The postoperative period

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Highlights - Hoogtepunte

- The importance of postoperative monitoring and the minimum monitors required.
- Discharge criteria of patients to the ward.
- Causes and management of Scoline® apnoea and laryngospasm.
- Advantages, methods and drugs used in post-operative pain relief.
- Die belang van postoperatiewe sorg en die minimum monitors wat daarvoor nodig is.
- Ontslagkriteria om pasiënte na die saal toe te kan stuur.
- Oorsake en hantering van Scoline®-apnee.
- Post-operatiewe pynverligting: voordele, metodes en gencesmiddels wat gebruik word daarvoor.

SA Fam Pract 2003;45(3):58-65

1. THE RECOVERY ROOM

Recovery rooms have been in existence for only 30-40 years in most medical centres. Many postoperative deaths occurred shortly after operation as patients were recovering from the effects of anaesthesia and surgery.

The realisation that many of these deaths were preventable emphasised the need for specialised nursing care immediately following surgery.

Design

The recovery room should be located near the operating rooms, since it ensures that the patient can be rushed back to surgery if needed.

A ratio of 1½ recovery beds per operating room is required. Staff should have expertise in airway management and advanced cardiac life support. A ratio of one recovery nurse for two patients is satisfactory. A minimum of two nurses ensures that if one patient requires continuous 1:1 nursing care, other patients will still be cared for adequately.

Equipment

Monitors

- Pulse oximetry (SpO_2)
- Electrocardiograph (ECG)
- Automated blood pressure
- Mercury/anaeroid back up sphymomanometers
- Capnography (useful for intubated patients) (desirable)
- Thermometer
- Warming/cooling blanket (desirable)

Emergency equipment

Separate from that of operating room:

- Oxygen cannulae
- Mask selection
- Oral and nasal airways
- Laryngoscopes
- Endotracheal tubes
- Ambubags
- Catheters for vascular cannulation (venous, arterial (desirable), central venous)
- Transvenous pacing catheters and pacemaker (desirable), defibrillator
- Emergency cart with drugs for advanced life support
- Tracheostomy, chest tube and vascular cut down trays.

Respiratory therapy

- Aerosol bronchodilator treatment.
- Ventilators should be near recovery room.

General care of the patient in the recovery room

a. After General Anaesthesia

As many as 30-50% of otherwise "normal" patients develop transient hypoxaemia (SpO_2 <90%) during transport when supplemental oxygen is not given. All patients recovering from general anaesthesia should receive 30-40% oxygen during emergence because even "healthy" patients can develop transient hypoxaemia.

Patients at increased risk for hypoxaemia, such as those with underlying pulmonary dysfunction, those undergoing upper abdominal or thoracic procedures, should receive supplemental oxygen.

Vital signs should be checked immediately on arrival. Blood pressure, pulse rate and respiratory rate measurements are taken every 5 minutes for 15 minutes or until stable and every 15 minutes thereafter.

b. After Regional Anaesthesia

Patients who are heavily sedated or haemodynamically unstable following regional anaesthesia, should also receive supplemental oxygen in the recovery room.

Sensory and motor levels should be periodically recorded following regional anaesthesia to document dissipation of the block. The sensory level achieved by a block can be assessed with pinprick, whereas the level of sympathectomy is assessed by measuring skin temperature.

The Bromage scale can be used to evaluate motor blockade:

1. "no block" - the ability to flex the knees and feet.
2. "partial block" - ability to flex the

knees and resist gravity with full movement of the feet.
3. "almost complete block" - inability to flex the knees but retained ability to flex the feet.
4. "complete block" - inability to move the legs or feet.

Complete resolution of the block is generally desirable to avoid inadvertent injuries due to motor weakness or sensory defecits.

Some medical centers allow earlier discharge to appropriately staffed areas in wards. The patients should at least show signs of resolution of both sensory and motor block (documentation of resolution of the block is critically important).

Failure of a spinal or epidural block to resolve after 6 hours raises the possibility of spinal cord or epidural hematoma, which should be excluded by radiologic imaging.

The minimum time a patient must be monitored in a recovery room after the administration of a regional block is 30 minutes.

Precautions in the form of padding or repeated warning may be necessary to prevent self-injury from uncoordinated arm movements following brachial plexus blocks.

Bloodpressure should be closely monitored following spinal and epidural anaesthesia.

