Old Dutch Church of Sleepy Hollow

1685

GO IN PEACE
SERVE THE LORD
post anesthetic care and post operative pain management

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post anesthetic care

- Level of postoperative care a patient requires is determined by degree of underlying illness
- Duration and complexity of anesthesia and surgery
- Risk postoperative complications
- Patients must be carefully evaluated to determine which level of postoperative care is most appropriate
post anesthetic care

- Preoperative history
- Medication allergies or reactions
- Underlying medical illness
- Chronic medications acute problems premedication
- NPO status
post anesthetic care

- Intraoperative factors
- Surgical procedure
- Type of anesthetic and drug doses
- Muscle relaxant and reversal status
- Intravenous fluids
- Estimated blood loss
- Urine output
- Unexpected surgical or anesthetics events
- Intraoperative vitalsigns and lab finding
- Nonanesthetic drugs
post anesthetic care

- Postoperative instructions
- Pain management
- Acceptable vital sign ranges, blood loss, urine output
- Anticipated cardiopulmonary problems
- Diagnostic tests
post anesthetic care

- Cardiovascular complications
- Postoperative pulmonary dysfunction
- Aspiration
- Postoperative renal complications
- Metabolic complications
- Electrolytes and glucose
- Miscellaneous complications
Cardiovascular complications

Post operative hypotension

- 20-30% decrease in BP from preoperative levels that result in symptoms of organ hypoperfusion
- Acidosis, oliguria, SNS activation, CNS disturbances
Cardiovascular complications

Differential diagnosis of hypotension

- Arterial hypoxemia
- Hypovolemia (most common cause)
- Pulmonary edema
- Myocardial ischemia
- Cardiac arrhythmia decreased systemic vascular resistance pneumothorax
- Cardiac tamponade
Cardiovascular complications

Post operative hypertension

- 20-30% increase in BP from base line levels
Cardiovascular complications

Differential diagnosis of hypertension

- Arterial hypoxemia
- Pre-existing essential hypertension
- Enhanced SNS activity (pain, carinal stimulation, bladder distension, pre-eclampsia)
- Excess fluid administration
- Hypothermia
Postoperative pulmonary dysfunction

- Inadequate postoperative ventilation
- Inadequate postoperative oxygenation
Postoperative pulmonary dysfunction

Differential diagnosis hypoventilation

- Inadequate ventilatory drive (residual effects of anesthetic, lack of sensory stimulation)
- Ventilatory mechanics
  - Increased airway resistance (obstruction)
  - Decreased compliance (obesity, fluid overload)
  - Residual neuromuscular blockade
- Increased dead space (pulmonary embolus)
- Increased carbon dioxide production (hyperthermia, hyperalimentation)
Inadequate postoperative oxygenation

- Acceptable PaO$_2$ must be defined for each individual patient
- Maintain PaO$_2$ between 70-100 mmHg
- Splinting due to postoperative pain contributes to detrimental loss of lung volume (especially functional residual capacity)
Postoperative pulmonary dysfunction

Differential diagnosis of arterial hypoxemia

- Distribution of ventilation (mismatch of ventilation to perfusion because of loss functional residual capacity)
- Distribution of perfusion (mismatch of perfusion to ventilation due to impaired hypoxic pulmonary vasoconstriction or altered pulmonary artery pressure)
Postoperative pulmonary dysfunction

Differential diagnosis of arterial hypoxemia

- Inadequate alveolar oxygen partial pressure
- Decreased mixed venous oxygen partial pressure (decreased cardiac output, increased tissue oxygen extraction owing to shivering or sepsis)
Aspiration

- Inhalation of acidic fluid (pH<2.5) in the perioperative period may manifest as varying degrees of arterial hypoxemia and infiltrates on chest radiographs
- Treatment is correction of hypoxemia with supplemental oxygen
- Tracheal intubation may be required
- Antibiotics are prescribed only if bacterial infection develops
Postoperative renal complications

Oliguria

- Urine output < 0.5 ml/kg/hr
- Adequate perfusion pressure
- Hydration
- Increase the possibility of acute tubular necrosis
Postoperative renal complications

Polyuria

- Usually self-limited
- Most often is due to generous intraoperative fluid administration or hyperglycemia (osmotic diuresis)
- Sustained polyuria (urine output >4-5 ml/kg/hr) may result in hypovolemia and electrolyte disturbances
Metabolic complications

- Respiratory acidosis (alveolar hypoventilation)
- Metabolic acidosis (hypovolemia, tissue hypoxia, hypothermia, renal failure, ketoacidosis, sepsis)
- Respiratory alkalosis (hyperventilation)
- Metabolic alkalosis (prolonged gastric suctioning, potassium wasting diuretics)
Electrolytes and glucose

