

FUNDAMENTALS OF ANESTHESIA FOR THE PERIANESTHESIA NURSE

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History of the Recovery Room

- England:
 - 1751: separate rooms for major surgery
 - 1863: separate rooms to recover from anesthesia
- United States:
 - 1918: 1st GA ambulatory surgery
 - 1920's-1930's- increased surgical complexity
 - 1923: John's Hopkins: 3 –bed NS recovery unit
 - 1947: Anesthesia Study Commission of Philadelphia
 - 1/3 preventable postop deaths could be eliminated by improved postoperative nursing care
 - Specialized nursing, close proximity to OR

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Pre-operative Preparation

- Including but not limited to:
 - Capacity to consent
 - Pertinent labs, EKG, cardiac w/u
 - Medication history/reconciliation/adjustment
 - ? Pre-hab- PT
 - Screenings (OSA, suicide, falls, ADLs)
 - Consults: cards, pulm, nutrition
 - What the patient understands/teaching



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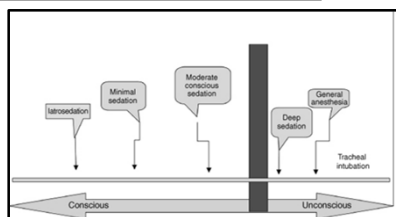
Anesthetic Plan

- Surgical procedure
- Length/location (OR vs NORA)
- Surgeon: skill, timing,
- Pt co-morbidities/age/size
- Pt postop disposition
- Resources
- Anesthesia provider skills/competence

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Anesthesia as a Continuum

- Awake
- MAC
- Neuroaxial
- Regional
- TIVA
- General anesthesia
- *Combinations of the above*



[https://www.dental.theclinics.com/article/S0011-8532\(21\)00054-9/fulltext](https://www.dental.theclinics.com/article/S0011-8532(21)00054-9/fulltext)

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Levels of Sedation

Moderate Sedation

- Airway/ventilation/CV OK
- Purposeful response to verbal or tactile ~ NOT PAIN

Deep sedation/analgesia

- Response after painful stimulus
- Airway maybe needs to be supported
- Spont ventilation maybe inadequate
- CV OK

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General Anesthesia

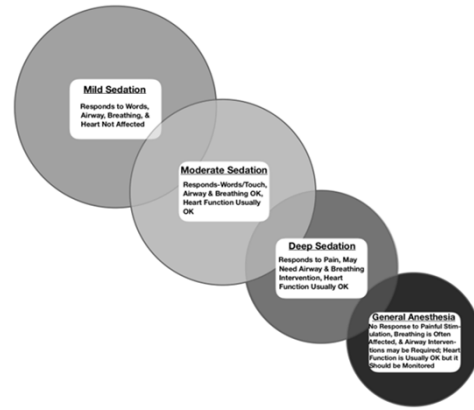
GA *LEVEL* of sedation:

- Unarousable even to pain
- Airway supported
- Inadequate spont ventilation
- Impaired CV function

Pt can progress to a deeper level of sedation
intentional or unintentional

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<https://www.clorelaw.com/insights/under-attack-from-over-sedation-suffocation-in-minor-surgery-medical-procedures>

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MAC vs TIVA vs GEA

- All provided under the direct supervision of anesthesia provider
- Describes intended anesthetic plan + anesthetic medications
- DOES not describe the level/depth of sedation
- Anesthetic plan ~ aligning patient safety, airway management and successful surgical outcome

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American Society of Anesthesiologist (ASA) Physical Status Classification

Developed by the ASA to indicate overall physical status of the patient's preexisting medical condition

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ASA Physical Status

ASA 1	Normal healthy patient
ASA 2	Pt. w/ mild systemic disease
ASA 3	Pt. w/ severe systemic disease that limits activity but not incapacitating
ASA 4	Pt. w/ incapacitating systemic disease that is constant threat to life
ASA 5	Pt. is not expected to survive 24 hours w/o the operation
ASA 6	Pt. has passed brain death criteria and is an organ donor
"E"	Emergent pt. w/ unknown or limited history

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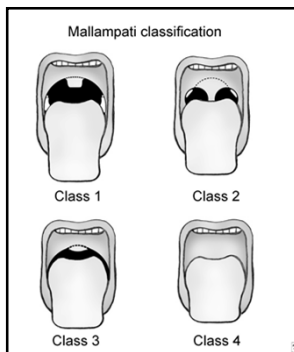
Airway Assessment

- Identification of potential for difficult intubation
- Mallampati Airway Classification
 - Exam: mouth opened to 50-60 mm
- Interincisor distance ~ FB
- Thyromental distance

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Mallampati Airway Classification

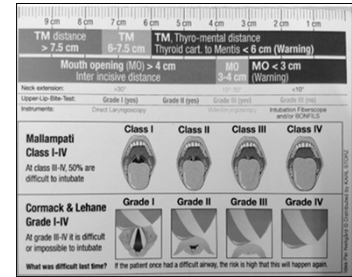


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Airway Assessment

- Mallampati Grade I-IV
- Thyromental distance
- Mouth opening
- Neck flexibility



