

SIEMENS

Interventional and Intraoperative MRI



Interventional and Intraoperative MR

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Collaborations Manager
Interventional MR

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Slide 1

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The Interventional and Intraoperative MR Program



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A Brief History...



Routine Open

+ MR-GP Package

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MR- Guided Procedures Package

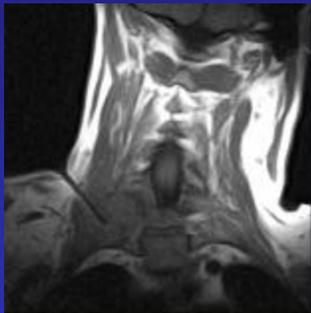
Fluoroscopic Sequences auto-display (1 sec / ima)



In-Room MRC



Breath-hold Sequences



Surgical Drape
Open Body Coil



Fiberoptic Lamp



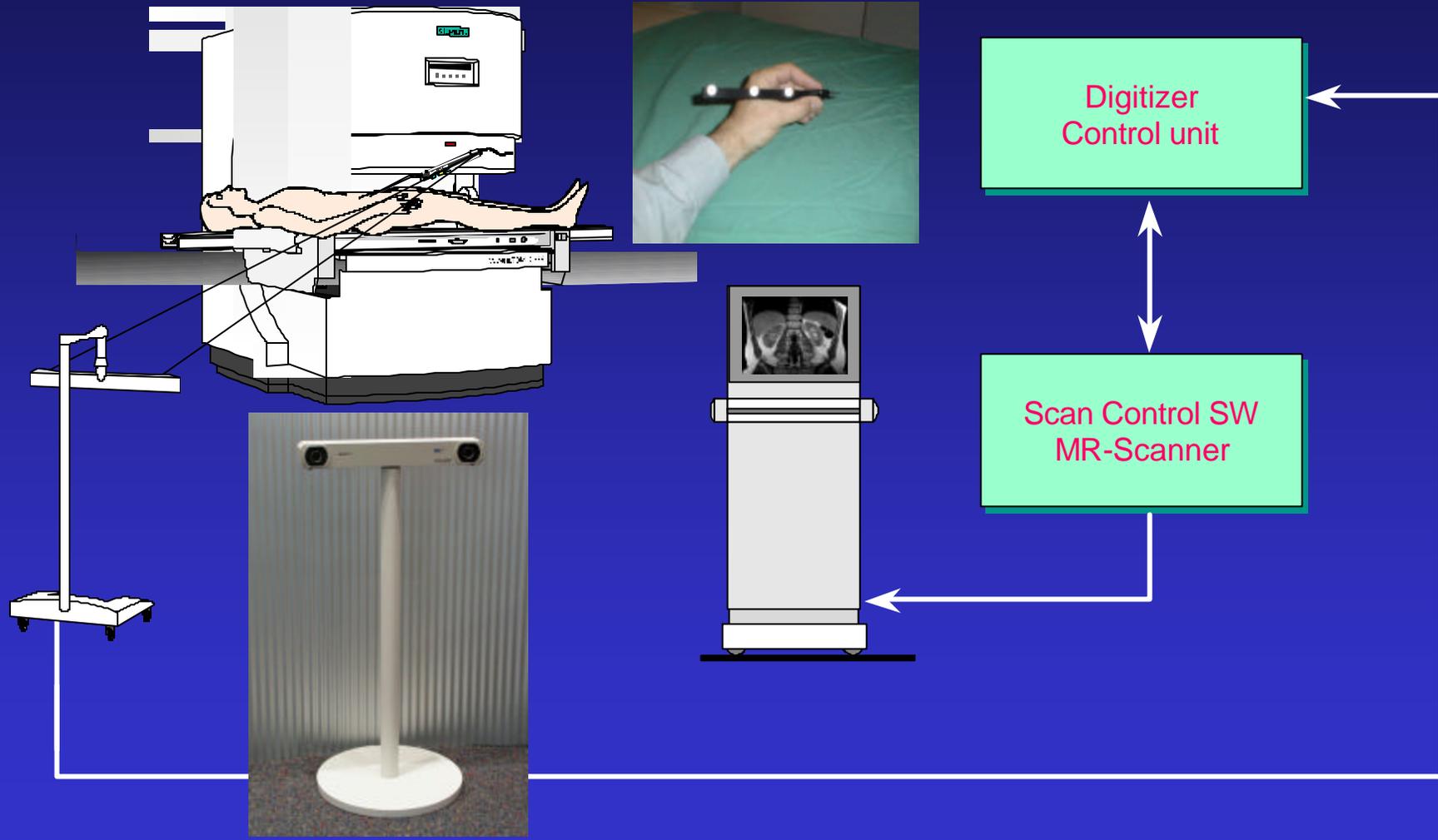
Knee Chair

Foot Switch

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Optical Surgical Navigation System



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Status of the Guided Procedures Package

35 packages installed, 12 more ordered

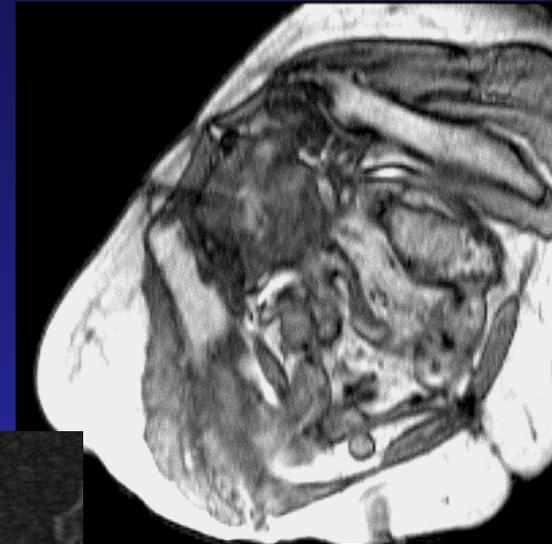
- MR-guided biopsies and drainage's
- MR-guided pain therapy (spine, tumor)
- MR-guided laser therapy (liver, brain, breast)
- MR-guided RF-therapy (liver, brain)
- MRI and focused US
- MRI and endoscopy
- MR measurement of tissue temperature
- Intraoperative MRI



