Working in a Multi-Modality Operating Suite

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Discuss

- Setting up a Hybrid Operating Room or Suite
- Training Staff
- Safety Training
- Discuss some procedures

No Financial Disclosures

Grant Funding from the NIH

Planning

Grants from National Institute of Health
 Buy in from Hospital Administration/Finance

Advanced Multi-Modality Image Guided Operating Suite (AMIGO)

OR with Interventional Angiography System

ionizing radiation

OR with 3T MRI Scanner

ever present magnetic field

• OR with PET/CT scanner.

- Radioactive sources (PET)
- ionizing radiation (CT)

Why use image guidance???

- Visualize area of interest (aoi)
- Visualize marker, probes needles in aoi
- Soft tissue discrimination
- See adjacent critical structures
- Visualize tumor margins
- Cross sectional imaging
- Monitor thermal effect

Planning / Construction

- State Department of Health
- JCAHO Guidelines
- Architects Construction Meetings
- Project Manager
- Guidelines for Design and Construction of Hospital and Health Care Facilities
- AORN Guidelines
- MR Safety Guidelines

Planning Meetings

- Administration
- Radiology
- Nursing
- Anesthesiology
- Information systems
- Biomedical Engineering

Staff Training

- Nurses
- Radiology technologists
- . Anesthesiologists
- . Radiologists
- . Surgeons
- . Ancillary staff

Radiology Divisions

- . Angiography
- MRI
- **.** Nuclear Medicine PET/CT
- . Ultrasound

Layout

- OR with MRI
- OR with Angio/X-ray and Ultrasound
 OR with PET/CT









MRI Moves into Main OR on Ceiling Rails



Staff training

- Operating Room Environment
 - Sterile environment with air exchange
 - Bovie, Bipolar, Cusa, Scopes,
- Radiology Environment
 - MR scanner
 - CT scanner
 - X-ray C-ARM

Nursing Orientation

- Spend time working in various radiology environments or spend time in the operating room
- Limit the number of staff being oriented to hybrid OR until the core team member become the experts
- Specific training should include live lectures and videos pertaining to the various aspects of radiology and safety
- Training should be repeated each year (on-line)

OR nurse vs IR nurse

OR nurse

- Circulator/scrub
- Open surgeries & minimally invasive procedures
- Anesthesia always present

IR nurse

- Angio/CT/MRI/Nuc Med
- Minimally invasive procedures
- Moderate sedation/ACLS trained
- Anesthesia sometimes present



MRI & Radiology Safety Education

- Hospital Radiation Safety Officer should oversee education and compliance of safety in the Hybrid Operating Rooms.
- OR and Radiology staff must work together to establish policies and provide education.

 Radiology staff are the experts in safety with the specific image modality in which they are trained. (MRI, CT, Angio, X-ray, Nuclear Medicine)

Radiation Safety

- Educate Staff on Radiation Safety
- ALARA As Low As Reasonably Achievable
- Reduce Exposure-Time, Distance, Shielding
- Wear Dosimetry badges
- Wear lead aprons with thyroid shield

Lead Apron, Thyroid Shield, Dosimetry Badge



 2 piece apron distributes weight of apron better

- Thyroid shield worn with thyroid dosimetry badge attached
- 2nd dosimetry badge worn at waist level inside lead apron
- Aprons x-rayed each year to check for cracks or holes

Dosimetry: measurement of the absorbed dose delivered by ionizing radiation.



