

# Anesthesia at Remote Locations

# Some terms

- Nonoperating room anesthesia (NORA)
- Anesthesia at remote location
- Outpatient anesthesia
- Office-based anesthesia (OBA)

# Anesthesia Outside the OR

- Radiology- CT, MRI, Interventional Radiation Therapy
- Cardiology- Cardio version, PPM insertion, catheterization
- Psychiatry- Electroconvulsive therapy
- Gastroenterology- EGD, colonoscopy
- Urology- ESWL

# Objectives

- Understanding that the standards of anesthesia care and patient monitoring are the same regardless of location.
- To remember that the key to efficient and safe remote anesthetic relies on open communication between the anesthesiologist and non-operating room personnel.
- Realize that remote locations have different safety concerns, such as radiation and powerful magnetic fields.

# Special problem of NORA

- Limited working place, limited access to the patient,
- Electrical interference with monitors and phones, lighting and temperature inadequacy,
- Use of outdated ,old equipment
- Less familiar with the management of patients
- Lack of skilled personnel, drugs and supplies

# ASA GUIDELINES



**Approved by the ASA House of Delegates on October 15, 2003 and amended on October 22, 2008)**

- a reliable oxygen source with backup
- a suction source
- waste gas scavenging
- adequate monitoring equipment to meet the standards for basic anesthetic monitoring
- a self-inflating hand resuscitator bag
- sufficient safe electrical outlets
- adequate patient and anesthesia machine illumination with battery-powered backup
- sufficient space for the anesthesia care team
- emergency cart with a defibrillator
- emergency drugs, and other emergency equipment
- a means of reliable two-way communication to request assistance
- compliance of the facility with all applicable safety and building codes
- Appropriate postanesthesia management should be provided
- Adequately trained staff to support anesthesia team

# RCoA recommendations(2011)

- Familiarity with all remote areas
- Standardized anesthetic equipments
- Mandatory monitoring should be as for any location.
- Availabilty of fully trained assistant
- Ensuring patients safety
- Expert recovery care
- Accurate documentation of anesthetic procedure
- Wherever poossible anesthesia provided by expert consultants

# AAP guidelines for NORA pediatric patients

- No administration of sedating medication without safety net of medical supervision
- Careful presedation evaluation
- Appropriate fasting for elective procedures
- Balance between depth of sedation and risk
- Focussed airway examination
- Clear understanding of medications and its effects
- Appropriate training and skills for airway management



# AAP guidelines for NORA pediatric patients

- Appropriate equipments for airway management and venous access
- Appropriate medications and reversal agents
- Sufficient no of people
- Appropriate monitoring
- Properly equipped recovery area
- Recovery to presedation level before discharge
- Appropriate discharge instructions

# EQUIPMENTS CHECK (SOAPME)

**S (suction)** – Appropriate size suction catheters and functioning suction apparatus.

**O (oxygen)** – Reliable oxygen sources with a functioning flowmeter. At least one spare E-type oxygen cylinder.

**A (airway)** – Size appropriate airway equipment:

- Face mask
- Nasopharyngeal and oropharyngeal airways
- Laryngoscope blades
- ETT
- Stylets
- Bag-valve-mask or equivalent device.

**P (pharmacy)** – Basic drugs needed for life support during emergency:

- Epinephrine (adrenaline)
- Atropine
- Glucose
- Naloxone (reversal agent for opioid drugs)
- Flumazenil (reversal agent for benzodiazepines).

**M (monitors):**

- Pulse oximeter
- NIBP
- End-tidal CO2 (capnography)
- Temperature
- ECG

**E (equipment):**

- Defibrillator with paddles
- Gas scavenging
- Safe electrical outlets (earthed)
- Adequate lighting (torch with battery backup)
- Means of reliable communication to main theatre site.