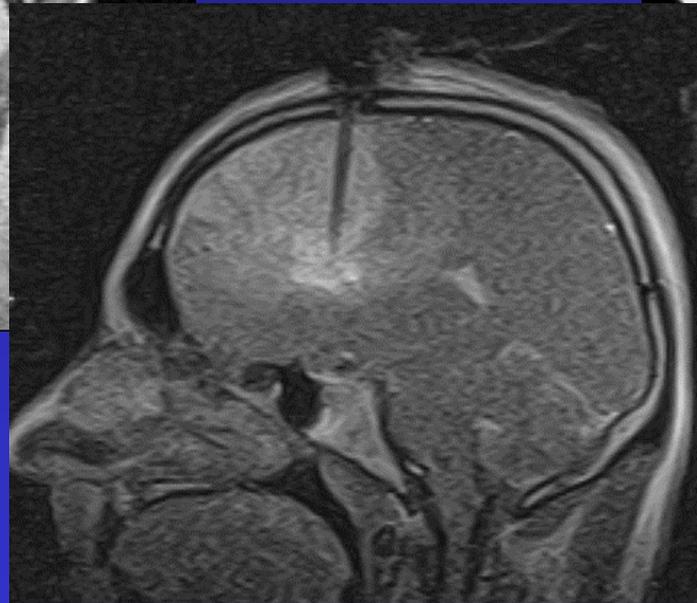
Drainage of Subphrenic Abscess



Freehand biopsy

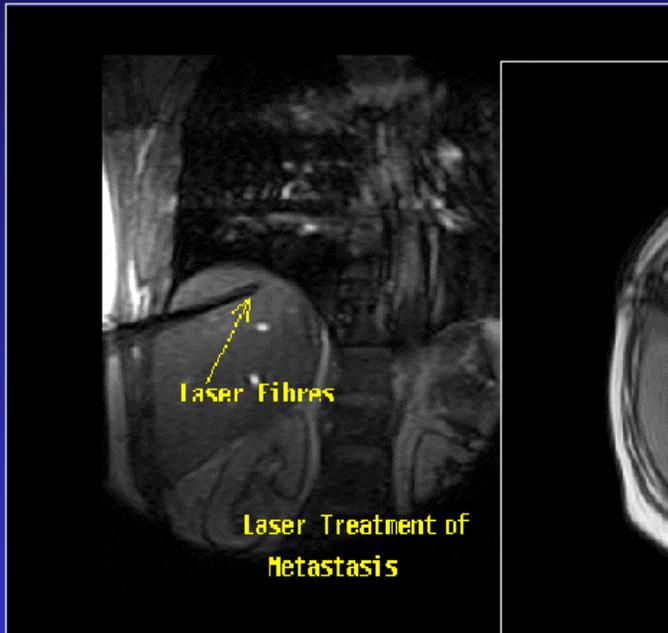


Injection of Ethanol

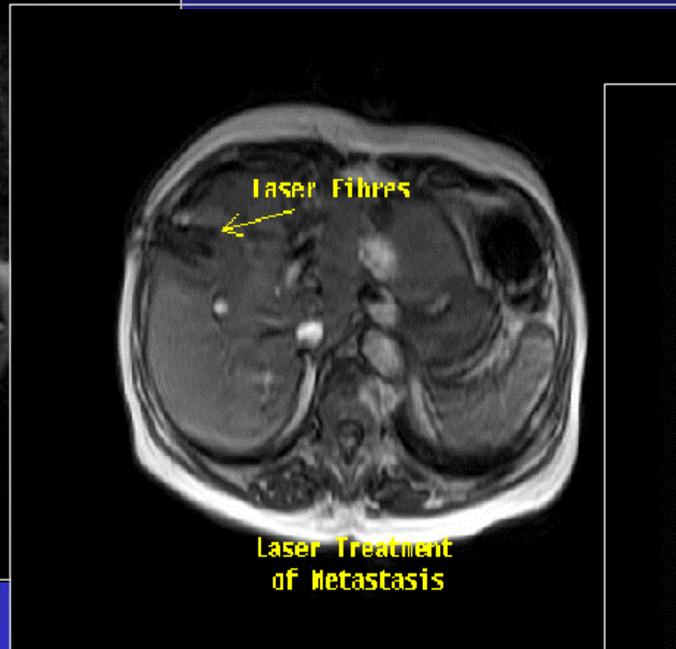


Laser therapy of liver metastasis

*Middlesex Hospital, London
Magnetom Open, 0.2 T*



Fibre positioning

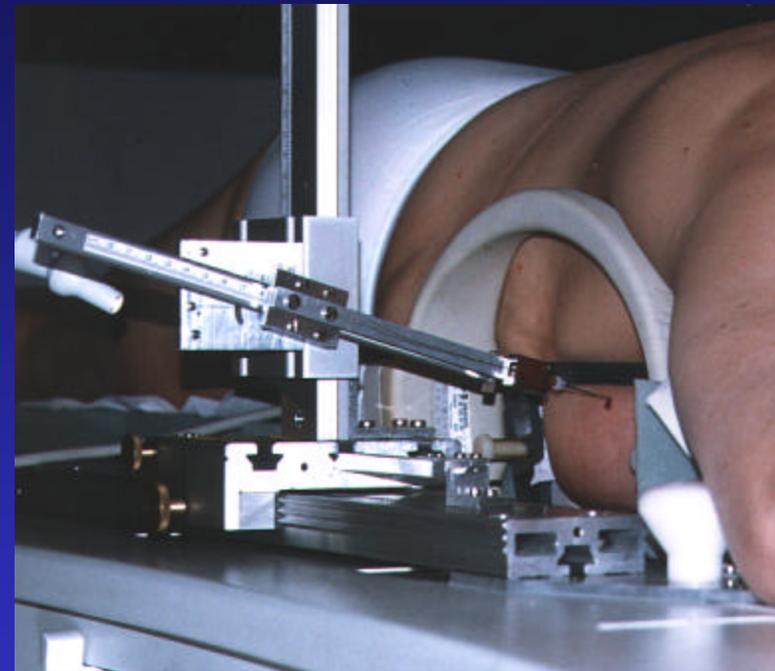


Laser ablation



Lesion post Laser ablation

Breast Biopsy

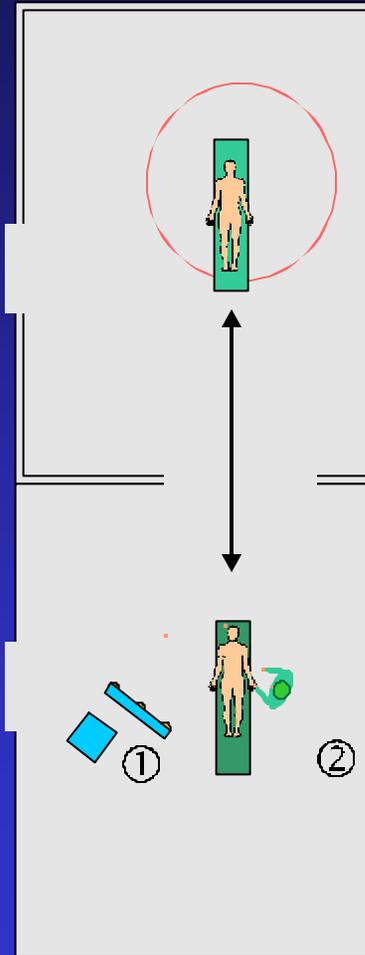
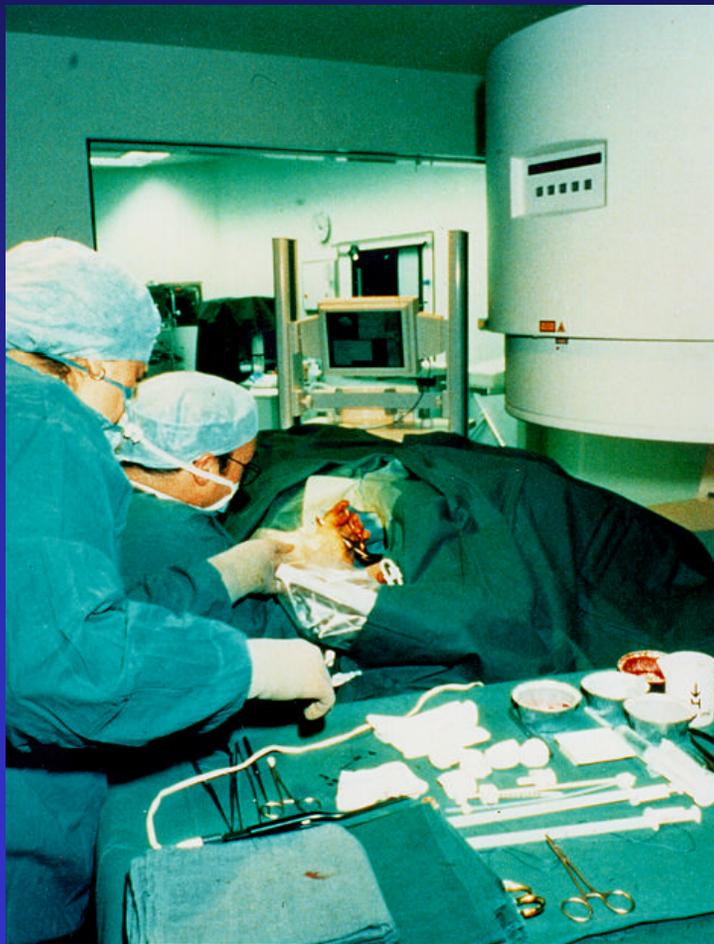


*Courtesy of
Dr. Sittek, Radiologie Großhadern*

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First Siemens Intra-operative Installations



Heidelberg 1995
Erlangen 1Q/ 1996

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Prerequisites for Intraoperative MRI



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Two Different Approaches... to IMR