Dosimetry Badges

Radiation Dosimetry Report

Contrast Media

- Enhances visualization of area of interest.
- Patient with contrast allergies should be premedicated.
- Contrast Reaction Kits should be available in each Hybrid OR.
- X-Ray Contrast is different than MRI contrast

Contrast Reaction Kit

		CON	TRAST REAC	TION BOX	2 3014
_		BRIGHA	M AND WOME	N'S HOSPIT	0600940 (8/04
Date	_	DEPA	RTMENT OF	PHARMACY	Channella
Units Used	Units in Kit	GSN#		DRUG IT	EM
	1	4817-10	ATROPINE	ATROPINE IMG/10ML SYRINGE	
	1 .	5039-3	ALBUTEROL 2.5MG/3ML NEBULIZER		
	1	114	AMINOPHYLLINE 250MG/10ML VIAL		MG/10ML VIAL
	1	353833	AROMATIC AMMONIA INHALANT_		INHALANT_
	1.	11590	DIPHENHYDRAMINE 50MG/ 2ML VIAL		
	1	16879	EPINEPHRI	NE 0.3MG S	YR. (EPI-PEN)
	1	6696	HYDROCORTISONE 100MG VIAL		
	1.	475	NITROGLYCERIN 0.4MG TABLET		
	I.	21732	PEPCID 20M	IG IV PREN	IIX BAG -
	1	1221-10	SODIUM CH	SODIUM CHLORIDE 0.9% 10ML VIAL	
	1	1167	STERILE WATER 10ML VIAL		VIAL.
	2	11594	DIPHENHYI	DRAMINE	25MG TABS
				bo	Milo

Contrast reaction kit

Emergency Situations

- Perform A MOCK CODE
- . Contrast Reaction Kits
- . Code Buttons on the wall in each OR
- . Designated area for a code in MRI room

- Radiation
- MRI
- PET

Radiation Safety

- Yearly lecture on Radiation Safety
- . Dosimetry badges
- . Wrap around lead aprons
- . ALARA

MRI

- Screening Questionnaire for all staff
- Yearly MR safety training video with quiz
- Terminology. gauss, Tesla, quench
 THE MAGNET is always on.
- <u>. Color-coding instruments</u>
- . Labeling equipment

MR Safety

- ACR Policy
- Staff screening/training
- Patient screening
- MR Zones
- Testing Instruments/Equipment
- Annual safety drills including emergency in the event a patient has a cardiac arrest while undergoing a scan

ALL MUST BE MR SAFE

- . Instruments.
- . Tables, chairs, foot stools
- . IV poles,
- . Anesthesia Machines
- Patient Monitors

On-line Training

RealtStream Course Delivery	• • • • • • • • • • • • • • • • • • •
M F H H Stide 2 / 54 Stopped.	Silde 14 Silde 15 Zone 2 Zone 3 00:01 Zone 4 Safety concerns in an Projectile / Missile Eff Okygen tank UNF = of a manachtal 0 Minutes 19 Seconds Remaining

• What is MRI?

- Basic MRI concept
- Reported MRI Accident
- Magnetic field
- Shielding

Zones

- Safety concerns
- Projectiles/ Missile Effect

PET/ CT

• PET

- Radioactive tracers
- Half life varies depends on tracer
- Dosimetry badges
- Trash disposal
- . CT
 - CT plus fluoroscopy
 - Lead aprons
 - Dosimetry badges

Procedures

- . Brain and Pituitary Tumor resections
- Laser Therapy for brain tumor
- . Breast Lumpectomies
- . Lung surgery IVATS
- Cryotherapy & Microwave Ablation
- Biopsies- prostate and soft tissue

Brain Tumor Resection

Diagnostic Ax FLAIR

Low Grade tumor Diagnostic Ax T1 post gad

Intra-op shows residual tumor

Ax FLAIR –intra op

Ax T2 Blade – intra op

Post Surgical resection

Axial FLAIR –post surg

Ax T2 Blade – post surg

Follow up

Ax T1 Post gad

Ax T2 BLADE

Pituitary Surgery

Coronal Image

Sagittal Image

68 year-old woman with chronic headache, visual field deficit. Suspected pituitary macroadenoma

Diagnostic MRI Post Gad

Intra Op images showing residual tumor

Images post gad done next day on L1

Cryoablation

- Minimally invasive
- . Freeze using argon and helium gases
- . See ice ball on CT. better on MRI
- . Warm compresses to skin

The Freezing Process

- Argon Gas
- Passes through cryo-probes
- Tip is cooled & forms iceball
- Iceball engulfs tumor
- Iceball destroys tissue

Multiple probes

PET/CT

PET/CT-guided cryoablation

MRI-Monitored freezing

The iceball is visible during the MR scanning!

