



Memorial Sloan Kettering
Cancer Center

Interventional Radiology and Anesthesiology: Collaborative Approaches to Quality Care

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Objectives

- At the conclusion of this presentation, the participant should be able to :
 1. Describe the current practice landscape for anesthesia outside the OR
 2. Discuss the challenges associated with anesthesia care outside the OR
 3. Understand the key aspects of a successful quality plan



Financial Disclosure

- None



Question

- What describes your current clinical practice? Per month I deliver anesthesia services outside of the Operating room
 - a) Never
 - b) 1 – 5 times
 - c) 5 – 10 times
 - d) 10 – 20 times
 - e) > 20 times



65-year-old 113 kg male presents for Mediport placement. He is diabetic and on Ozempic weekly SQ. Well controlled HTN, HLD and no other issues. He reports NPO for 8 hours and last dose of Ozempic 4 days ago. His labs are WNL and he has a newly diagnosed lymphoma with chest wall adenopathy for which chemotherapy is needed urgently. No gastric ultrasound is available.

The anesthesia professionals agree to light sedation in light of the fact that the case needs to be done urgently. 16 mcg of Precedex given , 25 mcg of Fentanyl, generous local by surgeon and 1 gram of Acetaminophen. The patient is not tolerating the procedures, 25 mcg of additional Fentanyl and 1 mg of Versed given and the patient is fighting off team and not responding to verbal cues. 50 mg of Propofol is given

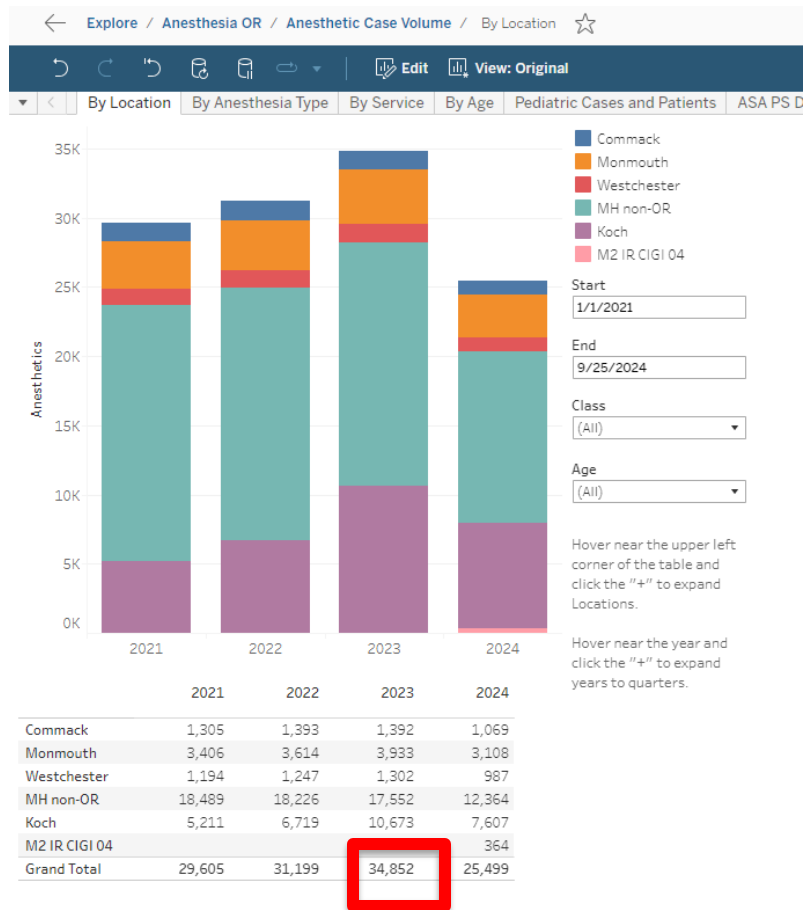
Patient became apneic, jaw thrust done and puncture made by proceduralist for Mediport. The CRNA notices green bile in the mouth and calls for help, SpO2 88 % and dropping . The patient is successfully intubated with a videoscope and stabilized. Extubated post-procedure and admitted overnight for observation.



