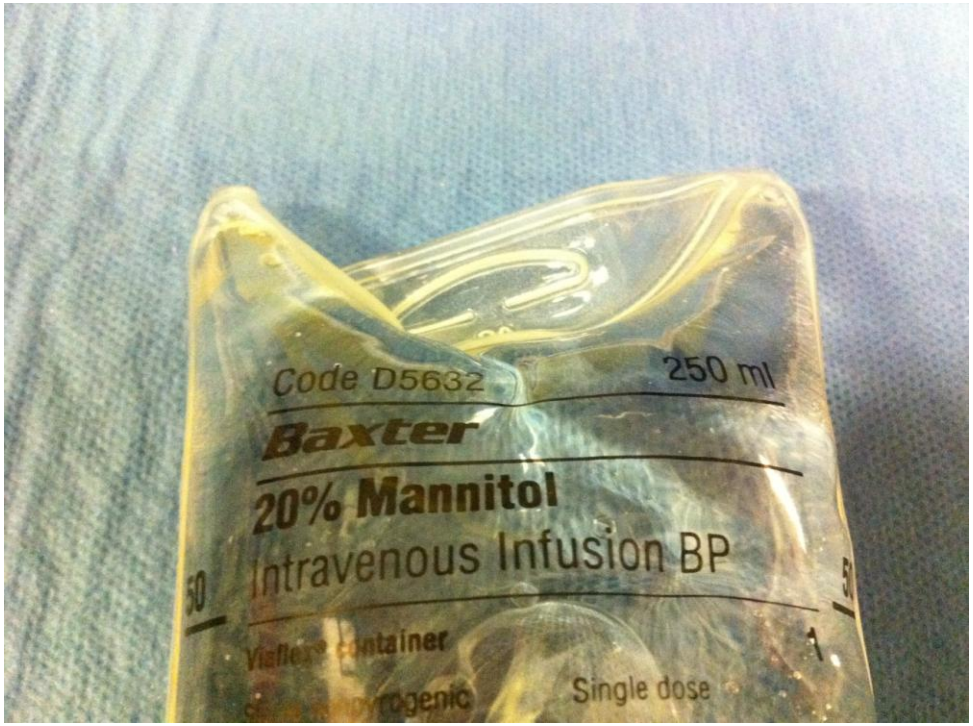
- most patients
  - dexamethasone 4 mg x 4/day
  - x 3-4 days
  - rapid reduction



- chemotherapy or radiotherapy ?
  - continue with dexamethasone 2 mg x 2/day

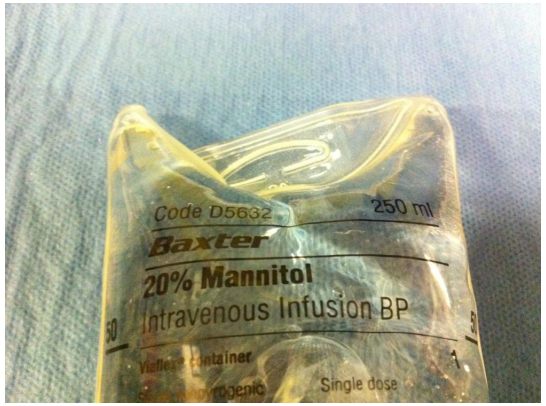
Optimizing peri-operative management ... mannitol





Optimizing peri-operative management … mannitol

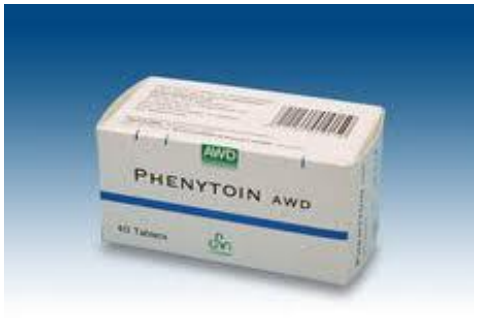
- not used routinely
- small dose 0.25 -0.5 g/kg
- unusual to give repeat bolus