- Hypokalemia (cardiac dysrhythmias)
- Hyperkalemia (renal failure)
- Hyponatremia (following TUR-P)
- Hyperglycemia
- Hypoglycemia
Miscellaneous complications

- Nausea and vomiting
- Persistent sedation
- Altered mental status
Nausea and vomiting

Several factors contribute to the etiology of postoperative nausea and vomiting

- The patient (motion sickness, women, children)
- Perioperative drugs (opioids)
- Anesthetic agents
- Site of operation (abdominal procedures, middle-ear surgery, laparoscopic surgery)
- Duration of surgery
- Gastric dilatation
- Intraoperative or postoperative hypoxemia
- Hypotension
post-operative pain management
Why pain?

- **57%** of those who had surgery cited concern about pain after surgery as their primary fear experienced before surgery.
- **77%** of adults reported pain after surgery, with **80%** experiencing moderate to severe pain.
sub-optimal analgesia for many patients

- lack of knowledge about drugs
- many myths associate with pain
  - pain is not harmful to patient
  - pain relief obscures signs of complications
  - patient will become addicted to opioids
  - risk of respiratory depression is high

**PRN:** means

‘give as infrequently as possible’
acute pain management

- 1990-92 PCA, post op. pain management
- Faculty of pain medicine (Aus & NZ)
- pain assessment & management standard 1999
- the decade of pain control and pain research
  (a law passed by US congress in 2001)
- the changing face of pain control
- multidimensional problems need multimodal treatments
- pain care should be integrated into the patient’s treatment plan
- pain assessment should be considered a **fifth vital sign**
- **vital signs:**
  - temperature
  - blood pressure
  - pulse rate
  - respiratory rate
  - pain score
definition of pain

- **IASP**: international association for the study of pain

  unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage
definition of pain

- pain is a very **individual** experience

- **factors:**
  - previous pain experiences
  - cultural background
  - socioeconomic
  - disease or surgical prognosis
  - fear, anxiety, depression

- **poor correlation** between patient’s assessment of pain and medical staff’s estimate of pain
mechanisms of pain

injury or tissue damage

neurotransmitters
prostaglandins, histamine, serotonin, bradykinin, 5-hydroxytryptamine, substance-P

nociceptors
(nociceptive receptors)

A delta, C fibers

spinal cord/brain
Low Intensity Stimulus
PNS
Low Threshold
A beta fibre
CNS
INNOCUOUS SENSATION

High Intensity Stimulus
High Threshold
A delta & C Nociceptor

PHYSIOLOGICAL PAIN

PAIN
PERIPHERAL SENSITIZATION

Tissue Damage  Inflammation  Sympathetic terminals

SENSITIZING ‘SOUP’

Hydrogen ions  Histamine  Purines  Leucotrienes
Noradrenaline  Potassium ions  Cytokines  Nerve growth factor
Bradykinin  Prostaglandins  5-HT  Neuropeptides

High Threshold Nociceptor
Transduction sensitivity

Low Threshold ‘Nociceptor’
CLINICAL PAIN

Low Intensity Stimulus

Sensitized
A delta & C

PNS

CNS

Nociceptor
Low Threshold

Mechanoreceptor
A beta

Hyperexcitable
Dorsal horn Neuron

PAIN
Peripheral and Central Pathways for Pain

**Ascending Tracts**
- Cortex
- Thalamus
- Midbrain
- Pons
- Medulla
- Spinal Cord

**Descending Tracts**
- Cortex
- Thalamus
- Midbrain
- Pons
- Medulla
- Spinal Cord
harmful effects of undertreated severe acute pain

<table>
<thead>
<tr>
<th>System</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>decreased lung volumes (TV, FRC) and cough, atelectasis</td>
</tr>
<tr>
<td>CVS</td>
<td>tachycardia, hypertension, increased myocardial O$_2$ consumption, deep vein thrombosis</td>
</tr>
<tr>
<td>GI</td>
<td>decreased gastric and bowel motility</td>
</tr>
<tr>
<td>GU</td>
<td>urinary retention</td>
</tr>
</tbody>
</table>
harmful effects of undertreated severe acute pain

- endocrine: vagal inhibition, increased adrenergic activity, increased metabolism, $O_2$ consumption
- CNS: anxiety, fear, fatigue
- immunologic: impairment, infection, delayed wound healing
The difference of pain

- acute VS chronic pain
- nociceptive VS neuropathic pain
Acute pain

- identified event
- usually nociceptive
- due to tissue injury
- resolves days–weeks, duration less than 10 days
- trauma, surgery, acute medical condition, physiologic process
measurement of pain

- visual analog scale (VAS)
- verbal numerical rating scale (VNRS)
- categorical rating scale
measurement of pain (cont.)