Changing Landscape

- The demand for anesthesia care for procedures outside the OR has dramatically increased
- 2007 – 12.7% of all anesthesia was outside of the OR
- Current estimates – 40 % of all cases are outside the Operating Room

2023 – 62,500



ASA Closed Claims Review

- Compared with OR -> remote location claims involved older and sicker patients ($P < 0.01$), with 50% of remote location claims involving monitored anesthesia care
- Anesthesia at remote locations poses a significant risk for the patient
 - **oversedation**
 - **inadequate oxygenation/ventilation during monitored anesthesia care**
- Similar anesthesia and monitoring standards and guidelines should be used in all anesthesia care areas.

Metzner, J et. Al. (2009) The risk and safety of anesthesia at remote locations: the US closed claims analysis. *Current Opinion in Anesthesiology*. 22(4)

ASPF (2011) Metzner & Domino. Risk of Anesthesia in Remote Locations .



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Respiratory events were more likely to occur in remote locations (44 percent) than in operating rooms (20 percent; $P < 0.001$; Figure 1). Inadequate oxygenation/ventilation was the most common respiratory event, occurring in only 3 percent of claims where care was provided in the operating room, but in 21 percent of claims where care was provided in a remote location ($P < 0.001$; Figure 1). Other types of respiratory events included esophageal intubation, difficult intubation and aspiration of gastric contents.

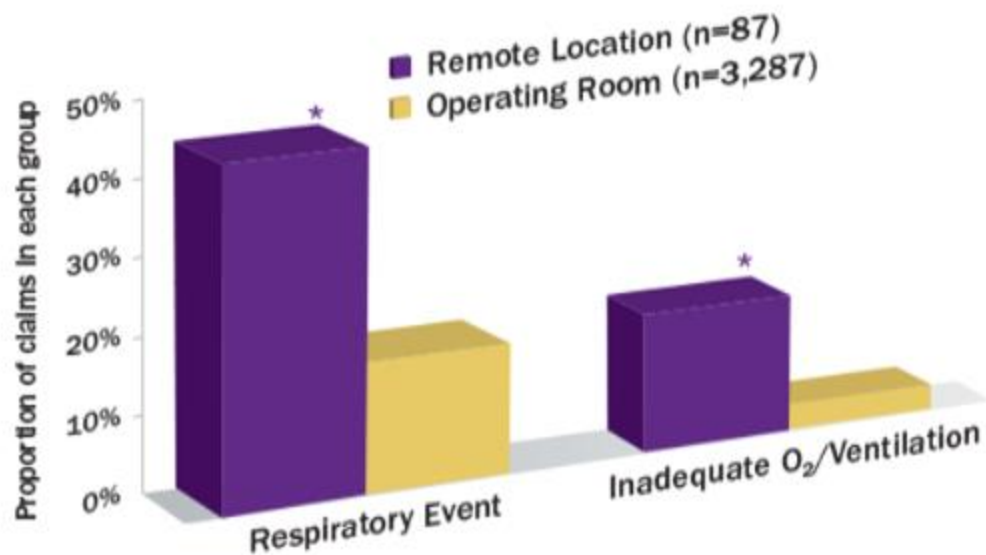


Figure 1: Remote Location Claims: Mechanism of Injury
* $p < 0.001$ remote location vs. operating room



In 54 percent of remote location claims, the care provided was judged as substandard compared to 37 percent of operating room claims ($P < 0.001$; Figure 2). In 32 percent of the remote location claims, care was judged preventable by better monitoring compared to only 8 percent of operating room claims ($P < 0.001$, Figure 2). There was no statistically significant difference in the proportion of payments made or the median payment between claims where care was provided in the operating room (\$210,000) compared to claims where care was provided at a remote location (\$330,000).