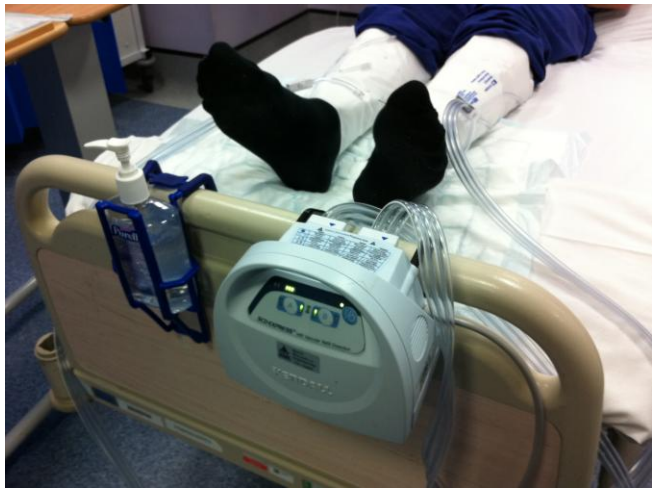
Optimizing peri-operative management … antiepileptic drugs (AED)

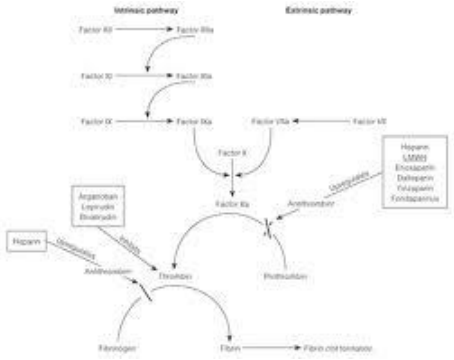
- not used routinely
- phenytoin or levetiracetam (Keppra)

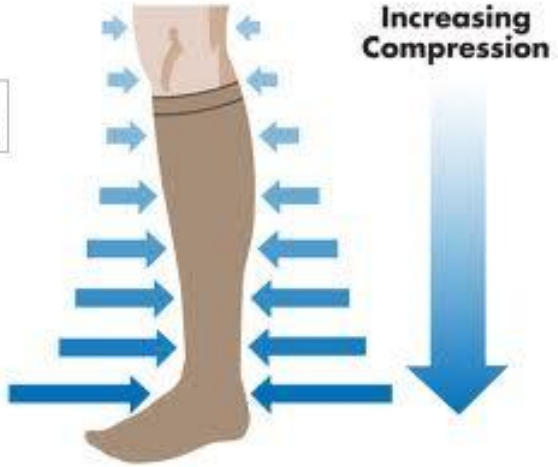
- 1st seizure post-op
  - propofol (anaesthetist)
  - lorazepam (non-anaesthetist)



Optimizing peri-operative management ... venous thromboembolic (VTE) prophylaxis







Optimizing peri-operative management ... venous thromboembolic (VTE) prophylaxis

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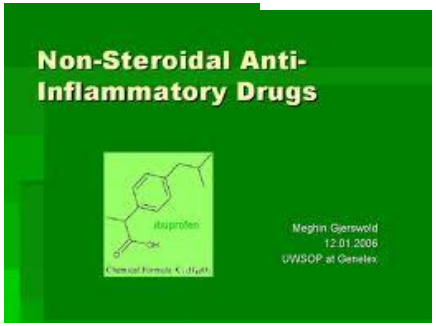
- all patients
- graduated compression stockings
- intermittent calf compression
  - in theatre
  - continued post-operatively until low-molecular weight heparin (LMWH)
- LMWH - 6 hours post-operative if patient OK

Optimizing peri-operative management … analgesia



Optimizing peri-operative management ... analgesia

- non-pharmaceutical adjuncts
  - head –up/cold packs
- regular paracetamol
- NSAIDs > 6 h
- Oramorph 5 -10 mg qds
- Oramorph 5 -10 mg 3 hourly prn

Optimizing peri-operative management … specialist teams

- if required … referred to specialist team

SALT- speech and language therapy

Acute pain team

Occupational therapy

Wound surveillance team

Psychologist

Physiotherapy

Nutritional support


Home - day 5 for majority

Thank you for your attention