OR in the MR

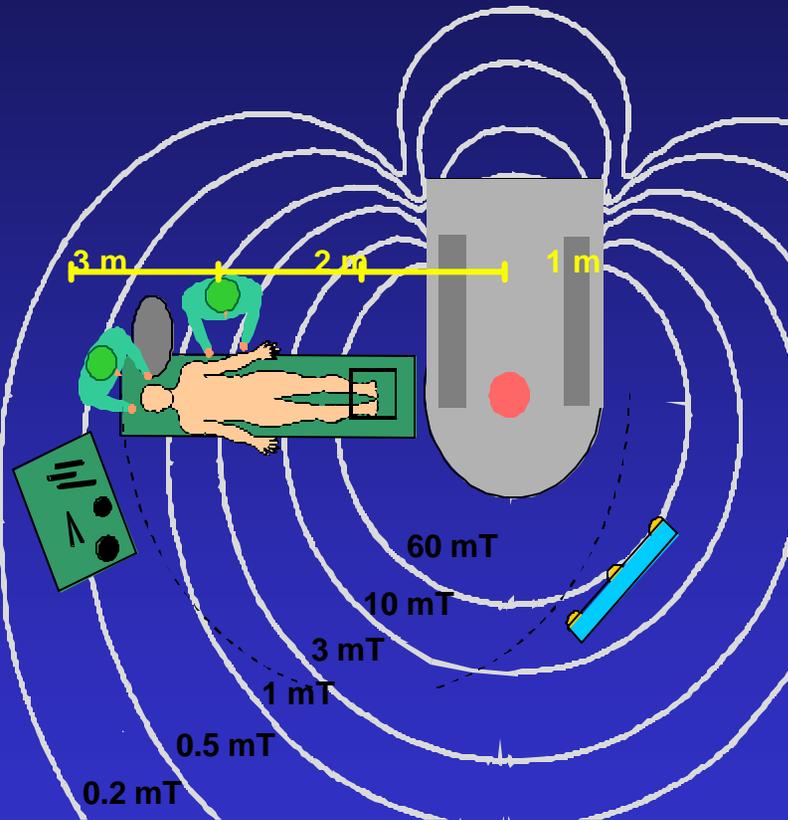
Can Image all the time
But have to adapt surgery to
a very confined space



MR in the OR

Can Image only some of the time
But can perform surgery
“normally”

Adapting MR to the OR



- Surgery performed “normally”
- Fully operational surgical table
- Good access to all of patient
- “Normal” surgical equipment
- No problems with lines and drapes

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**It gets very
busy in an
OR !**



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Intraoperative MRI suite

Case Western Reserve University
University Hospitals of Cleveland



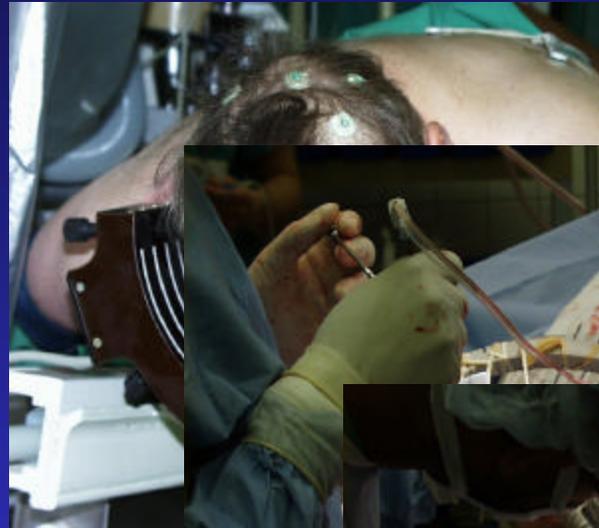
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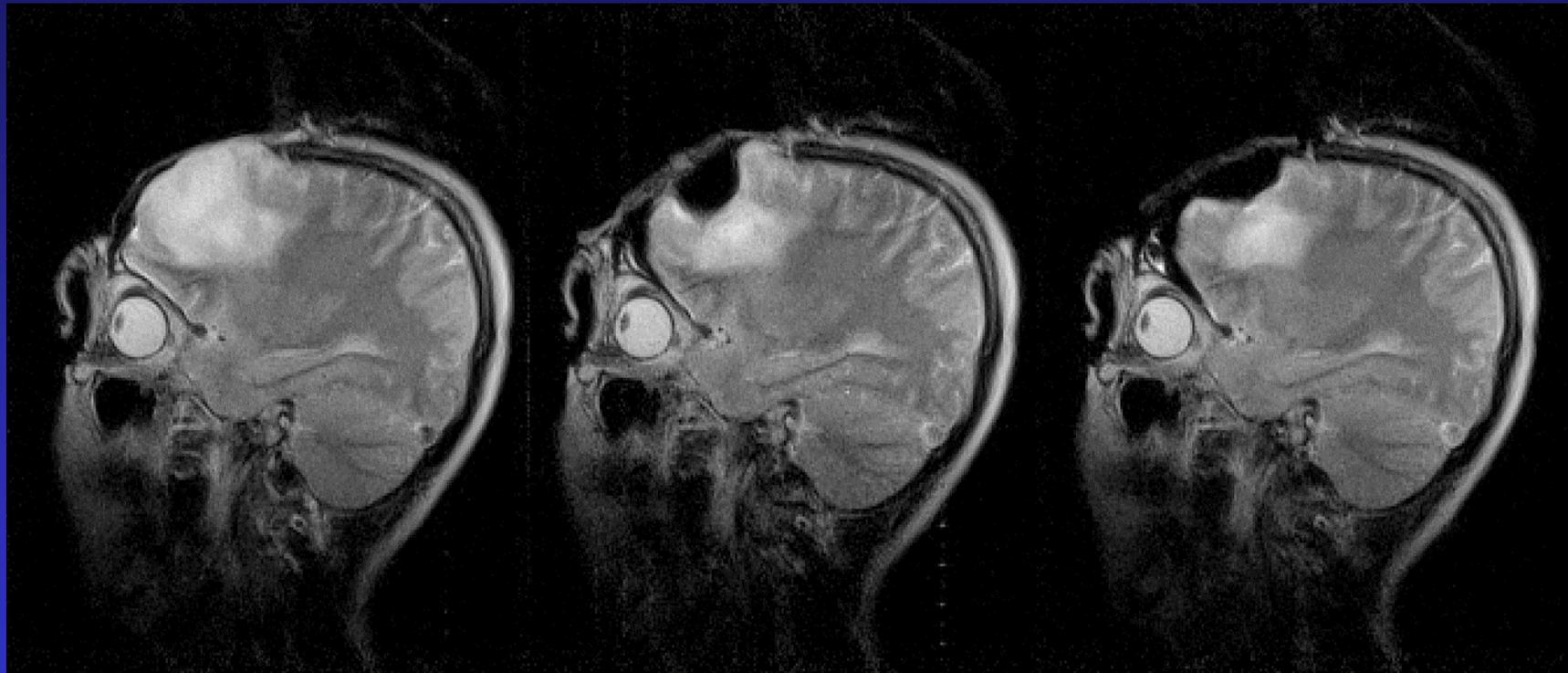
Head Holder, Retractor, Coil Assembly