<https://openairway.org/tag/mallampati/>

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Difficult Airway

- Pre-assessment ~ ? difficult
- Preparation: glidescope, fiberoptic
- Colleague assistance
- Expert consultation
- Patient consent/preparation
- ? Awake intubation
 - No paralytics, ability to abort

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Management of Difficult Tracheal Intubation

A Closed Claims Analysis

N=102 (2000-2012)
ASA III-V
Emergent procedures
Death: ICU (33), PACU (3), ED (6), ward (2), cath lab(1), radiology (1)

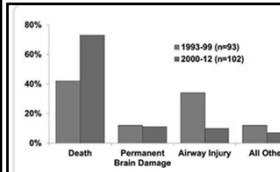


Fig. 1. Clinical outcomes in difficult tracheal intubation claims 1993 to 1999 versus 2000 to 2012. Airway injury and "all other" outcomes exclude death or permanent brain damage. $P < 0.001$ by chi-square test.

Table 3. Predictors of Difficult Tracheal Intubation and Judgment Failures in Airway Management

Question	Claims, No.	%
Indicate any predictors of difficult tracheal intubation (whether known/recognized at the time or not) or factors that contributed to difficult airway management.		
Airway obstruction from any cause*	31	30%
Past history of difficult intubation	21	21%
Mallampati grade 3 to 4	19	19%
Limited cervical spine extension	16	16%
Limited mouth opening	13	13%
Secretions/blood in airway	12	12%
Short neck	10	10%
Swollen tongue	6	6%
Short thyromental distance	6	6%
Thick or ball neck	6	6%
History of neck irradiation	5	5%
Precarotid	2	2%
Prominent teeth	1	1%
Number of predictors		
0	24	24%
1	36	35%
2 to 6	42	41%

ANESTHESIOLOGY 2019; 131:818-29

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General Endotracheal Anesthesia Pharmacology

- Induction agents
- Inhalation agents
- Muscle relaxants
- Opioids
- Dissociative agents
- Reversal agents

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Monitored Anesthesia Care

- Sedative agents: propofol, dexmetomidine
- Fentanyl
- Midazolam
- Other...

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IV Induction

- Rapid onset, brief duration
 - Profound decrease in BP (risk)
 - Induces anesthesia
 - CNS depression occurs
 - Spontaneous respiration diminishes, ceases
 - Protective reflexes are lost
 - Increased risk for aspiration
 - Amount of drug distributed = blood flow
 - Brain, heart, liver, kidney are highly perfused
 - Anesthetized first
 - As time progresses, drug concentration levels <

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IV Induction Agents

- Propofol
 - Rapid onset/rapid emergence
 - Hypotension likely
 - NO ANALGESIC PROPERTIES
- Etomidate
 - Hypnotic
 - Unconsciousness in < 1 minute
- Ketamine
- Benzodiazepines (more commonly pre if at all)



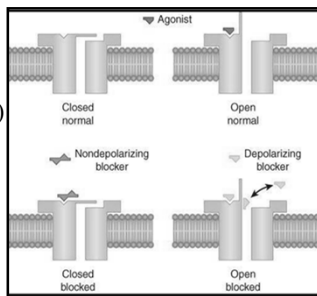
https://www.laroche.edu/Academics/Area_of_Study/Nurse_Anesthesia/Graduate_Program/

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Neuromuscular Blocking Agents

- Depolarizing
 - Succinylcholine
- Nondepolarizing (NDMRs)
 - Atracurium
 - Vecuronium
 - Rocuronium
 - Cisatracurium



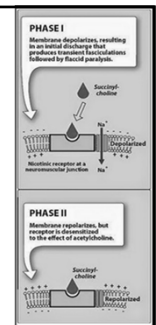
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<https://basicmedicalkey.com/skeletal-muscle-relaxants-3/>

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Succinylcholine (SCh)

- Depolarizing muscle relaxant (DMR)
- Only drug of its class in the US
- Used for intubation only
- Rapid onset/offset ~ 1 min onset
- Elimination: hydrolyzed by Pseudocholinesterase (PChE) or *plasma cholinesterase*
- MH trigger



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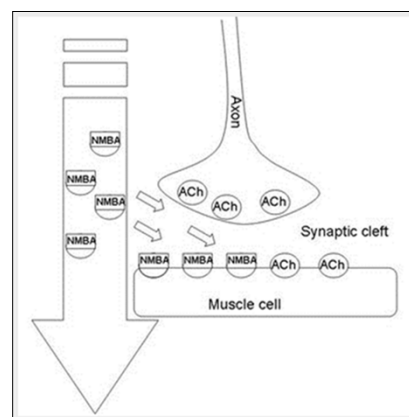
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NDMR Actions

- Binds to postsynaptic receptors
- Block binding of ACh
- Impairs muscle contraction
- ACh is still released- NMDRs compete for receptor sites
- Extent of muscle relaxation depends on dose of NMDRs

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Nondepolarizing Muscle Relaxants

