Clinical Anesthesia for nonclinical anesthesia colleagues by James H. Philip
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Objectives

Understand who anesthesiologists and nurse anesthetists are
Understand what anesthesiologists and nurse anesthetists do
Understand the fundamental components of an anesthetic
Understand the choices of drugs and equipment
Understand the anesthesia gas delivery system, esp. circuit
Understand, speak, and write, using anesthesia terminology correctly and appropriately
Appreciate the thinking process behind anesthesia decisions
Appreciate the role of anesthesia care providers in the perioperative process
Understand the need for clinical technology support
Understand the need for information technology support
Understand the need for supply and equipment management support
The Operating Room

Personnel

The sterile field

Equipment

Generic vs. specialized environments
Personnel

Surgeons
Anesthetists (Anaesthetists (G.B. and MGH))
Scrub Nurses or Scrub Technicians
Circulating Nurses
Anes Technicians
Biomedical Engineering Technicians
Clinical Engineers
Surgeons

Classic surgeons - operate with a scalpel

Modern surgeons - use newer technology
Scope to visualize
Fluoroscopy, Ultrasound to visualize
Insufflation to show organs (Laparoscopy)
Robot to perform tiny procedures magnified
and without tremor or organ motion

Interventionalists
Trained in other field and doing the above modern surgery
Anesthetists

Anesthetist = one who administers anesthesia
  MD Anesthesiologist
  CRNA Nurse Anesthetist (USA only)
  AA Anesthesia Assistant (USA only)(some states)

Administer = Give to patient

Anesthesiologist = One who studies anesthesia
  and administers anesthesia to patients

Anesthesia Care Team
  Anesthesiologist AKA Attending is supervisor
  CRNA, AA, or Resident directly administers
OR Utilities

Electrical
Gases
Vacuum
Surgical Equipment

Lighting system
OR table
Electro Surgical Unit (ESU)
Electrocautery
Clean Area
More
Specialized OR Equipment

Cardiovascular
  CPB or Pump
  LVAD, RVAD
    (L,R Ventricular Assist Devices)
IAB (intra-aortic balloon to support blood pressure)
Lasers, Argon Plasma Coagulators (APCs)
Microscopes
Imaging systems
Navigation systems
EEG (brain wave monitor)
Robots to assist with surgery
More
If you visit

Key Principle
Typical OR Layout

Personnel
A1 = Anes Resident
A2 = Anes Attending/Faculty
C = Circulating RN
SR = Surgical Resident
S = Surgeon
ST = Surgical Scrub Technician
Sterile Field

Don’t touch anything green or blue !!!
Generally, don’t touch anything....
Specialty Environments

<table>
<thead>
<tr>
<th>Operating Rooms</th>
<th>Other Rooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Pain Management</td>
</tr>
<tr>
<td>Thoracic</td>
<td>Diagnostic Radiology</td>
</tr>
<tr>
<td>Vascular</td>
<td>Therapeutic Radiology</td>
</tr>
<tr>
<td>General</td>
<td>MRI/MRT - the Magnet</td>
</tr>
<tr>
<td>Gynecology</td>
<td>PACU (Post Anes Care) RR</td>
</tr>
<tr>
<td>Day Surg</td>
<td>ICU (Intensive Care Unit)</td>
</tr>
</tbody>
</table>
The Perioperative Process

Peri = around. Now it means during, also
Preoperative evaluation of the patient
Case preparation
The anesthetic
Post-operative care
Follow-up
Booking (Scheduling) a Case

Internist diagnoses disease and refers to Surgeon determines if and what surgery is required

Preoperative visit - Anesthesia component
  Evaluate patient
  Consider anesthesia options
  Meet patient’s needs
  Satisfy patient’s desires
Preoperative Evaluation

Surgery planned
Patient disease related to surgery
Patient disease irrespective of surgery
Patient physical attributes (size, shape)
Patient emotional attributes and needs
ASA Physical Status classification

1 Healthy patient with localized surgical disease
   no organic, physiologic, biochemical, or psychiatric disease
2 Mild to moderate disease - non-limiting
3 Severe systemic disease - limiting
4 Life threatening systemic disease
5 Moribund (very sick) with little change of survival without immediate surgery

E Added if emergency operation is required (3E)
Preoperative Preparation

Communication
  surgeon & OR team (equipment, orientation, …)
  patient & family (NPO p Midnight, …)

Safety Pause

Room setup
  Anesthesia supplies present and checked
  Anesthesia equipment present and checked
  Surgical supplies present and checked

Patient
  IV access, informed consent, premedication sometimes.
The Anesthetic

Enter OR

Anesthesia begins
  Induction
  Maintenance
  Emergence (awakening, tube removal)
  Recovery
Anesthesia ends
The Anesthetic

Enter OR  Stretcher, wheelchair, walk
Anesthesia begins
Induction  Going to sleep
Maintenance Staying asleep
Emergence  Waking up
Recovery  Returning to normal
Anesthesia ends
Preparation

Prepare Drugs
Prepare and check Equipment
  Laryngoscope, IV Pole; Anesthesia Machine
Start IV (usually in Pre-Op area)
Evaluate patient
Formulate a plan
Communicate with patient and surgeon
Bring the Patient to the OR

Enter OR
Position patient on OR Table
Attach Monitors, leads, tubes
Final check
Overlooked
  OR Table control and interactions
  Suction functional
Forced Hot Air blanket in place ad with air
Components of General Anesthesia

1. Sleep - unconsciousness
2. Amnesia - loss of memory/recall
3. Analgesia - loss of pain
4. Paralysis - muscles relaxed/soft
5. Autonomic block - no body response
Anesthesia Types