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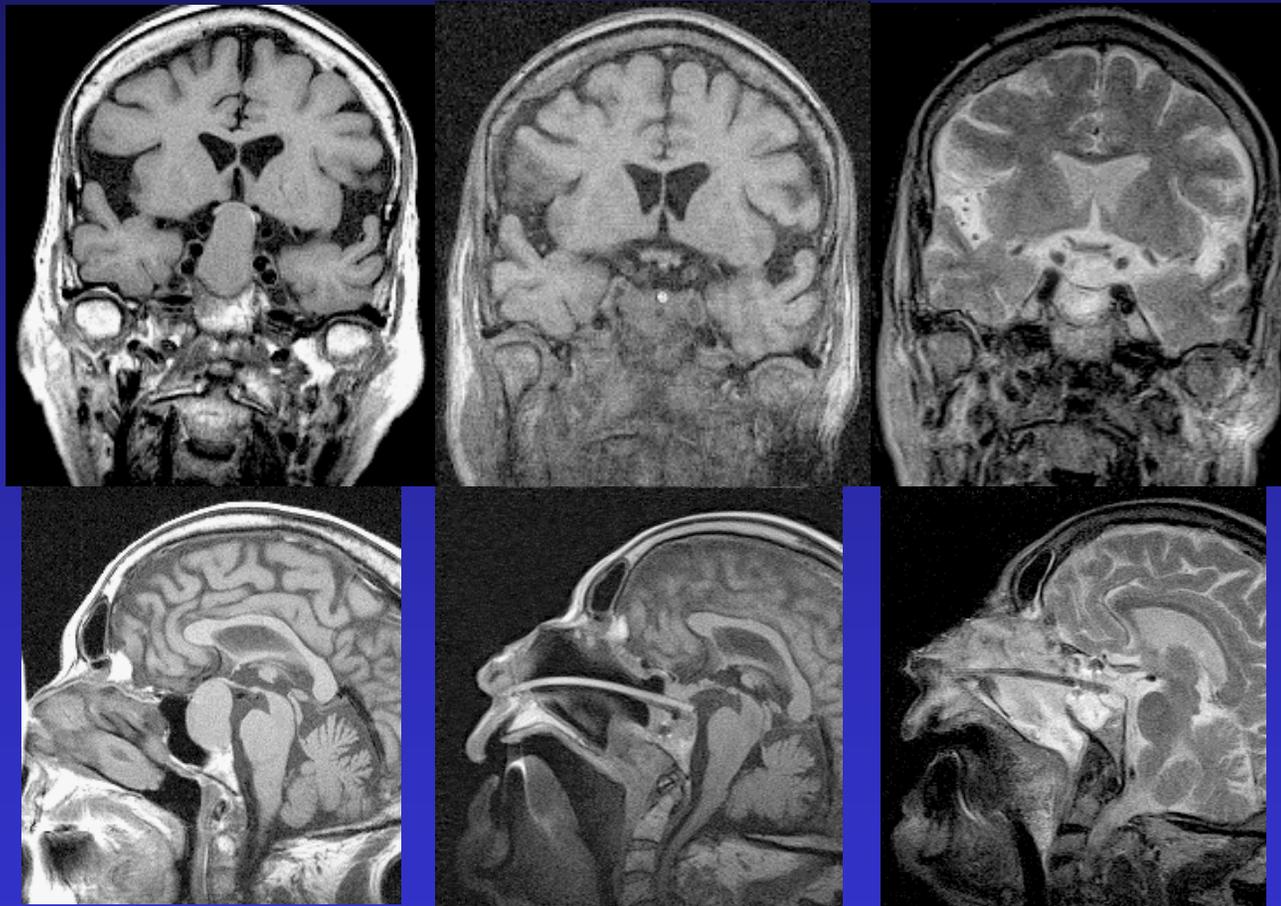
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Localization of an Anaplastic Astrocytoma