- Sequence of relaxation: fine to gross motor impairment
- eyes-jaw-hands-limbs and neck-intercostals-*diaphragm*
- Return of function is in reverse order
- Reversal:
 - Natural decay
 - Reversal agents-pharmacologic interventions

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Advanced Airway

- Induction medications
- ETT / LMA
- What can go wrong:
 - Difficulty
 - Laryngospasm
 - Dental/lip trauma
 - Malposition
 - Failure

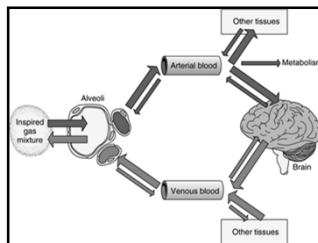


<https://www.skillspoint.com/product/advanced-airway-management/>

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Inhalation Agents

- Volatile agents:
 - Sevoflurane
 - Isoflurane
 - Desflurane
- Gas:
 - Nitrous oxide



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Volatile Inhalational Anesthetics

- Liquids that evaporate at room temp
- Vaporizer controls amount of liquid is evaporated
- Pts depth of anesthesia is determined by concentration of vapor administered
- Minimum alveolar concentration (MAC)
 - Concentration (%) of anesthetic vapor that prevents muscle movement in 50% of pts in response to surgical incision

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Inhalation Agents

Administration:

- Used by itself w/o adjuncts
- Balanced: narcotics, muscle relaxants added to reduce dose of inhalation agent required

Pharmacokinetics

- Inhaled-alveoli-across alveolar-capillary membrane ~ cap bed
- Uptake depends on lipid solubility of agent
- Distribution depends on blood flow
 - Highly perfused: brain, heart, kidney, liver
 - Moderately: muscle, skin
- Elimination: determined by blood flow
 - Obese pts store anesthetic agents longer

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Pharmacodynamics

- Dose dependent CNS depression
- CV- irritability
- Resp:
 - Depresses spont. resp
 - Obtunds reflexes
 - Dulls ventilatory response to hypercarbia, hypoxemia
 - Bronchodilation

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CV Effects of Inhaled Anesthetics

- Decrease in MAP during induction/increase in % gas
- Peripheral vasodilation
- Decrease systemic vascular resistance
- Surgical stimulation off-set decrease
- > HR
 - > sympathetic stimulation
 - Stimulation of carotid baroreceptors

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Opioids

- Mainstay of periop
 - (although note increasing focus of opiate sparing)
- Induction, maintenance and emergence
- Fentanyl (potency 100X morphine)
- Remifentanyl
- Sufentanil
- Hydromorphone
- Morphine
- Demerol

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Mechanical Ventilation

- Anesthesia circuit ~ ventilator
- Modes:
 - Controlled: AC/VC or AC/PC
 - Ventilator assumes ALL WOB
 - Spontaneous: PSV
 - Recruitment maneuvers



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Induction

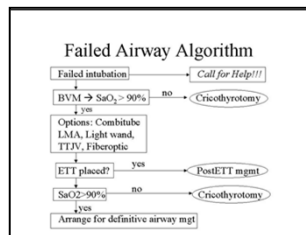
- IV agents: loss of consciousness
- Intubation/advanced airway
- Controlled mechanical ventilation
- Inhalational agents
- Analgesics

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What Can Go Wrong?

- Unable to intubate ~ unable to ventilate
- BVM ~ Call for help
- Surgical airway
- Laryngospasm
- Bronchospasm



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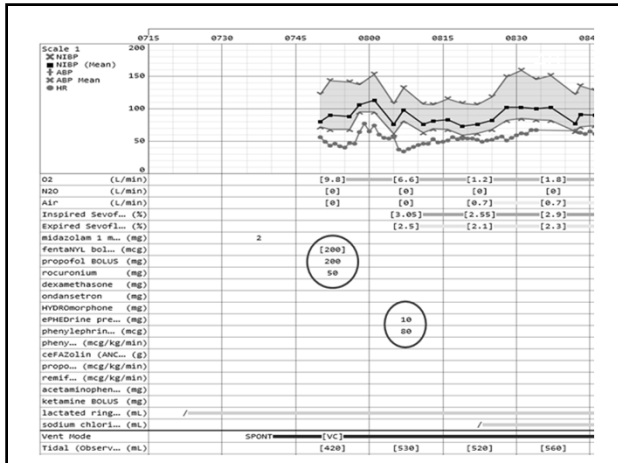
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Maintenance Phase of Anesthesia

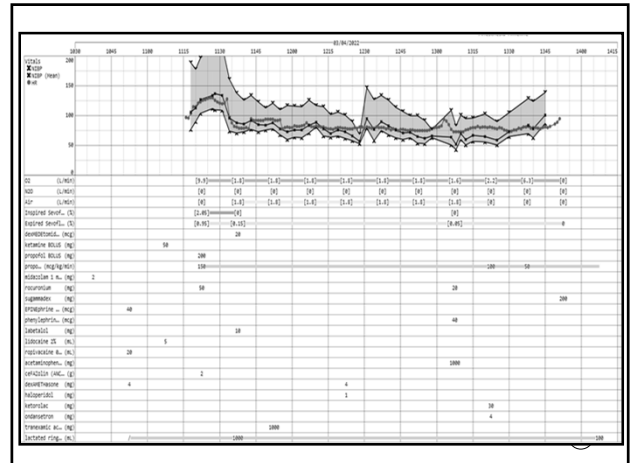
- Inhalation agents
- Opioids
- Antibiotic re-dosing
- Surgeon requests/surgery specific
 - i.e. heparin
- Propofol: incremental doses/infusion
- BP support :
 - Phenylephrine: syringe push and/or infusion
 - Ephedrine
 - BP support critically unstable: Norepi Vaso Epi