# REMOTE LOCATIONS

# Electroconvulsive therapy (ECT)

- Indications
  - Major depression
  - Mania
  - Certain forms of schizophrenia
  - Parkinson's syndrome
- Contraindications
  - Pheochromocytoma
  - Increased ICP
  - Recent CVA
  - Cardiovascular conduction defects
  - High risk pregnancy
  - Aortic and cerebral aneurysms

# Electroconvulsive therapy (ECT)

- **Periods:** 6 to 12 treatments over 2 to 4 weeks
- **Physiologic effects:**
  - a grand mal seizure tonic phase : 10 to 15 s,
  - clonic phase :30 to 50 s.
  - first reaction: bradycardia and hypotension
  - following reaction: hypertension , tachycardia,5-10min ECG changes ,ICP, intraocular and intragastric pressure increase

# Anesthetic Goals

1. Amnesia and rapid recover
2. Prevent damage
3. Control hemodynamic response.
4. Avoid interference with initiation and duration of induced seizure.

# Anesthetic Management of ECT

- *Anesthesia and neuromuscular blockade are necessary: to prevent psychological and physical trauma*
- *Careful preoperative evaluation: antidepressants, comorbid conditions*
- *Anticholinergic pretreatment- glycopyrrolate/atropine: To prevent transient asystole, bradycardia, antisialogogue*

# Anesthetic Management of ECT

- Induction : Intravenous anesthetics –  
Methohexital (.75-1 mg/kg)---Gold standard  
Propofol, etomidate, thiopental, Bzd, ketamine  
not usually a choice
- Volatile anesthetics- Sevoflurane agent of  
choice in children specially
- Opioids- Remifentanil+barbiturate alternative  
to etomidate



# Anesthetic Management of ECT

- Antidepressants:
  - TCA (block reuptake of catecholamines)- anticholinergic, antihistaminic, sedative, slow cardiac conduction
  - MAOI (blocks metabolism of catecholamines)- hypertensive crises, inhibit hepatic microsomal enzymes
  - Lithium-prolongs NMB , bzd, barbiturates duration; cognitive effects post ECT (discontinue pre ECT)
  - Newer antidepressants (trazadone, bupropion, fluoxetine): less side effects; preferred

# MRI



# Anesthetic Considerations for MRI

- Physical Environment
  - pt positioning (area of interest must be close to MRI coil)
  - narrow aperture (Obese pt's may not fit)
  - remote viewing necessary
  - limited access to pt/airway
  - noisy atmosphere (hearing protection)

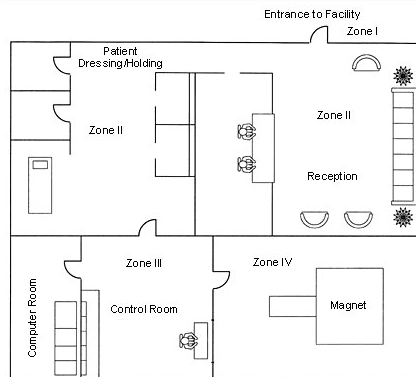
# Anesthetic Considerations for MRI

- Magnetic field/Radiofrequency signal
- no ferromagnetic components (ETT, PPM, vascular clips, biologic pumps, shrapnel, ocular metal)
- interference of monitors
- necessity for immobilization of monitors to prevent degradations of magnetic field homogeneity
- physical harm to those in the room

# Zones in MRI

- Zone One consists of all areas freely accessible to the general public
- Zone Two acts as a buffer between Zone One and the more restrictive Zone Three. Here, patients are under the general supervision of MR personnel
- Zone Three should be restricted by a physical barrier. Only approved MR personnel and patients that have undergone a medical questionnaire and interview are allowed inside Zone Three. The MR control room and/or computer room are located within Zone Three
- Zone Four is strictly the area within the walls of the MR scanner room, sometimes called the magnet room. Access into the MR scanner room should only be available by passing through Zone Three

Figure . Recommended 4-Zone MRI Suite Design Recommended by the American College of Radiology