*University Hospitals
Cleveland*

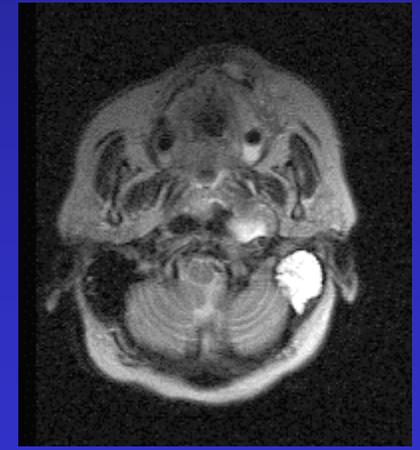
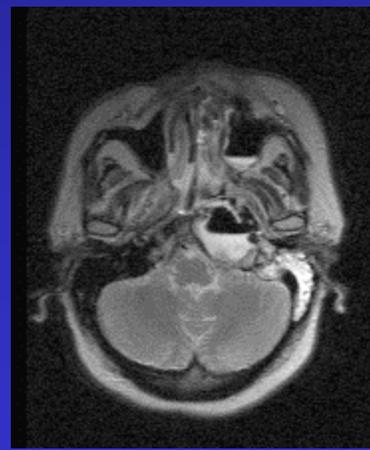
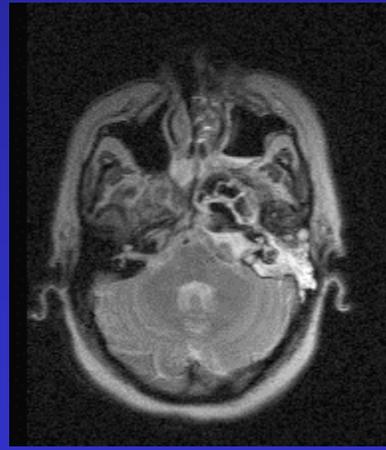
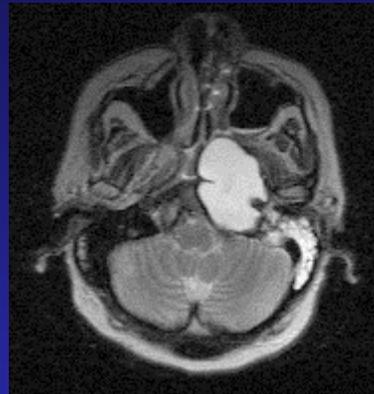
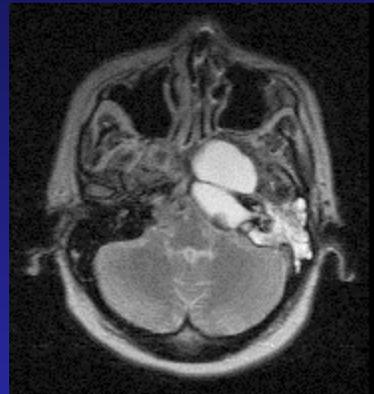
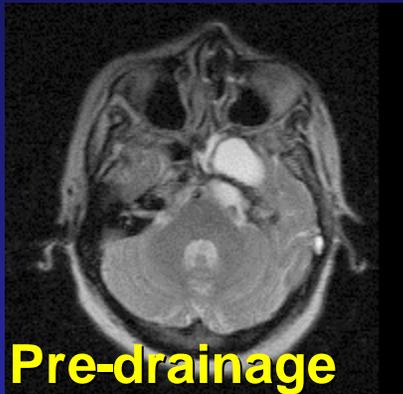
Trans-Sphenoidal Neurosurgery