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Reversal Agents as Needed

- NDMR
- Opioids
- ? benzodiazepines

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NDMR Reversal Agents

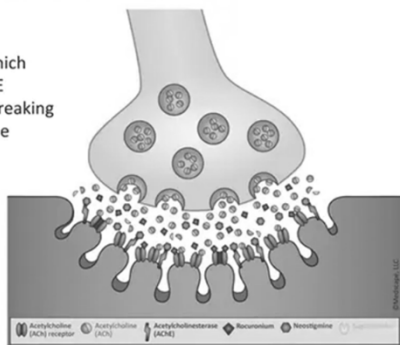
- Anticholinesterases ~ neostigmine
- Increases amount of acetylcholine (ACh) at post synaptic membrane
 - >>>> competition w/ NDMR
 - Concentration of Ach >>>> than NDMR
 - Muscle can now contract; weakness/relaxation dissipates

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Mechanism of Action (cont)

Introduction of neostigmine which blocks the AChE enzyme from breaking down ACh at the synaptic cleft



Epemolu O. *Anesth* 2003;99:632-637.

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Reversal Agents

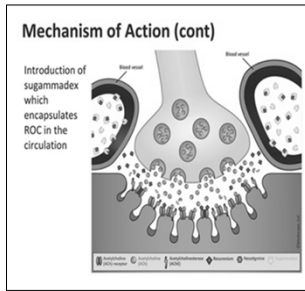
- Undesired effects: > ACh at muscarinic receptors
 - Eyes: miosis
 - Heart: < HR
 - Lungs: bronchospasm
 - GI: enhanced peristalsis
 - Secretory glands: > secretions
- Effects offset by anticholinergic meds: glycopyrrolate

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Sugammadex

- Selective relaxant
- binding agent
- Acts by 'encapsulation'
- TOF should be assessed
- Pt education
re: add'l birth control methods



<https://line.17qq.com/articles/omnhhccv.html> 43

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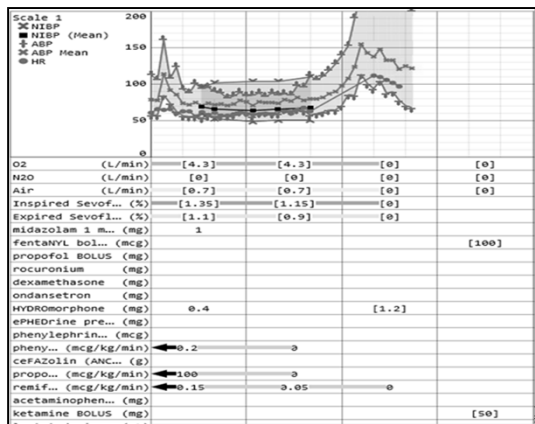
Emergence



- Communication w/ surgeon
- Return of spontaneous ventilation (unless plan is to keep intubated)
- + twitches
- Response to > ETCO₂
- Extubation ~ or not.....
- Antiemetics, NSAIDS, acetaminophen, add'l opioids maybe
- Gas off (timing)

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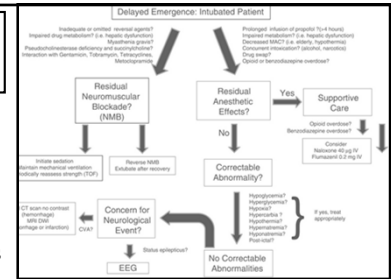
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What Can Go Wrong?

- Loss of airway
- Laryngospasm
- Bronchospasm
- Residual paralysis
 - Timing
- Surgical complications
- Hemodynamic changes
- Emergence delirium



<https://www.cambridge.org/core/books/abs/postanesthesia-care/delayed-emergence/18967DAD666AFCD14F1DE063CD718261>

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Anesthesia-related Cardiac Deaths

- 10 year retrospective review; 160 cases
- 37 related to anesthesia
- Loss of airway on transport
- Loss of airway w/ laryngeal ca; unable to ventilate
- Extubated after long case; apneic on arrival to PACU
- Known difficult airway; extubated end of case; unable to ventilate-trach. Pt died

Ellis, S. et al. (2014). Anesthesia-related cardiac arrest. *Anesthesiology*, 120, 820-838.

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Recovery room incidents: a review of 419 reports from the Anaesthetic Incident Monitoring Study (AIMS)

M. T. Kluger¹ and M. F. M. Bullock²

Table 6 Presenting problem in 87 airway incidents recovery room incidents reported to AIMS.