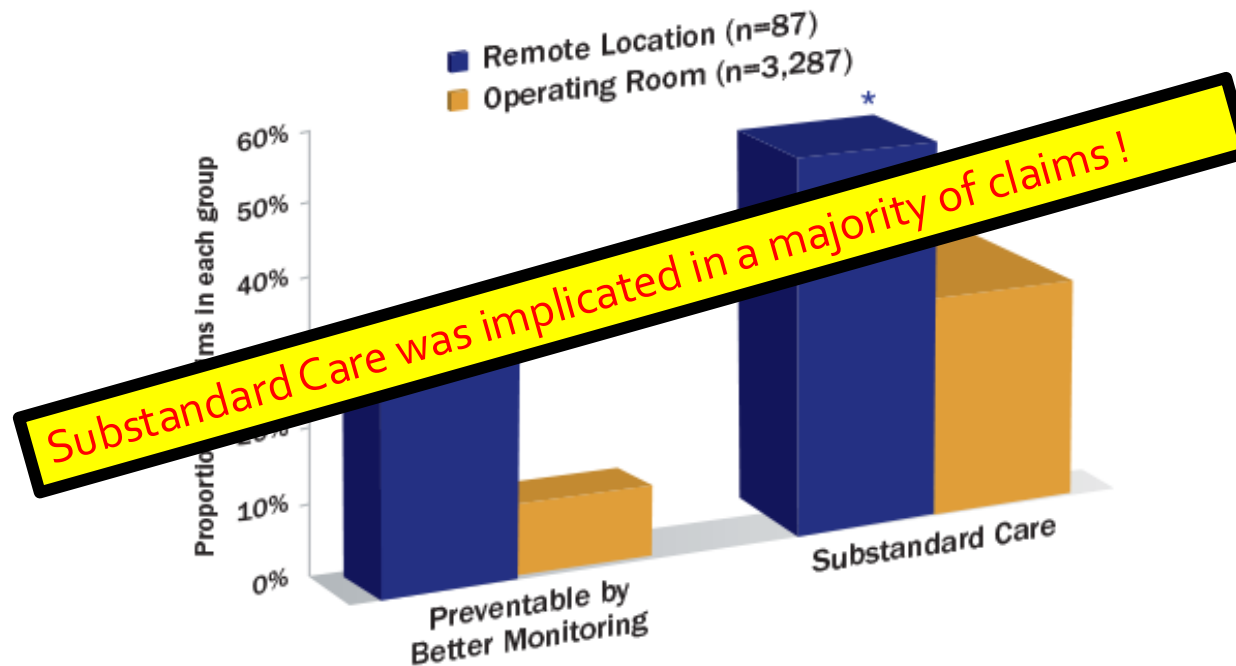


Figure 2: Remote Location Claims: Liability
* $p < 0.001$ remote location vs. operating room

AANA Closed Claims Analysis

- 245 claims
- Adverse events occurred
 - hospitals (n = 171, 69.8%)
 - ambulatory surgery centers (n = 54, 22%),
- Patient classifications
 - outpatient (n = 122, 49.8%),
 - inpatient (n = 80, 32.7%),
- As opposed to the previous descriptive study (1989- 1997) this study was associated with more outpatient (49.8%) than inpatient (32.7%) admissions, while the initial study had fewer outpatient (33%) admissions compared to inpatient (48%)
- In both studies common negative outcomes were due to respiratory events (31.8%, 2003-2012 vs. 39%,1989-1997)



Have drugs will travel

- Office based
- Emergency Room
- Intensive Care Unit
- Floor Intubations
- GI/Endoscopy
- MRI/CT
- IR
- Cath Lab
- ESWL
- Cysto
- ECT
- Bronchoscopy
- Cardioversion
- Pain Clinic
- Hospital Room
- Basement



Players

- CRNA
- Anesthesiologist
- Anesthesia Technicians
- Physician performing procedure
- RN working with physician
- PCTs/Nursing Assistants
- RNs administering sedation and analgesia **



Why is it so stressful ?