Bladder catheterisation may be necessary in patients who have had spinal or epidural anaesthesia for longer than 4 hours.

Ward staff should be informed that the patient has a regional block and the postoperative pain medication will be started at a later stage. (i.e. Not immediately should the patient be pain free).

2. PROBLEMS THAT MAY OCCUR IN THE RECOVERY ROOM

Circulatory complications

a. Hypotension

Definition
20-30% reduction of blood pressure below patients baseline level.

Causes
1. Hypovolemia – usually most common cause, due to inadequate intraoperative fluid replacement.
2. Sepsis.
3. Allergic reactions (anaphylaxis).
4. Underlying heart disease (ventricular dysfunction due to myocardial ischemia or dysrythmias).
5. Following chest trauma (cardiac tamponade, tension pneumothorax).
6. Secondary to regional anaesthesia.

b. Hypertension

Definition
Greater than 20-30% of patients' normal baseline blood pressure.

Causes
Typically occurs within the first 30 minutes after admission due to:
1. Noxious stimulation from incisional pain.
2. Endotracheal intubation.
3. Bladder distension.
4. Sympathetic activation secondary to hypoxaemia, hypercapnia or metabolic acidosis.
5. Endocrine conditions.
6. Systemic hypertension.
7. Fluid overload.
8. Intracranial hypertension.

Marked hypertension can precipitate postoperative bleeding, myocardial ischemia, heart failure or intracranial hemorrhage and requires treatment of the cause.

Respiratory Complications

a. Hypoventilation

Causes
- Continued effect of anaesthetic drugs.
- Insufficient reversal of muscle relaxants.

b. Hyperventilation

Due to
- Artificial ventilation
- Pain
- Hypoxia

c. Airway obstruction

- Larynx – laryngospasm
- Tracheobronchial tree – bronchospasm

Agitation

Causes
1. Pain is often manifested as postoperative restlessness
2. Serious systemic disturbances
   - Hypoxaemia
   - Acidosis
   - Hypotension
3. Bladder distension

Nausea and Vomiting

This is common following general anaesthesia and can also be seen with hypotension from spinal or epidural anaesthesia.
- Young women.
- Intraperitoneal surgery.
- Opioid based anaesthesia report a higher incidence of emesis.

Management
- Metoclopramide (Maxalon®) – 0,15mg/kg given slowly intravenously
- Odansetron (Zofran®) – 0,05 – 0,1mg/kg intravenously (a selective 5-hydroxytryptamine serotonin antagonist) is less likely to cause acute extrapyramidal (dystonic) reactions than metoclopramide.

Shivering

Causes
1. Intraoperative hypothermia
   - cold ambient temperature in operating room
   - use of large amounts of unwarmed intravenous fluids
   - high flows of unhumidified gases
2. High concentration of volatile anaesthetic gases.
3. Epidural injection of local anaesthetics.
4. Sepsis
5. Drug allergy
6. Transfusion reactions

Management
Shivering due to causes (1) to (2) should be treated with heating blankets or small intravenous doses of meperidine (Pethidine®) 10-20 mg.

Intense shivering causes a precipitous rise in oxygen consumption (by 300%) which is poorly tolerated by patients with pre-existing cardiac or pulmonary impairment.

3. DISCHARGE CRITERIA

An anaesthesiologist must take responsibility for the discharge. Criteria can vary according to whether the patient is going to be discharged to an intensive care unit, regular ward, the outpatient department or home.

Before discharge, patients should have been observed for respiratory depression for at least 30 minutes after the last dose of parenteral narcotic.

Minimum discharge criteria include:
1. Easy arousability
2. Full orientation
3. Ability to maintain and protect the airway
4. Stable vital signs for at least 1 hour
5. Ability to call for help if necessary
6. No obvious surgical complications (active bleeding)
7. Normothermia
8. Signs of resolution of both sensory and motor blockade after regional anaesthesia.
9. Control of postoperative pain

Reliable quantitation of pain severity helps determine therapeutic interventions. This is a challenge, because pain is a subjective experience.

The visual analog scale (VAS), is a 10cm horizontal line labelled "no pain" at one en and "worst pain imaginable" on the other end. The patient is asked to mark on this line where the intensity of the pain lies. The distance from "no pain" to the patients mark numerically quantitates the pain. It is simple, efficient and minimally invasive but unfortunately describes intensity but not quality of pain.