Presenting airway problem	No. (proportion total incidents)
Airway obstruction	59 (14%)
Laryngospasm	18 (4%)*
Jaw dislocation	2 (0.5%)
Allergy	2 (0.5%)
Foreign body (throat pack)	1 (0.2%)
Failed extubation	1 (0.2%)
Failed intubation	1 (0.2%)
Endobronchial intubation	1 (0.2%)

*11 adult; 7 child.

Table 8 Contributing factors in 419 recovery room incidents reported to AIMS.

Contributing factor	No. (proportion)
Error of judgement	77 (18%)
Communication	57 (14%)
Fault of technique	29 (7%)
Inadequate patient assessment	29 (7%)
Sick patient	14 (3%)
Inattention	11 (3%)
Other equipment	11 (3%)
Surgical team	10 (2%)
Lack of equipment	10 (2%)
Inexperience	8 (2%)
Haste	8 (2%)
Problem with monitor	4 (1%)
Problem with equipment	3 (1%)
Fatigue	3 (1%)
Lack of facility (bed shortage)	3 (1%)
Drug labelling	2 (0.5%)
Inadequate assistance	2 (0.5%)
Unfamiliar environment	2 (0.5%)

Anaesthesia, 2002, 57, pages 1060-1066

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ADVERSE EVENTS IN ANESTHESIA 993

Table 7. Failures and Causes of Adverse Events in Anesthesia of the Selected Studies (N = 21)

Active Failure	Cause	N	%	Article
Error	Delay recognizing hemodynamic alterations/anesthetic complications	7	33.3	Moody ²⁰ ; Ruibal ²¹ ; Cheney ²² ; Davies ¹¹ ; Lee ¹⁰ ; Roh ¹⁹ ; Schulz ¹¹ .
	Administration/maintenance inadequate of regional anesthesia	1	4.7	Cook ²⁰ .
	Mispractice in cardiac arrest care	1	4.7	Davies ¹¹ .
	Incorrect identification of medications	1	4.7	Domino ²³ .
Slip/Lapse	Incorrect execution of regional/opthalmic blockades	8	38	Lee ¹⁰ ; Davies ¹¹ ; Cook ²⁰ ; Mihal ²⁴ ; Ochoaugh ²⁵ ; Nayana ²⁶ ; Clarke ²⁷ ; Rathnel ²⁸ .
	Medication changes during anesthetic induction	6	28.5	Domino ²³ ; Fasting ²⁹ ; Cook ²⁰ ; Mihal ²⁴ ; Cavallaro ³⁰ ; Erdmann ³¹ .
	Difficulty in the control/management of the airway	4	19	Moody ²⁰ ; Cook ²⁰ ; Davies ¹¹ ; Schulz ¹¹ .
	Professional misuse of equipment	2	9.5	Caplan ³² ; Domino ²³ .
Violation	Incorrect puncture of central venous cannulation	1	4.7	Cook ²⁰ .
	Absence of an oximeter/capnograph	5	23.8	Lee ¹⁰ ; Mihal ²⁴ ; Roh ¹⁹ ; Lee ¹⁰ ; Schulz ¹¹ .
	Inadequate preoperative assessment	4	19	Domino ²³ ; Moody ²⁰ ; Roh ¹⁹ ; Schulz ¹¹ .
	Failure to check equipment	3	14.2	Caplan ³² ; El Dawlaty ³³ ; Ruibal ²¹ .
Latent failure	Communication failures	7	33.3	El Dawlaty ³³ ; Ruibal ²¹ ; Davies ¹¹ ; Mihal ²⁴ ; Cook ²⁰ ; Hudson ³⁴ ; Erdmann ³¹ .
	Fatigue	2	9.5	Hudson ³⁴ ; Erdmann ³¹ .
Other conditions	Pressure to perform	1	4.7	Erdmann ³¹ .
	Patient clinical problems	5	23.8	Moody ²⁰ ; El Dawlaty ³³ ; Lee ¹⁰ ; Davies ¹¹ ; Hudson ³⁴ .
	Equipment failures	3	14.2	Caplan ³² ; Ruibal ²¹ ; Cheney ²² .

Journal of PeriAnesthesia Nursing, Vol 34, No 5 (October), 2019; pp 978-998

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Initial PACU Assessment

- AIRWAY
- O2 sats, LOC
- VS: HR, BP, RR
(not from monitor ~ chest wall impedance)
- Surgical site integrity
- MAE/orientation

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Airway

- Obstruction
- Spasms
- Respiratory depression +/- somnolence
 - Opiates
 - NMB
 - Residual gas
 - TIVA associated sedation
- Airway trauma/dentition

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Emergency Airway Equipment

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Nursing Considerations

- Impaired spontaneous ventilation
- Depression of laryngeal, pharyngeal reflexes
 - Aspiration always a risk
- Dysrhythmogenic effect
- No residual analgesic effect
- MH risk from triggering agents (not N2O)
- Hypothermia
 - d/t intraoperative heat loss
 - Shivering possible -> O2 consumption

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Iatrogenic Airway Trauma

- Oral injuries ~ 5%
- Dental injuries ~ 1%
- Anes consent includes mention of potential injuries
- Factors:
 - Skill of the provider
 - Medical condition of the patient
 - Emergent intubations
 - Non-OR locations
 - # of intubation attempts

Vaida, S. (2020). *Anesthesiology News*, 83-88.