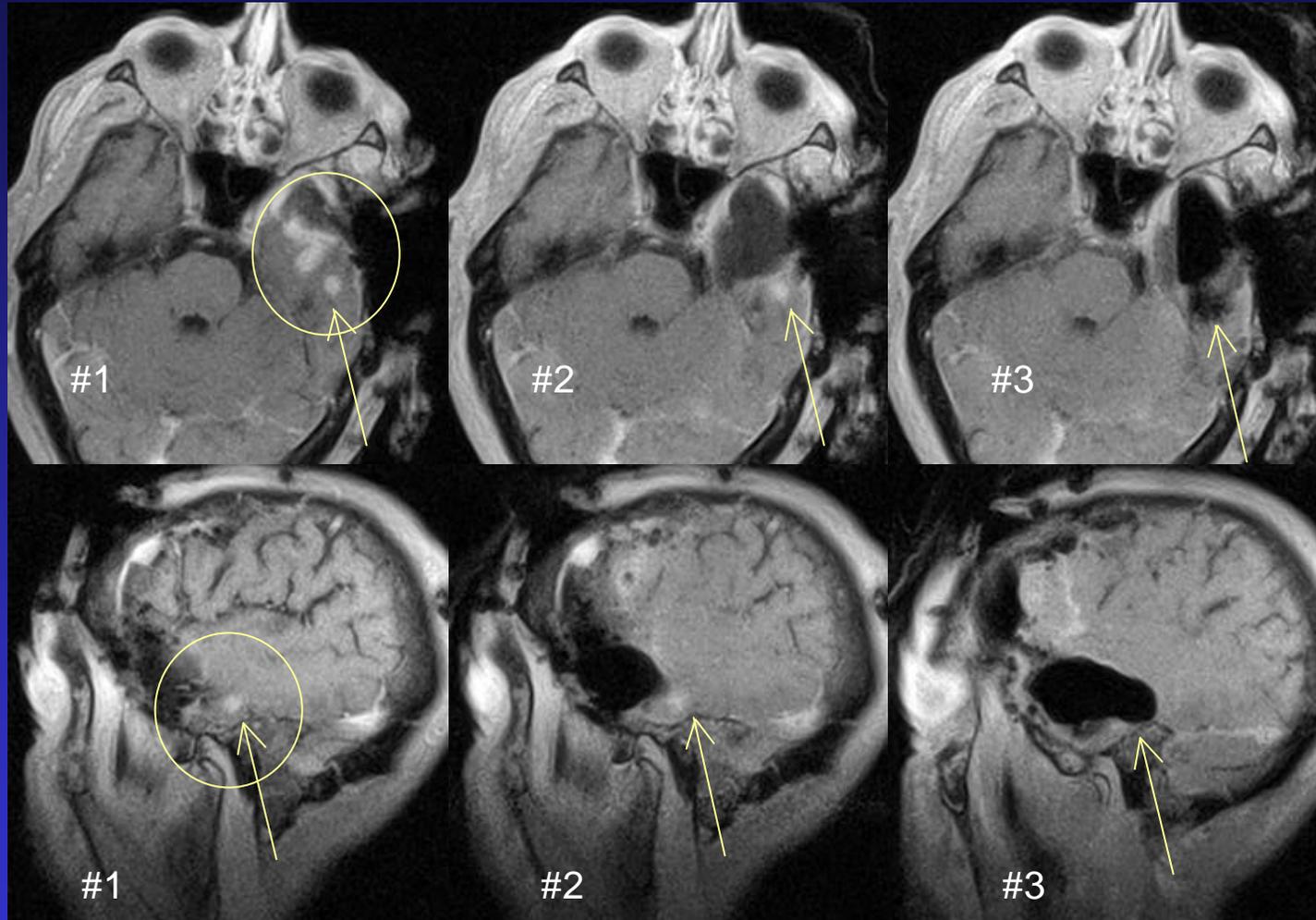
courtesy J. Lewin, M.D UHC

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Drainage of Skull-Base Cyst

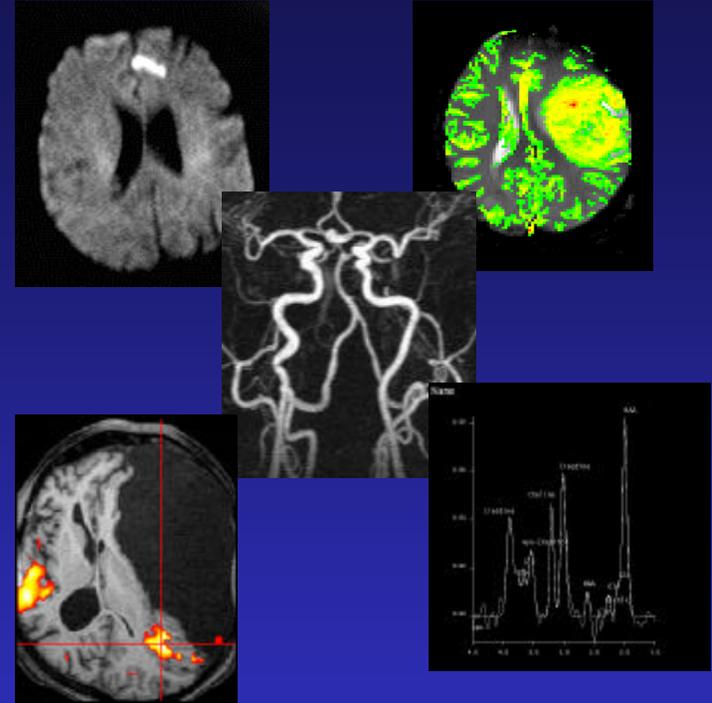


courtesy J. Lewin, M.D UHC



Astrocytoma, 2 1/2 min. T1 courtesy J. Lewin, M.D UHC

Intervention at High Field



- Higher Performance
- Less access to patient
- Drapes & lines a problem

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MAGNETOM Allegra 3T HeadScanner