- Working with people who do not understand the nuances of anesthetic management and may not appreciate the fine line between uneventful case and a potentially dangerous /lethal one
- Less efficient or effective scheduling, resulting in inefficient or hurried patient preparation
- Equipment maybe less well maintained than in the operating room
- Greater variation in physical set-ups and anesthesia and monitoring equipment, resulting in the clinicians decreased familiarity with the environment and the equipment
- Greater variability in the time needed to obtain patient records, which can cause delays in collecting adequate information about patient history and the procedures to be performed
- Inadequate monitoring of stock items, which therefore may be missing or in short supply
- Nursing and support personnel who do not follow rigorous pre-procedure check-in processes or follow same AORN standards
- Working with individuals whom you haven't met not met before or do not know well
- Being at a distance from the core areas where anesthesia staff congregate, so less local support is available when problems arise, there are fewer opportunities to discuss questions or concerns, and there are fewer opportunities to collaborate if problems appear
- Right handed profession 😊



New Surroundings

- When arriving at new site for first time get the lay of the room
- Where are anesthesia drugs, equipment
- O₂, suction
- Where things need to be kept, out of field, away from MRI/CT machine
- Sharing of space with physicians and machines
- Who can assist you with finding items?

HELP !



ASA Guidelines for *Non- operating Room*

- Reliable source of O₂ and backup (i.e. full green oxygen E-cylinder)
- Suction
- If inhalational agents used, anesthesia machine with scavenger
- Sufficient space for patient and equipment
- Bag valve mask
- Sufficient electrical outlets and emergency outlets clearly labeled



ASA Guidelines for *Non- operating Room Anesthetizing Locations*

- Battery powered backup illumination, not laryngoscope
- Emergency cart with defibrillator
- Emergency drugs and necessary equipment to provide cardiopulmonary resuscitation
- Staff trained to support anesthesia provider and reliable two way communication
- Post-anesthesia management



Recovery Care

- Formal discharge criteria to assess patients postoperatively after ambulatory surgery provides a safe and reliable mechanism that could help in improving efficiency, workflow processes, and costs
- Medically stable before transport.
- Accompanied to the recovery area by the individual providing the anesthesia or sedation/analgesia care.
- Provision of oxygen delivery and monitoring while the patient is on the transport cart may be required.
- Appropriate recovery facilities and staff must be provided.
- In the recovery area patient condition must be documented and continually assessed.
- Immediate availability of personnel trained in advanced cardiac life support should be ensured.
- Recovery continues even after hospital discharge, with current evidence of cognitive impairment for up to 3 days after general anesthesia.

Table 1
The modified Aldrete scoring system for determining when patients are ready for discharge from the postanesthesia care unit

Discharge Criteria from Postanesthesia Care Unit	Score
Activity: able to move voluntarily or on command	
Four extremities	2
Two extremities	1
Zero extremities	0
Respiration	
Able to breathe deeply and cough freely	2
Dyspnea, shallow or limited breathing	1
Apneic	0
Circulation	
Blood pressure ± 20 mm of preanesthesia level	2
Blood pressure ± 20 –50 mm preanesthesia level	1
Blood pressure ± 50 mm of preanesthesia level	0
Consciousness	
Fully awake	2
Arousable on calling	1
Not responding	0
O₂ saturation	
Able to maintain O ₂ saturation >92% on room air	2
Needs O ₂ inhalation to maintain O ₂ saturation >90%	1
O ₂ saturation <90% even with O ₂ supplementation	0

A score ≥ 9 was required for discharge.

From Aldrete JA. The post-anesthetic recovery score revisited. *J Clin Anesth* 1995;7:89–91; with permission.



Standards cont.