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On-going PACU Management

- Somnolence ~ d/t anes, other
 - Airway concerns
- Restlessness, agitation, delirium
 - Adequate oxygenation
 - Noxious stimuli
 - Baseline
- Pain and comfort
 - Multimodal
- Review anes record to align w/ clinical presentation

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Postoperative Opioid-Induced Respiratory Depression (RD)

Lee, L. et al. (2015). *Anesthesiology*, 122, 659-665.

- Closed claims cases-1990-2009
- OIRD assoc w/ p-op death, anoxic brain damage w/in 24 hours/op
 - *deemed preventable*
- Inclusion criteria
 - RR < 8/min
 - Somnolence
 - SpO₂ < 90% in absence of abnormal baseline
 - Pinpoint pupils
 - High dose opioids in opiate-naïve pt
 - Qualitative observation of RD: snoring
 - Arrest w/ presumed risk of RD

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Clinical Presentation, Treatment, and Complications of Malignant Hyperthermia in North America from 1987 to 2006

- NAMHR: N= 286 Larach, M. et al. (2010). *Anaesthesia & Analgesia*, 110(2), 498-507.
- 75% male/70% Caucasian
- 30% muscular build
- Mean age 22; 45% ≤ 19 years old
- Previous anesthetic/family hx
 - 50% had ≥ 2 prior unremarkable GA
 - 7% increased muscle tone
- Clinical sx: MMR, hypercarbia, ST, > temp, skin mottling, cyanosis
 - *Elevated temperature was one of 1st 3 signs*

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Neuroaxial/Regional Anesthesia

- Primary anesthetic approach *or*
- Adjunctive to GA
- Local anesthetic +/- opioid
- Block sodium channels – nerve conduction
- Regional block: peripheral nerve blocks
- Spinal & epidural- interrupts sensory, motor, sympathetic nerve pathways

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Patient Selection

- Surgical procedure
- Hemodynamic stability
- Lack of neurological deficits
- Intact hematologic system
 - Anticoagulant use
 - Platelet dysfunction (liver disease)
- No infection, local or systemic
- No recent spinal trauma (spinal, epidural)
- Pt consent

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Neuroaxial/Regional Anesthesia

- Render *portion* of body insensate to painful stimuli
- Potential complications:
 - Nerve trauma
 - Adverse drug event
 - Local anesthetic toxicity
 - Falls d/t alteration motor function
 - PDPH
 - Hemodynamic changes

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Spinal Anesthesia

- 1st spinal performed in 1898 by Dr. Bier
- >'ing popularity w/ joints
- Anesthetic solution and/or narcotic injected into intrathecal space ~ lumbar area only
- Baricity: add'n of glucose to make solution heavier than CSF
- Hyperbaric: solution settles to most dependent aspect of subarachnoid space

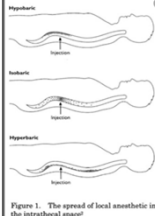
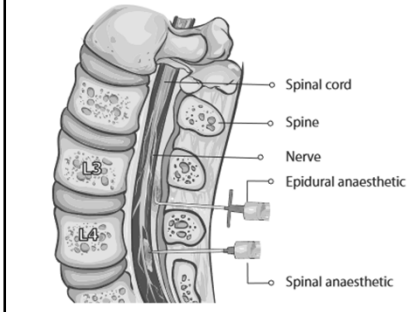


Figure 1. The spread of local anesthetic in the intrathecal space

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Spinal vs. epidural administration

As illustrated below, a spinal anesthetic is injected into the subarachnoid space and an epidural is injected into the epidural space.



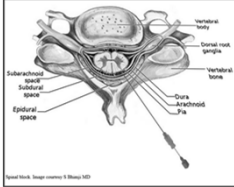
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Spinal Anesthesia

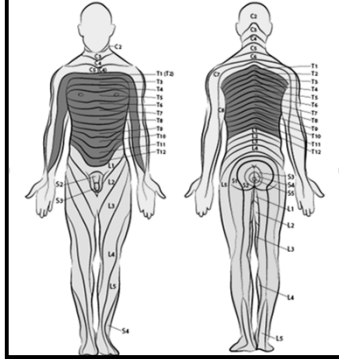
- Sequence of loss of function/sensation
- Autonomic or sympathetic- vasomotor, bladder control
- Sense of temperature
- Pain
- Touch
- Movement
- Proprioception
- Return of function is in reverse order



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Dermatomes (Map and Locations on Skin)




https://www.emedicinehealth.com/dermatomes/article_em.htm

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Complications

- Postdural puncture headache (PDPH)
- Backache ~ assoc w/ lidocaine spinal; transient
- Total spinal anesthesia
- N/V ~ r/t hypotension; O₂, Rx hypotension
- Hypotension ~ sympathectomy d/t blockade
- Urinary retention ~ autonomic blockade of sacral nerves