Ultra-High
performance 3T
Head Scanner

One of the three
Allegra systems
at MGH will be in
Neuro ICU

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Biopsy on a Conventional 1.5 T System



University Hospital, Bern

From Fluro Data Set
3 images/sec



Lung biopsy

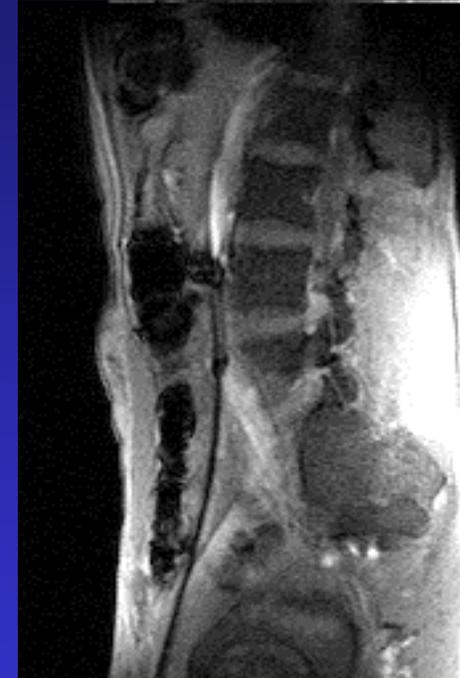
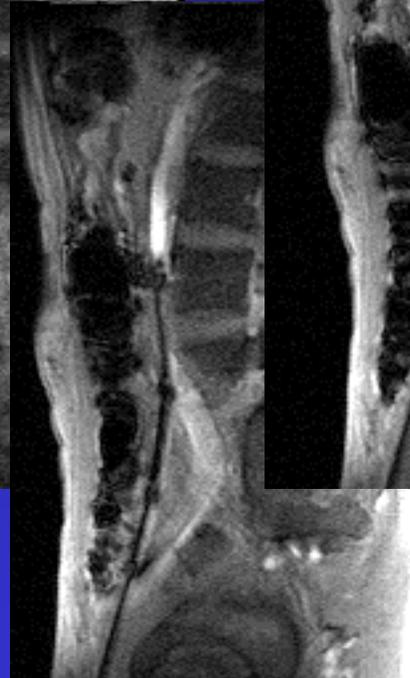
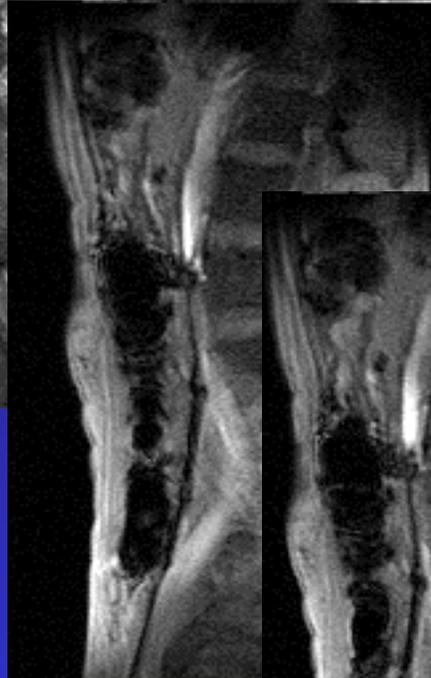
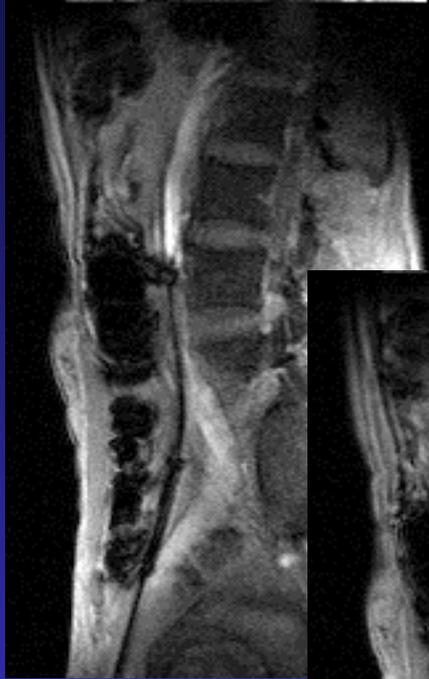