- Use of non anesthesia personnel to administer sedation → can administer minimal sedation
- Medical professionals administering conscious sedation must be trained to evaluate and monitor patient and manage airway if sedation becomes deeper



Depth of Sedation

Table 1
Continuum of depth of sedation: definition of general anesthesia and levels of sedation–analgesia

Consideration	Minimal Sedation ^a (Anxiolysis)	Moderate Sedation–Analgesia ^b (Conscious Sedation)	Deep Sedation–Analgesia ^c	General ^d Anesthesia
Responsiveness	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response after repeated or painful stimulation	Unarousable, even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often
Spontaneous ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular function	Unaffected	Usually maintained	Usually maintained	May be impaired

Because sedation is a continuum, it is not always possible to predict how an individual patient will respond. Hence, practitioners intending to produce a given level of sedation should be able to rescue patients whose level of sedation becomes deeper than initially intended. Individuals administering monitoring sedation–analgesia (conscious sedation) should be able to rescue patients who enter a state of deep sedation–analgesia, and those administering deep sedation–analgesia should be able to rescue patients who enter a state of general anesthesia.

^a Minimal sedation (anxiolysis) is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected.

^b Moderate sedation–analgesia (conscious sedation) is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. (Reflex withdrawal from a painful stimulus is not considered a purposeful response.) No interventions are required to maintain a patient's airway, and spontaneous ventilation is adequate. Cardiovascular function usually is maintained.

^c Deep sedation–analgesia is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. (Reflex withdrawal from a painful stimulus is not considered a purposeful response.) The ability to maintain ventilatory function independently may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function usually is maintained.

^d General anesthesia is a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function often is impaired. Patients often required assistance in maintaining a patent airway, and positive pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired.

From American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists. Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists. *Anesthesiology* 2002;96(4):1005; with permission.



Position Statement regarding Propofol Administration

- **AANA-ASA Joint Statement Regarding Propofol Administration*April 14, 2004**
- ***Sedation is a continuum, it is not always possible to predict how an individual patient will respond. Due to the potential for rapid, profound changes in sedative/anesthetic depth and the lack of antagonistic medications, agents such as propofol require special attention.***
Whenever propofol is used for sedation/anesthesia, it should be administered only by persons trained in the administration of general anesthesia, who are not simultaneously involved in these surgical or diagnostic procedures.
- ***This restriction is concordant with specific language in the propofol package insert, and failure to follow these recommendations could put patients at increased risk of significant injury or death.***
- ***Similar concerns apply when other intravenous induction agents are used for sedation, such as thiopental, methohexital or etomidate.***



Capnography?

- **American Society of Anesthesiologists, Closed Claims database**
 - Remote locations:
 - significant risk for the patient - related to oversedation and inadequate oxygenation/ventilation during monitored anesthesia care.
 - **Anesthesia and monitoring standards and guidelines should be consistent**
 - Monitored Anesthesia Care:
 - Oversedation leading to respiratory depression was an important mechanism of patient injuries
 - Appropriate use of monitoring, vigilance, and early resuscitation could have prevented many of these injuries
- **ASA and AANA Position Statements : End Tidal CO₂ monitoring**
 - During moderate or deep sedation (regardless of location), adequacy of ventilation be evaluated by both continual observation of qualitative clinical signs and by monitoring for the presence of exhaled carbon dioxide.
 - Hypoxia follows hypoventilation or apnea -> monitoring EtCO₂ can catch it quicker
 - Administration of oxygen maintains oxygenation for a longer interval after apnea and can delay detection of apnea