- visual analog scale (VAS)

no pain ________________________________ worst pain
0____________________________________10
measurement of pain (cont.)

- verbal numerical rating scale (VNRS)
  0 = no pain
  10 = worst pain
measurement of pain (cont.)

- categorical rating scale
  - none = 0
  - mild = 2-3
  - moderate = 4-5
  - severe = 6-7
  - very severe = 8-9
  - worst pain = 10
Numeric

Categorical

Visual Analogue Scale

None Mild Moderate Severe Worst

None Worst Possible
When should pain be measured?

- usually asked when patients are resting
- better indicator is assessment of pain caused by coughing, deep breathing or movement
- reassessed regularly
- frequency if poorly controlled or changed treatment
techniques for reduced acute post operative pain

- traditional methods of opioids administration
- patient-controlled analgesia
- regional anesthetic techniques
- other drugs used
- other techniques
traditional methods of opioids administration

- Papaver somniferum
- 1806: alkaloid of opium: morphine (Morpheus: god of dreams, son of Hypnos: god of sleep)
- 1973: opioid receptors in brain and spinal cord
- 1975: endogenous opioids: endorphins, enkephalins, dynorphins in brain, spinal cord, GI, plasma
Opioid pharmacology

- Conjugated in liver
- Excreted via kidney (90%–95%)
- First-order kinetics
traditional methods of opioids administration (cont.)

**opioid receptors**

<table>
<thead>
<tr>
<th></th>
<th>actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>mu 1</td>
<td>supraspinal, euphoria, miosis, nausea and vomiting, urinary retention, pruritus</td>
</tr>
<tr>
<td>mu 2</td>
<td>sedation, respiratory depression, constipation</td>
</tr>
<tr>
<td>Opioid Receptors</td>
<td>Actions</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Kappa</td>
<td>Spinal, sedation, miosis</td>
</tr>
<tr>
<td>Delta</td>
<td>Spinal, respiratory depression, nausea and vomiting, pruritus</td>
</tr>
<tr>
<td>Sigma</td>
<td>Dysphoria, hallucination</td>
</tr>
</tbody>
</table>
Pharmacology of opioids

- *mu*-agonist: morphine
- partial *mu*-agonist: buprenorphine
- mixed agonist-antagonist: pentazocine (partial *mu* agonist, *kappa* agonist, *delta*-antagonist)
- nalbuphine (partial *kappa*-agonist, *mu*-antagonist)
traditional methods of opioids administration (cont.)

- **PRN**: pro re nata according to circumstances as the situation requires
- q 4 hours: wait until 4 hours for another injection
- IM, IV, SC, PO, Rectal
opioids administration (cont.): analgesic corridor
opioids administration (cont.): IM.
opioids administration (cont.):

IV.

Figure 4.2
traditional methods of opioids administration (cont.)

- morphine
- pethidine
- fentanyl
Not recommended

- pethidine
  - norpethidine is a toxic metabolite
    - longer half-life (6 hours), no analgesia
    - psychotomimetic adverse effects, myoclonus, seizures
    - accumulates with renal failure
Not recommended

- **Mixed agonist-antagonists:**
  - pentazocine, nalbuphine
    - compete with agonists → withdrawal
    - analgesic ceiling effect
    - high risk of psychotomimetic adverse effects with pentazocine
Parenteral

- SC, IV, IM
  - bolus dosing q 3–4 h
  - continuous infusion
  - easier to administer
  - more even pain control

Intraspinal

- Epidural
- Intrathecal
traditional methods of opioids administration (cont.)

- side effects:
  - respiratory depression
  - nausea and vomiting
  - hypotension
  - delayed gastric emptying time
  - urinary retention
  - pruritus
traditional methods of opioids administration (cont.)

- respiratory depression
- sedation score
  - 0 none
  - 1 mild, occasionally drowsy, easy to rouse
  - 2 moderate, constantly or frequently drowsy, easy to rouse
  - 3 severe, somnolent, difficult to rouse
  - S normally asleep
How much is enough?
How much is too much?

aim of pain treatment:

to make the patient comfortable while keeping the sedation score below 2 and respiration more than 8 /minute
traditional methods of opioids administration (cont.)