- General
- Regional
- Sedation (MAC)
Two Companies

GE-Datex-Ohmeda
Aestiva

Draeger Fabius
GS
Aisys with PIMS
Normal flow in breathing circuit

Normal use, not Circuit Prime

Flow goes forward in circuit in the direction of the valves

Emptying and filling reservoir bag may go backward and lungs, alternately
Normal flow in the breathing circuit - Inspiration

Exhaust

CO₂ Absorbant

Sampled 200 mL/min

Fresh
Normal flow in the breathing circuit - *Expiration*

- **Exhaust**
- **CO₂ Absorbant**
- **Sampled 200 mL/min**

*Fresh*
Anesthetic path from vaporizer to brain and beyond

Desflurane
DEL %atm

10
6.7 CKT

10
6.2 ALV

10
6.2 ART

10
6.2 VRG

10
1.7 MUS

10
0.1 FAT

10
5.0 VEN

FGF L/m

VA L/m

CO L/m

00:30:00 Time (hh:mm:ss)

0.00
1.00
4.02
5.00
2.18 Uptake ($)
Technique Names

Inhalation anesthesia

Intravenous anesthesia
  usually with nitrous oxide

Balanced Anesthesia - Inhaled + IV

TIVA - Total Intra Venous Anesthesia

MAC - sedation
Technique - how do I choose

Minimum impact on patient
Allow the planned surgery
Anesthetic Techniques

Regional Anesthesia
  Spinal, Epidural, Extremity

Monitored Anesthesia Care = deep sedation = MAC

General Anesthesia
  see below
General Anesthesia types

IV (intravenous) Drugs
Inhaled (breathed) drugs
Combination of IV and Inhaled Balanced
Airway Control Products

Room air
Facemask with oxygen flow
Laryngeal Mask Airway (LMA)
Tracheal Tube
Types of General Anesthetic

Achieved with only IV drugs
TIVA = Total IntraVenous Anesthesia

Achieved with only volatile liquids and gases
VIMA = Volatile Induction & Maintenance An.

Achieved with one or more inhalants + more
Balanced Anesthesia

Achieved with IV + Inhalation + Regional
Combined Anesthesia
Choice of anesthetic technique

Must meet the surgical need
Must be compatible with the patient’s health
Controlled comparisons rarely show outcome differences
Individual anesthesiologists have techniques that work best for them based on knowledge, skill, experience
Typical General Anesthetic

Induction
Maintenance
Emergence
Recovery to normal state
Anesthesia Induction

- Preoxygenate (denitrogenate)
- IV induction agents
- Adjuvant
- Monitor and Control
  - Airway
  - Breathing
  - Circulation
Pre-oxygenation

Why preoxygenate (denitrogenate)?

Goal: Replace nitrogen in air with oxygen

FRC = Lung volume after exhalation

FRC = 2000 mL

Air: 0.21 \times 2000 = 420 \text{ mL O}_2

100\% \text{ O}_2: 2000 \text{ mL O}_2

Oxygen Uptake = 250 \text{ mL/min}

100\% \text{ O}_2 Safe time = 8 minutes

Air (21\% \text{ O}_2) Safe time < 2 minutes
Anesthesia Induction

Preoxygenate (denitrogenate)
IV induction agents
Adjuvant
Monitor and Control
  Airway
  Breathing
  Circulation
Preoxygenate
IV Drugs
Secure or Control Airway

Tracheal Tube
  Endotracheal Tube, ET
Laryngeal Mask Airway
  LMA

Natural airway with mask
  Oropharyngeal or Nasopharyngeal devices included
Tracheal Intubation

Tube in trachea (windpipe)
Protects lungs from vomit
Allows easy Ventilation
    patient can breath
    I can assist, control, mechanically ventilate

Muscle Relaxant
    Succinylcholine, Vecuronium

Laryngoscopy (metal scope to see larynx)
Intubation - place tube in trachea
Maintenance

Airway
Breathing
Circulation
Drugs for ongoing anesthesia
Equipment for monitoring
Fluid management
Get it down (on paper) - Recordkeeping
Real danger is ABC

Really AAA B C

Airway, Airway, Airway

Breathing

Circulation
Maintenance

IV drugs
narcotics for pain - now and later
muscle relaxants to soften muscles
sleep drugs to maintain sleep & amnesia

Inhaled drugs
nitrous oxide
vapors - isoflurane, sevoflurane, desflurane, halothane (kids)
Emergence

Plan for wake-up
Eliminate the inhalation anesthetic
Await re-distribution of most IV drugs
Await metabolism of a few IV drugs
Establish or maintain analgesia (no pain)
Reverse muscle relaxants
Extubate Trachea (remove tracheal tube)
Protect airway (Airway, again)
Transfer to stretcher or wheelchair
Recovery

Exit the OR
Monitor ABC
Oxygenate (treat or monitor SpO₂)
Transfer to PACU
  Post Anesthesia Care Unit (aka RR)
Manage pain
Post-Op Pain Management

Methods
Block response (analgesics), block signals (regional)

Routes
Intravenous, intramuscular, oral, transdermal (patch), rectal
Regional block (Epidural, Field, Local)

Medications
Anti-inflammatory, opioids (narcotics), local anesthetics

Techniques
Patient-controlled (PCA, PCEA [E for Epidural)
Nurse-controlled (Intermittent injections by clock or request)
Potential After-Effects of Surgery and Anesthesia

- Sleepiness
- Respiratory depression
- Nausea, Vomiting (PONV)
- Pain
- Cardiovascular stress or depression
- Other Complications
Follow-up

Manage Pain
Visit post-op
Determine quality of care
  Look for complications
Send bill to third party payer
Thank you