Capnography

2011

BRCA/DAS
Airway

BRCA/BSG
Propofol sedation

AARC
Mechanical Ventilation

'96 minute Man'
Resuscitation

AAGBI
Sedation and ICU

EBA
Sedation and ICU

ASA
Moderate-Deep Sedation

APSF
Post-op Opioids

2012

CAS
Sedation

ICS
ICU

NHI
Sedation

IHI
Sedation and Narcotics

AAOMS
Sedation

TJC
Hospital opioids

BRCA/CEM
Sedation in EM

AAAHCIOI
Moderate Sedation

2013

CMS
PCA

AAGBI
Post-op Opioids

AHA
Resuscitation

SIR
Sedation

ARMC
Sedation

ECRI
PCA

CMS NYSPFP
Opioids

2014

ACEP/ENA
PSA in ED

EBA
Sedation, Recovery and Transfer

BRCA
Propofol Sedation GI

TennCare
SNF Ventilators

CMS Memo
IV Opioids

ECRI
Opioids

SGNA
Sedation for GI

ICS
ICU

USAF
OMS/Dental Sedation

2015

BCS/BHRS
Interventional Cardiology

BRCA
Sedation, ICU, ED

RCI
Respiratory Compromise

AHA/ERC/UKRC
Resuscitation

ACEM/ANZCA/CICM
Transport

ARIN endorses the routine use of capnography for all patients who receive moderate sedation/analgesia during procedures in the imaging environment.



The perioperative RN should use capnography to evaluate ventilation in addition to pulse oximetry to evaluate oxygenation



**ASSOCIATION OF
PERIOPERATIVE REGISTERED
NURSES (AORN)**

**GUIDELINE FOR CARE OF THE
PATIENT RECEIVING
MODERATE
SEDATION/ANALGESIA**



AORN MODERATE SEDATION/ANALGESIA GUIDELINE

- Full document only available by purchase through AORN \$175 (members) \$225 (non-members) - <https://www.aorn.org/guidelines/purchase-guidelines/print-edition>
 - Full guideline is 31 pages and fully covers all aspects of moderate sedation and literature review
 - Rec I – Scope of Practice
 - Rec II – Nursing Assessment
 - Rec III – Care and Monitoring
 - Rec IV – Sedation Medications
 - Rec V – Discharge
 - Rec VI – Education and Competency
 - Rec VII – P&P
 - Rec VIII – Quality Assurance
 - Bibliography
 - AORN Guideline Essentials Website (<http://www.aorn.org/essentials/moderate-sedation>) has several tools for overview and implementation
 - Guideline at a Glance
 - Case Studies
 - Implementation Road Map
 - Gap Analysis and Audit* Tool
 - Key Things to Remember*
 - Policy and Procedure Template*
 - Clinical FAQs*
 - Competency Verification Tool*
 - PowerPoint Presentation*
 - Webinar*
 - Other Resources - Video
- * - Specific Mention of Capnography

CAPNOGRAPHY GUIDELINE SUMMARY

- III.c.1 – Baseline patient monitoring and documentation should include...
 - Respiratory rate
 - SpO₂ by pulse oximetry
 - End-tidal carbon dioxide (CO₂) by capnography
- III.c.2 – Intraoperative patient monitoring and documentation should include...
 - Respiratory rate
 - SpO₂ by pulse oximetry
 - End-tidal carbon dioxide (CO₂) by capnography
- Review of capnography evidence (pro/con) – Overwhelmingly pro
- III.c.3 – Postoperative assessment, monitoring, and documentation should include
 - Respiratory rate
 - SpO₂ by pulse oximetry
- IV.e. – Supplemental oxygen should be immediately available... “The collective evidence establishes the benefit of using supplemental oxygen during moderate sedation/analgesia procedures. “ Discussion of literature supporting use of 2 l/m to prevent desats

ARIN POSITION STATEMENT

FEBRUARY 2016

Position

ARIN endorses the routine use of capnography for all patients who receive moderate sedation/analgesia during procedures in the imaging environment. This technology provides the critical information necessary to detect respiratory depression, hypoventilation, and apnea, thus allowing the timely initiation of appropriate interventions to rescue the individual patient. Capnography use is associated with improved patient outcomes. Capnography should be used at all times, regardless of whether sedation is administered by an anesthesia provider or a registered nurse credentialed to administer moderate sedation/analgesia medications.