- requirements:
  - an age-related range of doses
  - dose intervals appropriate to the route of administration
  - monitoring of pain score, sedation score, respiration
  - monitoring for presence of other side effects
Misconceptions
Pharmacology of opioid

- addiction = psychological dependence, behavioral & response including a compulsion to take drug on continuous or periodic basis for psychic effects
- pseudoaddiction = analgesia still not effective, increase dose for pain relief
Tolerance

- Reduced effectiveness to a given dose over time
- Not clinically significant with chronic dosing
- If dose is increasing, suspect disease progression
Physical dependence

- A process of neuroadaptation
- Abrupt withdrawal may → abstinence syndrome
- If dose reduction required, reduce by 50% q 2–3 days
  - avoid antagonists
# Opioid adverse effects

<table>
<thead>
<tr>
<th>Common</th>
<th>Uncommon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>Bad dreams / hallucinations</td>
</tr>
<tr>
<td>Dry mouth</td>
<td>Dysphoria / delirium</td>
</tr>
<tr>
<td>Nausea / vomiting</td>
<td>Myoclonus / seizures</td>
</tr>
<tr>
<td>Sedation</td>
<td>Pruritus / urticaria</td>
</tr>
<tr>
<td>Sweats</td>
<td>Respiratory depression</td>
</tr>
<tr>
<td></td>
<td>Urinary retention</td>
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</table>
Opioid allergy

- !! Nausea / vomiting, constipation, drowsiness, confusion
  - adverse effects, not allergic reactions
- Anaphylactic reactions are the only true allergies
  - bronchospasm
- Urticaria, bronchospasm can be allergies; need careful assessment
Respiratory depression

- Opioid effects differ for patients treated for pain
  - Pain is a potent stimulus to breathe
  - Loss of consciousness precedes respiratory depression
  - Pharmacologic tolerance rapid

- Management
  - Identify, treat contributing causes
    - Reduce opioid dose
    - Observe
  - If unstable vital signs
  - Naloxone, 0.1-0.2 mg IV q 1-2 min
techniques for reduced acute post operative pain

- traditional methods of opioids administration
- patient-controlled analgesia
- regional anesthetic techniques
- other drugs used
- other techniques
patient-controlled analgesia (PCA)

- negative feedback loop
- microprocessor-controlled pump
- basal (infusion) rate
- incremental (bolus) dose
- lockout interval
- 4-hour limit
- monitoring: pain score, sedation score, RR, other side effects
patient -controlled analgesia (PCA)
techniques for reduced acute post operative pain

- traditional methods of opioids administration
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- other drugs used
- other techniques
regional anesthetic techniques

- **peripheral block**
  - local infiltration
  - nerve block - femoral n. block etc.
- **central neuraxial block**
  - subarachnoid/spinal block (intrathecal)
  - epidural block
regional anesthetic techniques (cont.)
regional anesthetic techniques (cont.)

- **intrathecal analgesia**
  morphine: water soluble, 8-24 hr

- **epidural analgesia**
  intermittent, continuous, patient-controlled epidural analgesia (PCEA)
  opioids and/or local anesthetics
  0.0625% bupivacaine and morphine or fentanyl
  3-5 days
regional anesthetic techniques (cont.)

- **side effects**
  - respiratory depression
  - nausea and vomiting
  - hypotension
  - delayed gastric emptying time
  - urinary retention
  - pruritus
techniques for reduced acute post operative pain

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Paracetamol (Acetaminophen)

- antipyretic
- analgesic (mild to moderate pain or synergistic)
- step 1 analgesic, coanalgesic
- site, mechanism of action unknown
  - minimal anti-inflammatory effect
  - inhibit cyclo-oxygenase
- 15-20 mg/kg
- Hepatic toxicity if > 4 g / 24 hours
  - increased risk
    - hepatic disease, heavy alcohol use
NSAIDs

- antipyretic, anti-inflammation
- analgesic (mild, moderate pain, synergistic)
- inhibit cyclo-oxygenase
- **side effects:** GI irritation, GI bleeding, platelet dysfunction, renal toxicity, hemorrhage
NSAIDs

- Inhibit cyclo-oxygenase (COX)
  - vary in COX-2 selectivity

- Highest incidence of adverse events
  - Renal insufficiency (maintain adequate hydration, COX-2 selection inhibitors)
  - Inhibition of platelet aggregation
  - Gastropathy

- Analgesic ceiling effects
  - effective for bone, inflammatory pain
  - individual variation, serial trials
NSAIDSs

phospholipid → Arachidonic acid

\[ \text{cyclooxygenase} \]

prostaglandin
NSAIDSs

- AHCPR guidelines suggest that NSAIDS should be the first-line drug for treatment of mild to moderate pain and should be used in combination with opioids for more severe pain.
listens with your eyes
looks with your ears
and touch
the patient’s inner feeling