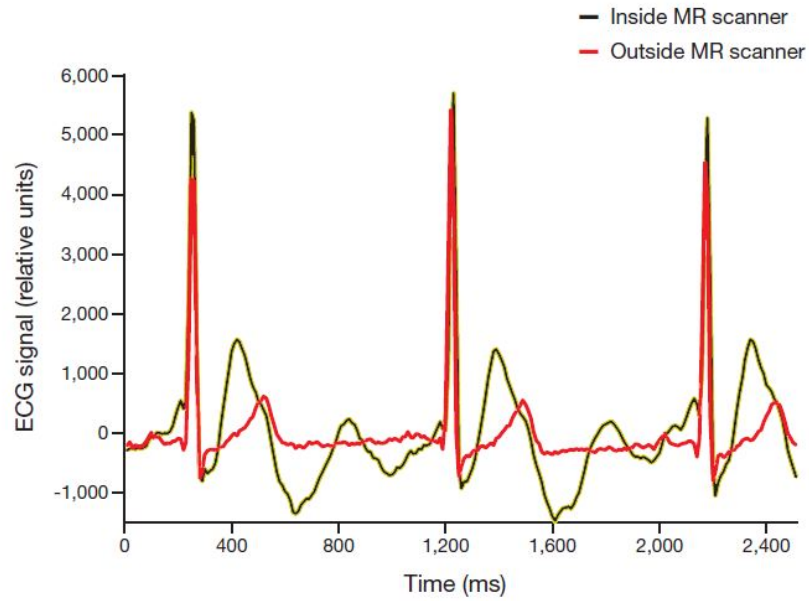


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# Monitoring Considerations

- ECG
  - rapidly changing magnetic fields produce artifact, ST and T wave abnormalities, and may mimic arrhythmias
  - if ECG wires are in a loop, a the magnetic field may heat the wires and leads, thus leading to thermal injury (antenna coupling effect)
- Pulse oximetry
  - like ECG wires, the antenna effect may produce thermal injury
- Capnography
  - increased length of sampling line may have prolonged time delay
- Blood pressure
  - need for plastic components

# ECG wave in MRI



# Special Considerations

## MRI roadtrip

- What to bring:
  - Cart (peds vs. adult)
  - Anesthesia machine/circuits (adult and peds)
  - Monitors
    - noninvasive BP record and cuffs
    - End-tidal CO<sub>2</sub> monitor and window
  - Airway
    - LMA/ETT
    - MRI adapter
    - Long corrugated ventilation tubing
    - Jackson-Rees/Mapleson tubing
  - Syringe pump and 3 extension sets (this stays at the foot of the MRI table, far from the machine)
  - Meds: propofol, ketamine, midazolam, fentanyl, sux, , ephedrine as needed.
  - IV tubing and IV fluids
  - Paper charts: pre-op, OR records, charge sheet, and PACU order forms



- Initial workup: vital signs, pre-op, set up your equipment in the far corner of the holding area, and familiarize yourself with physical layout, location, verify availability of assistance, check gases, suction, and MRI monitors.
- Induce the patient in the holding area on the MRI-safe cart, and then transport the patient to the MRI.
- Do not take metal into the MRI room!
- Leave the monitors, anesthesia machine, oxygen cylinder, etc. outside of the room.
- Place the patient on the MRI table, and apply the MRI-compatible monitors already available in the MRI suite.
- At the end of the case, take the patient back to the holding area and extubate there.
- During the case, call angiography recovery room (yellow hallway) to give warning for patient recovery (they use the same anesthesia post-op order forms).