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Complications

- Neurologic injury
- Pulse loss; paralysis; pain unrelated to surgery
- Hematoma
- Arachnoiditis
- Hypothermia ~ vasodilatation, inhibits vasoconstriction

Major neurological complications

- Failure of technique
 - Primary (multiple attempts)
 - Secondary (failed spinal)
- Direct nerve trauma
 - Needle damage to spinal cord or major peripheral nerve/plexus
 - Intraneural injection
- Infection
 - Viral/bacterial
 - Perineural
 - Epidural/intrathecal
- Haematoma
 - Epidural
 - Brachial plexus
- Drug toxicity
 - Transient neurological symptoms (TNS)
 - Adhesive arachnoiditis
 - Drug error
- Miscellaneous
 - Anterior spinal artery syndrome
 - Spinal cord infarction

<https://www.frca.co.uk/article.aspx?articleid=100508>

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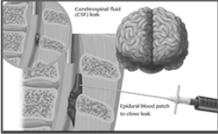
Total Spinal Anesthesia ~High Spinal

- Complete sympathetic blockade:
 - Bradycardia ~ cardioaccelerator fibers T1-T4 blocked
 - UE weakness/numbness
 - Respiratory distress
 - <<<<< BP
- LOC
- N/V
- RX:
 - O2 ~ possible advanced airway
 - Fluids ~ pressors
 - LE elevation
- ~ Caution w/ neo, levo d/t reflex bradycardia

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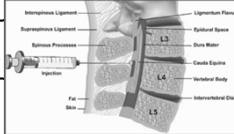
Postdural Puncture Headache

- PDPH
 - Most often frontal or occipital
 - Related to large needle size
 - Worsened by sitting or standing
 - Onset usually after 24-72 hours
 - Rx: hydration, analgesics, position flat
 - Epidural blood patch



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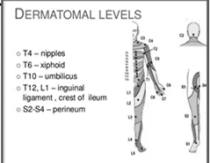
Epidural Anesthesia



- Anesthetic agents administered into epidural space
 - Single dose-continuous infusion
 - Less sympathetic blockade than spinal
 - > risk for systemic toxicity
 - Epidural catheters and medication safety
 - Tubing connections
 - Prevention strategies for inadvertent IV administration of epidural solution

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Nursing Considerations



- Dermatome levels
- Hypotension more likely w/ level > T6
 - < venous return to the heart
 - < venous tone
 - < CO
- Rx: neo gtt, ephedrine, fluid, atropine if < HR
- Bradycardia more likely w/ block > T3
 - Blocks cardiac accelerator nerve
- Severe cardiopulmonary collapse if block > T1
 - Careful monitoring essential
 - > c/o difficulty breathing- prepare to intubate

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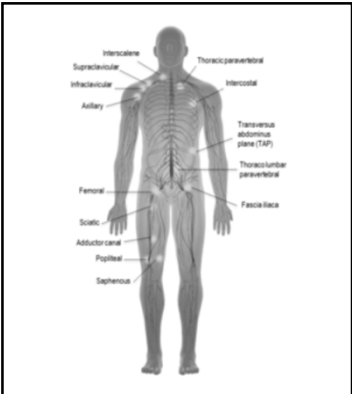
Complications



- Hematoma
- Prolonged/permanent loss of motor/sensation in blocked area
- > risk w/ use of anticoagulants
 - Careful medication management
- Ongoing neuro assessment ~ MOTOR function LE
- Immediate MD notification if suspect

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PNCs

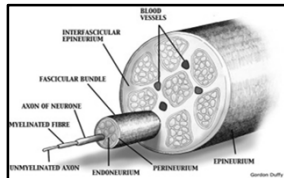


- Brachial Plexus
- Interscalene
- Supraclavicular
- Infraclavicular
- Axillary
- Bier Block
- Femoral
- Sciatic
- Popliteal/ankle
- TAP
- Other.....

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Peripheral Nerve Catheters

- Single shot/continuous infusion
- Local anesthetic regionally proximate to pain source
- Surgical
- Trauma



[https://www.bjwaed.org/article/S2050-5346\(18\)30115-X/fulltext](https://www.bjwaed.org/article/S2050-5346(18)30115-X/fulltext)

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Nursing Considerations

- Regional block ~ need add'l analgesics
- Numbness ~ safety
- Continuous infusions of local anesthetic ~ med safety
- D/C teaching ~ when the block wears off

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Local Anesthetic Toxicity

- Rates (est): 4/10,000 epidurals; 7.5-20 per 10,000 peripheral nerve blocks
- Toxicity:
 - High plasma concentration
 - Affects CV, neuro
- Causes:
 - Intravascular injection (use of test dose)
 - Catheter migration
 - Excessive dosing ~ systemic absorption

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Local Anesthetic Toxicity

- Circumoral, tongue numbness
- Lightheadedness
- Tinnitus
- Visual disturbance
- Slurred speech
- Muscle twitch
- Irrational conversation
- Grand mal
- Coma

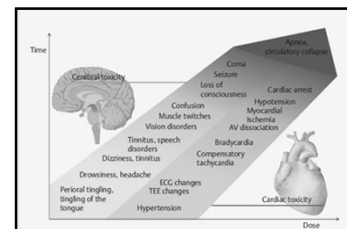


Fig. 20.1. Central and cardiac symptoms of systemic intoxication by local anesthetics. (Source: Graf and Neal 2012.)