In our hospital we grade pain as follows and it is documented on the anaesthesia record.
1. No pain
2. Mild
3. Moderate
4. Severe

Scoring systems for discharge are widely used (Table 1).

Table 1: Post anaesthetic recovery score

Ideally the patient should be discharged when the total score is 10.	
Colour	
• Pink	2
• Pale or dusky	1
• Cynotic	0
Respiration	
• Can breathe deeply and cough	2
• Shallow but adequate exchange	1
• Apnoea or obstruction	0
Circulation	
• Blood pressure within 20% of normal	2
• Blood pressure within 20 – 50% of normal	1
• Blood pressure more than 50% of normal	0
Consciousness	
• Awake and orientated	2
• Arousable but readily drifts back to sleep	1
• No response	0
Activity	
• Moves all extremities	2
• Moves two extremities	1
• No movement	0

4. SCOLINE APNOEA

Definition

A prolonged apnoea after the administration of suxamethonium (scoline).

Suxamethonium (Scoline®)

This drug is the prototype of depolarising muscle relaxants. It is chemically related to Acetylcholine (Ach), as it consists of two joined molecules of acetylcholine. This drug mimics the effect of Ach by binding to the post synaptic and subunits of the cholinergic receptors of the muscle nerve terminal. The resultant depolarisation is due to persistently open transmembrane canals, which prevent the propagation of action potentials and thereby cause muscle relaxation.

The dose of suxamethonium is: 1,5 mg/kg intravenously in adults.

The onset of action is very short (within 30-60 seconds).

Recovery of respiration occurs within 5 minutes and normal conduction of the adductor pollicis muscle occurs within 10 minutes.

Metabolism

Plasma cholinesterase is also known as pseudocholinesterase. This is to distinguish it from acetylcholinesterase.

Pseudocholinesterase hydrolises suxamethonium in the plasma to relatively inactive metabolites such as
- succinyl-monocholine
- choline

Pseudocholinesterase is synthesized in the liver. This hydrolysis in the plasma is the reason that only a very small amount of injected suxamethonium (10%) reaches the motorend plate. The duration of the block is determined by the amount of suxamethonium that escapes being broken down by cholinesterase.

Causes of decreased variation in pseudocholinesterase activity

1. **Physiological variations**
- First six months of life
- Pregnancy up to 6 weeks postpartum

2. **Aquired variations**
- Liver disease - cirrhosis
- Malignancy - metastasis especially hepatic and carcinoma of the lung. Depends on degree of the malignancy and the site of the primary tumor.
- Malnutrition - anorexia nervosa
- Heart disease - Severe heart failure
- Renal disease - uraemia
- Burns - decrease on day five or six
- Hypothyroidism
- Drugs
  - oral contraceptives
  - cholinesterase inhibitors, eg. Cytotoxics, echothiopate,

- organophosphates, neostigmine,
- cyclophosphamide
- pancuronium
- metoclopramide – prolongs action of suxamethonium

- Plasmaphoresis
- Cardiopulmonary bypass

2. Inherited variations

Atypical pseudocholinesterase enzymes exist and these variants have different rates at which they cause hydrolysis of suxamethonium. The heterozygotes hydrolise some of the drug, whereas the homozygotes virtually do not break down the drug at all.

Gene E is the gene locus that is responsible for the production of the enzyme pseudocholinesterase.

The various variants are described by gene E followed by the supercript which denotes the type of enzyme population the individual may have.

Dibucaine is a local anaesthetic that just happens to have an affinity for pseudocholinesterase and is used to differentiate atypical enzyme for which it has no attraction.

Dibucaine inhibits the activity of NORMAL plasma cholinesterase by approximately 80% i.e. the dibucaine number is 80.

Dibucaine will only inhibit 20% of the ATYPICAL enzyme and hence the number is 20.

The administration of the suxamethonium to patiens that are HOMOZYGOTIC for the atypical cholinesterase may lead to prolonged apnoea (longer than 2 hours, up to 4 hours).

Suppressed plasma cholinesterase activity in the absence of atypical genotypes can occur due to the acquired causes as mentioned above. Here the induced relaxation from suxamethonium is very rarely longer than 30 minutes. In South Africa the two most common genotypes are E^u and E^s. The E^s genotype is prevalent in the black population.

Treatment

Steps to be taken in the event of a "Scoline Apnoea", after the administration of suxamethonium.