# Types of Anesthesia

- General anaesthesia
  - Using ET Tube and IPPV
  - Using LMA
- Conscious sedation
- TIVA

# General anesthesia

- No specific anesthetic technique is required
- Adequate length of lines / wire
- No looping of wire to prevent antenna effect and thermal injury
- Medication biased towards sedation, unless analgesia is required
- Induced in induction area adjacent to MRI room after standard monitoring are placed and airway secured by ETT/LMA
- MRI compatible instruments only inside
- Maintained with inhaled anesthetic/propofol
- Transfer back to induction area and awaken after the procedure
- Observation in recovery room by qualified person and discharge after criteria are fulfilled
- Hearing protection is mandatory for anaesthesiologist if they must remain in MRI room

# Sedation

- Inadequate sedation may result in patient movement and a failed imaging study
- Controlled circumstances may be required in patients with more complex diseases to limit the time spent in the suite
- Efficacy of oral/rectally administered sedatives may not be predictable
- Patients with mental/emotional disorders may require deeper sedation

# TIVA

- Propofol infusion
- Initial dose of 2-3 mg/kg IV, followed by an infusion of 100 µg/kg/min
- Maintenance of spontaneous respiration
- If airway management is necessary → laryngeal mask airway or endotracheal intubation

# Radiology RFA

- Often done in CT but occasionally MRI.
- Kidney, lung, and liver.
- Currently requesting general anesthesia with ETT secondary to prone positioning and the need to lay still for extended periods of time.
- It is our job to check pressure points and padding. Radiology techs are not trained to be concerned.
- Bring a face pillow in addition to the MRI road trip list.

# ANESTHESIA FOR INTERVENTIONAL NEURORADIOLOGY

*Commonly performed procedures:*

- *Embolization of cerebral and dural AVM's*
- *Coiling of cerebral aneurysms*
- *Angioplasty of atherosclerotic lesions*
- *Thrombolysis of acute thromboembolic stroke.*

# General considerations

- Procedures require: deliberate hypotension/hypertension, deliberate hypercapnia, deliberate cerebral ischemia
- Rapid transition between deep sedation and an awake responsive state
- High resolution fluoroscopy + DSA- real time images: high exposure of radiation
- Contrast media used



# Anesthetic management

- Airway examination must: intraop. manipulation not possible
- History of contrast media reaction
- Evaluation of hypertension: *dellberate hypo/hypertension required*
- Patient completely immobile during procedure YET awake for neurologic testing
- Urinary catheters: *contrast /osmotic diuretic used frequently*
- Coagulation profile check: *heparin commonly used (ACT 2-2.5 baseline)*
- Smooth emergence essential: avoid coughing/bucking

# Interventional Neuro radiology

- General anesthesia and conscious sedation are both suitable techniques for interventional neuroradiology depending on the complexity of the procedure, the need for blood pressure manipulation, and the need for intraprocedural assessment of neurologic function
- Propofol infusions are widely used, as are combinations of a benzodiazepine (usually midazolam) and opioid (usually fentanyl).
- Anticoagulation with heparin is required during interventional neuroradiology

# Radiation Therapy

- External beam radiation treatments, usually for children with malignancies, and intraoperative radiation to tumor masses that cannot be completely resected
- Direct observation of the patient is not possible
- General anesthesia or deep-sedation techniques with propofol are preferable to prevent patient movement and to allow children to tolerate what can be fairly length procedures
- The goals of anesthesia for pediatric radiotherapy
  - Assurance of immobility
  - Rapid onset
  - Brief duration of action
  - Not painful to administer
  - Prompt recovery
  - Minimal interference with eating or drinking and playing
  - Avoidance of tolerance to the anesthetic agents
  - Maintenance of a patent airway in a variety of body positions

# INTERVENTIONAL CARDIOLOGY

- Coronary angiography
- Cardiac catheterization
- Coronary artery angioplasty/ stenting
- Valvotomy
- Endovascular closure of intracardiac defects, cardiac valve replacement
- Electrophysiologic studies with pathway ablation
- Cardioversion

# Anesthetic management

During PTCA:

Transient coronary artery occlusion during balloon inflation-monitor hemodynamic closely/vasodilators ready

Reperfusion (can induce ventricular arrhythmias): ready with amiodorone/ cardioversion

Rupture of coronary artery (hemopericardium, tanponade): ready with emergency pericardiocentesis

Thrombolytics Intracoronary (bleeding complications): ready with platelets/PRBC

# Remote Cardiac Lab

- Elective cardioversion
  - Cart with emergency drugs.
  - thiopental
  - Standard monitoring
  - Preoxygenate
  - Give small incremental doses of thiopental until the eyelash reflex is abolished.
  - Remove the mask immediately before the shock and confirm no one is touching the pt.
  - Ventilate with 100% O<sub>2</sub> post-shock until consciousness is regained.
  - Consider RSI with ETT if high risk for aspiration.