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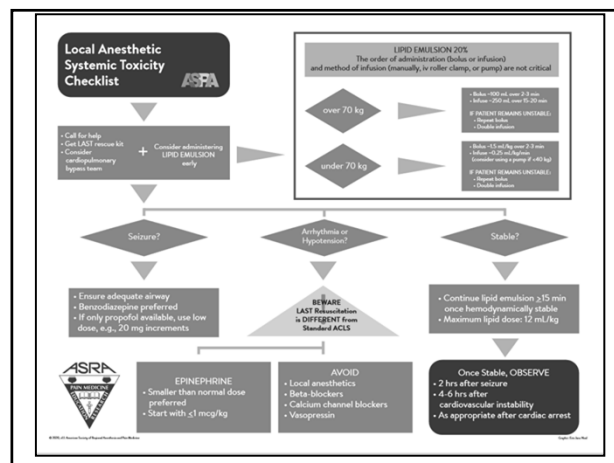
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Lipid Rescue

- Excess local anesthetic binds w/ lipid emulsion= reduced plasma drug level
- Dose (ASRA guidelines):
 - Initial bolus: 20% lipid 1.5 ml/kg rapidly
 - Cont. infusion: 0.25 ml/kg/min
 - Add" bolus if needed
 - Max dose: 10 ml/kg
 - ? CPB
 - ? ICU

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Complications Associated With Peripheral Nerve Blocks: Lessons From the ASA Closed Claims Project

- N=189
- 69% ASA 1 or 2
- Majority outpt
- Complications:
 - Nerve injury
 - Death
 - PTX
- 68% temporary/non-disabling

Table 1. Types of Peripheral Nerve Blocks in ASA Closed Claims Database

Block Type	n (% of 189 Claims) ^a
Interscalene	79 (42)
Axillary	50 (26)
Intravenous regional anesthesia	20 (11)
Femoral	8 (4)
Ankle block	8 (4)
Supraclavicular	7 (4)
Unspecified brachial block	6 (3)
Intercostal blocks	3 (2)
Other blocks ^b	8 (4)

Lee, L et al. (2011). *Anesthesia Clinics*, 49(3), 56-67.

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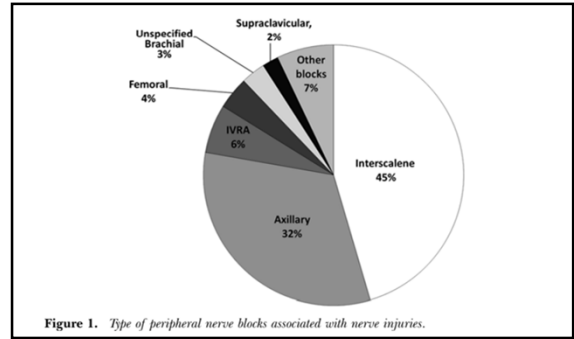


Figure 1. Type of peripheral nerve blocks associated with nerve injuries.

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Table 5. Associated Factors for Peripheral Nerve Blocks With Death or Brain Damage (n = 30)

	No. Claims
Local anesthetic toxicity	7
Inadvertent intravenous/absorption	5
Wrong dose	2
Test doses or divided dosing	5
Stroke	6
Prolonged hypotension	5
Beach chair position	4
Uncontrolled preoperative hypertension	1
Premature extubation/hypoxia on PACU Arrival	3
Injection into spinal cord under GA	2
Inadvertent Intrathecal injection	1
Myocardial Infarction	2
Other intraoperative cardiac or respiratory arrest	3
Other damaging events	7

GA indicates general anesthesia; PACU, postoperative anesthesia care unit.

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Final Thoughts

- Knowledge of anesthetic agents essential
- Best learned beside an anesthesia provider!
- Awareness/anticipation of potential complications
- MH/LAST initial and annual knowledge & skills assessment
- *Vigilance @ the bedside*

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THANK YOU!!!

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Question

One of the first indicators of local anesthetic systemic toxicity is:

- cardiac arrest
- circumoral numbness
- hypotension
- ventricular tachycardia

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Question

Your anesthesia provider performs a preoperative airway assessment and determines that the patient has a grade IV view. You interpret this to indicate:

- a) the patient will be easy to intubate
- b) potential for a difficult airway
- c) patient will likely need to remain intubated following surgery
- d) the provider was not skilled at evaluating the patient's airway

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Question

Monitored anesthesia care can best be described as:

- a) periprocedural/perioperative continuous infusion of propofol
- b) deep sedation
- c) anesthesia performed in procedural areas
- d) anesthesia provided by an anesthesia provider

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THANK YOU!!!

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