1. Continue to ventilate the patient.
2. In order to establish that there is an extension of the neuromuscular block it is essential to demonstrate the response to peripheral nerve stimulation.
3. Sedate the patient as this is a very unpleasant experience if the patient happens to be awake, until the block has worn off. Midazolam (Dormicum®) can be used intravenously.
4. Blood samples should be taken for plasma cholinesterase levels, as well as dibucaine and fluoride numbers.
5. A purified human form of cholinesterase, blood and plasma also contain active pseudocholinesterase, can hasten the recovery of the block. The risk of HIV prohibits the use of these products.
6. In the event of a prolonged apnoea, ventilation in intensive care until the neuromuscular block has resolved, is desirable. Ventilation and waiting will eventually lead to a complete recovery at no risk.
7. Once the incident has passed, it is the anaesthetists' responsibility to counsel the patient, arrange screening of blood relatives and ensure that the patient carries a "Medic Alert" bracelet as a warning to future anaesthetists.

5. LARYNGOSPASM

Laryngospasm may occur during induction of anaesthesia or during emergence. Usually it occurs as an inspiratory stridor if there is an incomplete obstruction, but may be complete obstruction where there is full adduction of the vocal cords with no sounds but with intense respiratory efforts.

Causes:

A level of anaesthesia that is inadequate, with local stimulation of the larynx.

1. Early insertion of an airway
2. Food particles
3. Excessive mucous production
4. High inspiratory level of anaesthesia gases
5. Early surgical stimulation such as stretching of the anal sphincter or cervix.

Treatment:

1. Stop all stimulation
2. Suction the mucous and remove the airway if it is the cause of the irritation.
3. Supply 100% oxygen under pressure.

Table 2: A summary of more common inherited variants for the plasma cholinesterase gene

Name	Plasma Cholinesterase Activity	Sensitivity to Suxamethonium
E^u normal enzyme	Normal	Normal
E^a atypical enzyme	Activity decreased by 70%	2 hour paralysis
E^f fluoride sensitive	Activity decreased by 60%	1 – 2 hour paralysis
E^s silent	No activity	3 – 4 hour paralysis
Other variants:		
J type	Activity decreased by 66%	1 hour paralysis
K type	Activity decreased by 30%	< 1 hour paralysis
H type	Activity decreased by 90%	2 – 3 hour paralysis

4. If spasm does not disappear quickly, administer suxamethonium and intubate the patient.

DO NOT WAIT FOR THE PATIENT TO BECOME CYANOTIC.

6. POSTOPERATIVE PAIN RELIEF

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. (WHO definition.)

The advantages of good post-operative pain relief are:

1. Patients comfort
2. Improved postoperative mobility, leading to improved recovery and decreased hospital stay.
3. Improved respiratory function.
4. Decreased risk for cardiac complications.
5. Decreased risk for deep venous thrombosis (epidural analgesia) after hip, knee, prostate surgery.
6. Improved gastro-intestinal function.
7. Decrease in general stress response and chronic pain incidence.

A summary of methods of postoperative pain relief

a. Infiltrate

Infiltrate the surgical area with local anaesthetic at the end of the procedure. If done thoroughly, it will greatly contribute to pain relief during the first 8-12 postoperative hours, which are the most painful.

Maximum safe dosage

- Ropivacaine (Naropin®): 2 - 3mg/kg 0,375 – 0,75% concentration
- Bupivacaine (Macaine®): 2mg/kg 0,25 – 0,5% concentration. The abovementioned dosages are with and without adrenalin
- Lignocaine with adrenalin: 7mg/kg
- Lignocaine without adrenalin: 3-4 mg/kg

b. Never let the patient leave the recovery room in pain

The mainstay for treatment of severe pain in the recovery room is titration of

Table 3: Main constituents of commonly used oral analgesics

	Paracetamol	Aspirin	NSAID	Weak opioid	
				Codeine	Propo-xyphene
	mg	mg		mg	mg
Brufen®			Ibuprofen		
Cataflam®			Potassium diclofenac		
Codis®		500		8	
DF118®				30,100	
Dolorol forte®	500			8	
Lentogesic®	400				65
Myprodol®	250		Ibuprofen	10	
Panado®	500				
Ponstan®			Mefenamic acid		
Stopayne®	320		Meprobamate		8
Surgam®			Tiaprofenic acid		
Synapforte®	500				50
Voltaren®			Sodium diclofenac		