- <http://www.arinursing.org/practice-guidelines/Capnography.pdf>

SUMMARY

- Strong support from ARIN and AORN for capnography use during moderate sedation based on clinical evidence
- Along with other statements from SGNA, AANA, and ASPMN, there is growing wave of support for capnography use
- Nursing/proceduralist is the most common model for sedation delivery, especially outside the hospital
- Continued discussions with ARIN, SGNA, AORN, AACN, and others to update a joint nursing statement on moderate sedation

Credentialing for RNs providing sedation

- ASA
- AORN
- National Sedation Center
- The Red Cross
- American Association of Moderate Sedation Nurses
- Should have BLS +/- ACLS
- Quality Review
- Approved drugs
- Access to code / RRT for emergencies
- Basic Airway management



MSK IR – across all campuses

Anesthesia

- 12 rooms daily
- 2 MRI locations
- Full equipment
- IT interface – same OR standards
- 5 day a week 7 – 7 PM
- Call coverage

Non- Anesthesia

- 4 rooms daily
- 24/7 call team
- 6 day a week schedule
- Conscious sedation by nurses
- Order set and limited meds
- Training for Nurses
Capnography



MSK IR

- Kyphoplasty
- Liver/lung biopsy/ Ablations
- SIRT
- Bone Biopsy
- Isolated Limb Infusion
- Denver shunts
- Tenckhoff catheter placements,
- TIPS
- Pericardiocentesis
- Neuro Embolization
- Ortho – cementoplasty/ nail

- What kind of anesthesia ?
 - All of it ! GA/Sedation/MAC/
DLT/Bronchial Blockers



MRI/CT/PET

- New Anesthesia machines and equipment that are MRI friendly
 - Poles, machine and monitors
 - Standard monitors
- Sedation is usually adequate, but general may be required for pediatric patients or sicker patients
- CT does not interfere with equipment
- ETCO₂ – follow trends, not always accurate
- Pulse Ox – may get interference from MRI machine
- ECG – MRI compatible ECG monitoring do not provide reliable assessment of the ECG, but can follow trends of HR and rhythm analysis
- BP, be sure no metal connections
- For MRI, anesthesia personnel outside room