Microwave Ablation

- PET/CT or MR guided
- . Heat
- . MW generator
- . Probe with tongs

Lung Surgery iVATS

- Visualize tumor on X-ray/fluoro
- . Takes only tumor leaves normal tissue
 - Instead of lobectomy

Lung Wedge Resection Surgery

Bueno, Gill, Jagadeesan

MR Guided Prostate biopsies

- . Elevated PSA with failed TRUS (Ultra Sound)
- No rectum so cannot have US guided bx

Breast Lumpectomies

- 20-40% of patients need redo surgery
- Surgically Remove tumor
- Do MRI to confirm tumor is gone
- . Pt gets MR contrast
- . Remove any residual tumor

Pre-procedure Supine DCE-MRI

20-40 % reoperation

First post-contrast DCE-MRI

3D volume-rendered view showing the tumor

Golshan, Gombos, Jagadeesan

BCS procedural steps

Pre-procedural imaging

Surgery

Post-procedural imaging

Re-excision

Golshan, Gombos, Jagadeesan

Post-procedure Supine DCE-MRI

First post-contrast DCE-MRI showing the surgical cavity

3D volume-rendered view showing the surgical cavity

Golshan, Gombos, Jagadeesan

746 Procedures in AMIGO

Neurosurgery	142	Pelvic Biopsy, Ablation, Brachytherapy 294			
 •91 MR and Ultrasound Guided Brain Tumor Resections •22 MR Guided Transsphenoidal Resections for Pituitary •15 MR Guided Deep Brain Stimulation Electrodes Placen •9 MR Guided Laser Brain Tumor Ablations •4 MR Guided Skull Base Surgery •1 MR Guided Epilepsy Electrode Placement 	Fumors nents	 192 MR Guided Prostate Biopsies 84 MR and Ultrasound Guided Gynecologic Cancer Brachytherapy 8 MR and Ultrasound Guided Prostate Brachytherapy 7 MR Guided Cryoablations of Prostate Tumors 1 MR Guided Biopsy of Penile Tumor 1 PET/CT Guided Penile Biopsy 1 PET/CT Guided Cryoablation of Pelvic Tumor 			
Thoracic Surgery, Biopsy, Ablation	65	Abdominal Tumor Ablation & Bx 229			
 •26 Video Assisted Thoracoscopic surgeries (iVats) •13 Breast Lumpectomies •8 PET/CT Guided Lung Biopsies •7 Cardiac EP Ablations •7 PET/CT Guided Microwave Ablations of Lung Tumors •3 PET/CT Guided Cryoablations of Lung or Rib Tumors •1 MR Guided Cryoablation of Metastatic Paraspinal Tum 	ors	 •146 MRI Guided Cryoablations of Liver or Kidney Tumors •31 MR Guided Biopsies of Liver or Kidney Tumors •29 PET/CT Guided Microwave Ablations of Liver or Kidney Tumors •23 PET/CT Guided Cryoablations of Liver or Kidney Tumors 			
Head & Neck Surgery	12				
 •5 Parathyroidectomies/Hemithyroidecotmies •3 PET/CT Guided Biopsy of Tongue/Mouth/Neck •2 MR Guided Biopsy of Tongue/Mouth/Neck •2 MR-guided Cryotherapy of Neck Tumors 					
Skeletal Biopsy & Ablation	4				
 •2 PET/CT Guided Biopsy of Spine Tumor •1 MR Guided Cryoablation of Spinal Tumor •1 MR Guided Biopsy of Femoral Tumor 					

With Greatest Admiration and Respect

Dr Ferenc Jolesz 1946-2014

THANK YOU akanan@partners.org