# Intracoronary radiation therapy (Coronary brachytherapy):

- *To prevent neointimal proliferation by breaking DNA strands and hence mitosis*
- *Concerns of radiation safety important*
- *Adult Cardiac catheterization:*
  - *Aware of supravent/ventricular arrhythmias*
  - *Generally done under LA+ mild sedation+oxygen*

# GI PROCEDURES

## ENDOSCOPY-

- - *endoscope is passed into the GI tract*
- - *evaluates mucosa of the esophagus, stomach & duodenum*
- - *dilation of strictured areas.*

## COLONOSCOPY-

- - *scope is inserted into the rectum*
- - *evaluate the colon*

## ERCP(Endoscopic retrograde cholangiopancreatography)

- - *Diagnosis of obstructive, neoplastic, or inflammatory pancreatobiliary structures.*



# Anesthesia for GI Procedures

- Pre anesthetic assessment
- Type of anesthesia:
  - *Moderate sedation- Midazolam and Fentanyl*
  - *Deep sedation- Addition of propofol*
  - *Some cases required general anesthesia*
- Anesthetic considerations:
  - *Strong vagal nerve stimulation as result of stimulation to colon*
  - *Most patients tolerate these procedures well*

# Dental Procedures

- Pediatric Dentistry- fillings, crowns, pulpotomies, tooth extractions and space maintainers
- Oral and Maxillofacial Surgery- extractions of impacted teeth, insertion of dental implants, treatment of infections of the head and neck and facial cosmetics
- Peridontics- surgery of teeth, gingiva, connective tissue, periodontal ligament and alveolar bone
  - Anesthesia : general anesthesia, minimal sedation, moderate sedation with local anesthetic for particular areas of surgery

# Anesthesia for Dental procedures

## **Inhalation sedation**

A titrated mixture of up to 70% nitrous oxide may be administered. Clinical monitoring of patient colour, respiration and pulse is sufficient, and adult patients need not be accompanied home afterwards. This is the technique of choice in children felt to be candidates for sedation.

## **I.V. sedation**

This is commonly achieved with a titrated benzodiazepine, although a patient- or target-controlled infusion of propofol has gained some popularity over recent years. Clinical monitoring must be supplemented by pulse oximetry and blood pressure readings. Facilities must be available to administer oxygen or ventilation if needed..

## **Oral sedation**

Temazepam and midazolam are useful. Monitoring and recovery requirements are as for i.v. sedation.

# Anesthesia for Dental procedures

## **General anaesthesia**

General anaesthesia should now only be performed in the hospital setting and requires a trained anaesthetist with a dedicated assistant.

It is required for three main groups of patients:

- simple dental extractions or exodontia, previously known as 'dental chair anaesthesia'. These are mostly performed in children aged 4–10 yr, or in those with learning difficulties;
- day-case anaesthesia for extraction of permanent molars or minor oral surgery work;
- inpatient anaesthesia for more complex or extensive dental work

# UROLOGIC PROCEDURES

- Extracorporeal Shock Wave Lithotripsy-
  - kidney and ureteral stones
  
- Cystoscopy/ ureteroscopy-
  - diagnosis and treat lesions of the lower (urethra, prostate, bladder) and upper (ureter, kidney) urinary tracts

# Anesthesia Technique

Depending on the pt and procedure anesthesia

- *Topical lubrication*
- *MAC*
- *Regional*

Regional Anaesthesia

- *T-6 level - upper tract instrumentation*
- *T-10 level - lower-tract surgery*

# ***CONCLUSION***

***The standards of anesthesia care and patient monitoring are the same regardless of location***