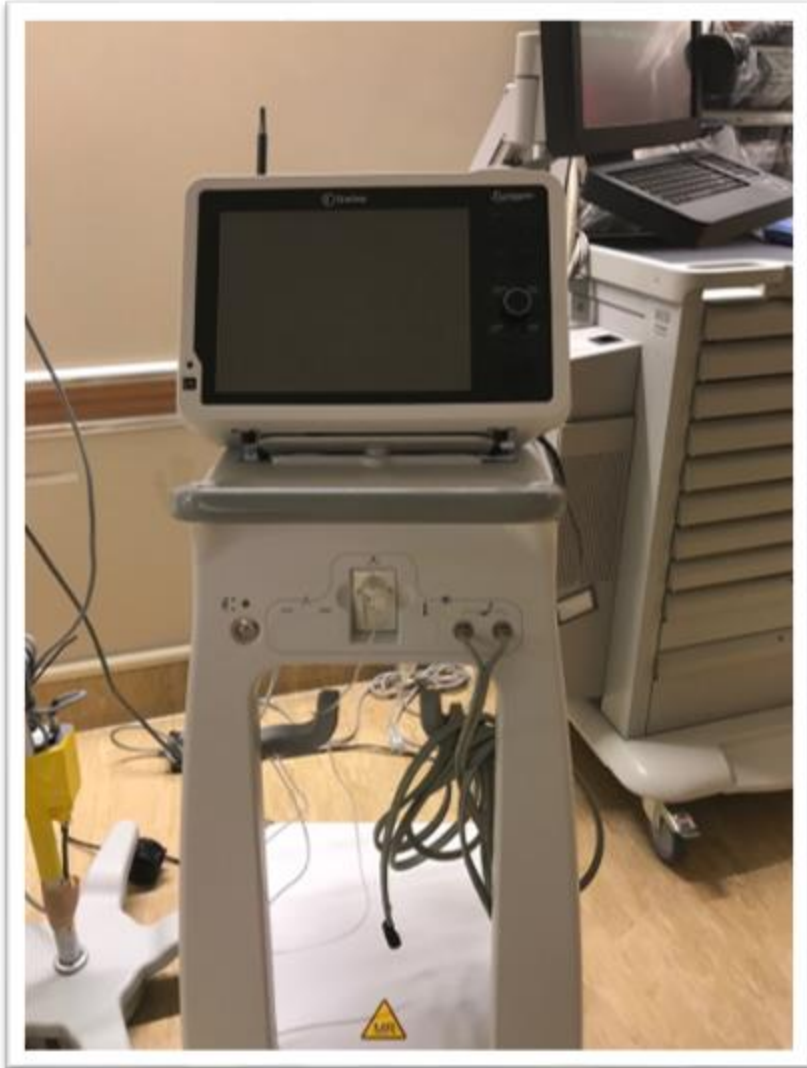


MRI

- ETCO₂ – follow trends, not always accurate
- Pulse Ox – may get interference from MRI machine
- ECG – MRI compatible ECG monitoring do not provide reliable assessment of the ECG, but can follow trends of HR and rhythm analysis
- BP, be sure no metal connections
- For MRI, anesthesia personnel outside room



MRI Equipment



MRI Safety



Pearls of wisdom



Introductions



Clear Communication
with closed loop
communication



Conflict resolution



Procedure list



Orientation



Photos distributed



Annual Joint Grand
Rounds



Interventional Radiology Procedure Summary

Procedure Index

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[Ablations](#)
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Revised 6.29.18



Checklists



Memorial Sloan Kettering
Cancer Center



MSKCC Perioperative Critical Event Checklists

MRI Emergency Steps

- **M6 OR 18:** Open side door and lock control room door
- Wand incoming help
- Call MRI Technician and Charge Nurse
- Move patient to MRI safe stretcher and transfer to corridor

Regional Sites

- Consider outside hospital transfer
- Call 911

MSKCC Revision 20180508.

Adapted by MSKCC with permission; Based on Ariadne Labs Revision April 2017 (D42417.1).
Includes 2015 AHA Guidelines Update for CPR and ECC.

Based on the OR Crisis Checklists at www.projectcheck.org/crisis.

All reasonable precautions have been taken to verify the information contained in this publication.
The responsibility for the interpretation and use of the materials lies with the reader.

Changes © 2017-2018 Memorial Sloan Kettering Cancer Center; Original © 2013-2018 Ariadne Labs: A Joint Center for Health Systems Innovation

SUSPECTED EVENT

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Hemoptysis Guideline – IR specific

10 Hemoptysis

Significant ble

START

- 1 For CIGI
For CIGI
For Koch
- 2 Turn pa
• Confir
- 3 Prepare
- 4 Intubat
• Exchan
• Isolate
- 5 Assess
• Open I
- 6 Transfe
- 7 Call for

EQUIPMENT Preparation

1. Vocera "M2 Anesthesia Tech", "M6 Anesthesia Tech", or "Koch Anesthesia Tech" to bring video laryngoscope and fiberoptic bronchoscope
2. Obtain emergency hemoptysis cart and video tower **(CIGI, Koch only)**
3. Obtain and set up therapeutic bronchoscope
4. Obtain and set up rigid bronchoscope **if requested**

EMERGENCY CART Contents

- Endotracheal tubes (8.0, 8.5, 9.0)
- Endotracheal tube Uniblocker (9.0 ID)
- Fogarty catheter (5F, 8-14F)
- Arndt endobronchial blocker (9F/78 cm)
- Thal-Quick Abscess Drainage Set
- Biopsy Forceps Boston Scientific Radial Jaw 4 Pulmonary (Large Cap 2.0 mm)
- Cook Airway Exchange Catheter 2.8 mm, Extra-Firm with Soft Tip



The Future

- More and more anesthesia locations
- With rising health care costs always looking to cut costs for patients but don't forget about safety of patients
- Robotic and VR in the IR suite



Key Points

Increasingly administering anesthesia in nontraditional settings

Same standards, monitors, equipment, and personnel for nontraditional settings as the OR

Pts undergoing anesthesia in any setting must have oxygenation, ventilation, and circulation monitored

Pts still need pre-anesthetic evaluation including airway!



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