Table 4: Example of effective analgesic regime for a total abdominal hysterectomy

1. Morphine 10mg IMI 4 hourly (not prn) for 48 hours. Extra morphine 5-10mg IMI every 30 – 60 minutes prn for the first 12 hours (for breakthrough pain if needed).
2. Diclofenac (Voltaren®) suppository 100mg 12 hourly. Change to Voltaren per os 50mg 3-4 times daily when patient can eat (for 5 days).
3. When 4 hourly morphine injections are discontinued add paracetamol and codeine (Stopayne®) 2 tablets 4 – 6 times per day for 7 days in combination with NSAID.

* Stopayne® contains paracetamol codeine (a weak opioid) and meprobamate. The latter has the potential of substance abuse (addiction in long term use (>10 days)

Morphine, Voltaren®, Stopayne® can be substituted with any other opioid, NSAID of your choice.

Remember, individualise to your patient's needs.

intravenous opioids against effect.

Eg. Morphine 1-2mg ivi every 5 minutes until the patient is comfortable

Morphine: 0,1mg/kg/hour ivi
0,01-0,02mg/kg ivi every 5 minutes

c. Intramuscular opioids (IMI)

The first 6-10 hours after surgery are the most painful!

How to make a regime of IMI opioids effective:

- Give IMI opioids at regular intervals and not prn
- Continue this as long as the severe pain is expected to last.
- Dosages opioids need to be individualised

Eg. Morphine 10mg every 4 hours for 48 hours
(3-4 days for abdominal surgery)
(2-3 days for joint surgery)
or Omnopon® 10-20 mg every 4 hours
or Pethidine® 50-100mg every 3-4 hours

Remember in healthy adults, the effect of morphine lasts 4 hours, the effect of pethidine only 3 hours.

- Allow for extra bolusses after surgery (for breakthrough pain)
  Eg. Morphine 5mg IMI every 30 minutes prn for 12 hours post-op
- Change the dose not the interval
  Eg. Increase morphine 15 mg 4 hourly if doses are too small.
  Decrease to 5-7.5mg 4 hourly if doses have too many side effects.
- Combine with analgesics of different category
  Eg. NSAIDS, paracetomol decrease opioids by 30%

d. Oral analgesics

Start with NSAID eg. Voltaren® and add paracetamol with or without codeine if necessary eg Stopayne®.

Do not combine different NSAIDS. A combination of different groups of analgesics eg. NSAIDS and opioids are synergistic, so combining these drugs will give better analgesia than doubling the dose of each (which would also increase the risk for side effects). This method is not suitable for severe acute post operative pain management, and requires a functioning gastrointestinal effect. Eg. Minor surgery

- First 2-3 days NSAIDS
- Diclofenac (Voltaren®) 50 mg 3-4 times per day
- Ibuprofen (Brufen®) 400 mg 2-3 times per day
- Mefloxicam (Mobic®) 7.5 mg 1-2 times per day
- After 2-3 days: Paracetamol preparations become first choice.

e. Patient controlled analgesia (PCA)

PCA via the intravenous or subcutaneous route is a very elegant method of postoperative pain relief, because the patient has security of controlling his/her own pain and titrating pain relief against side effects of the opioids. The machine has the facility to "lock out" for a period so that the patient cannot overdose themselves.

f. Central neuraxial analgesia

- Epidural
- Spinal
- Caudal

g. Peripheral nerve blocks

- Local
- Intercostal
- Ilioinguinal
- Penile
- Brachial plexus
- Intra pleural

Side effects of opioids

1. Respiratory depression
2. Nausea
3. Itch
4. Euphoric effect
5. Constipation
6. Substance abuse and addiction (in long term use)

Reversal of respiratory depression:
Naloxone (Narcan®)
Adults: 0,1-0,2mg IVI
every 2-3 minutes
Children: 0,005-0,01mg/kg IVI

Side effects of NSAIDS

1. Gastrointestinal ulcer – prohibit to short term treatment (1 week)
2. Bleeding – best avoided if hemostasis is impaired by other factors (anti-coagulants, bleeding disorders, neurosurgery, plastic surgery)
3. Renal – not given to dehydrated or shocked patients.❐

Please refer to CPD Questionnaire on page 66.

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