Liver biopsy

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Stent Positioning under MR guidance



'Memotherm-Stent'
Symphony

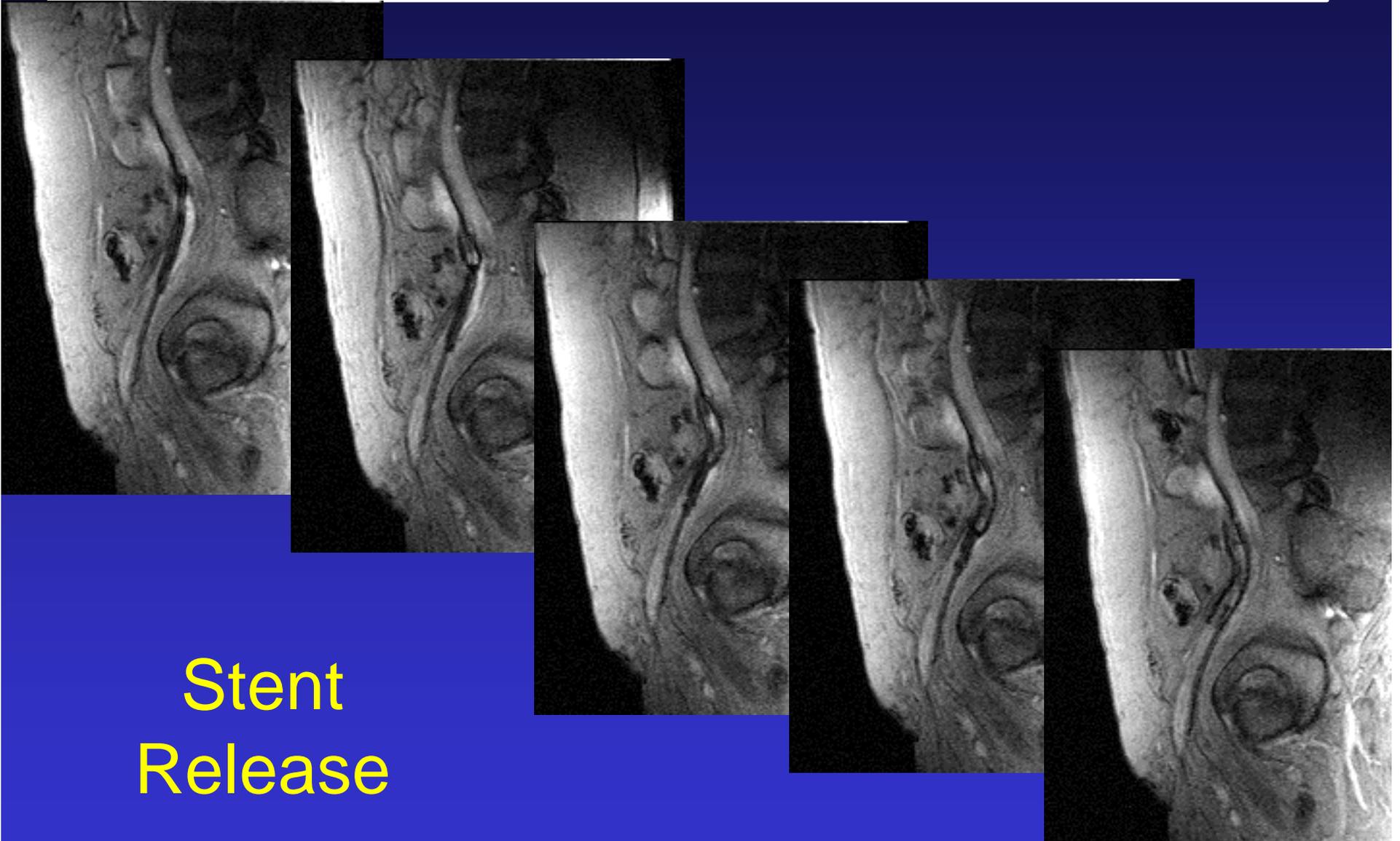
Courtesy University of Regensburg

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**Stent
Release**

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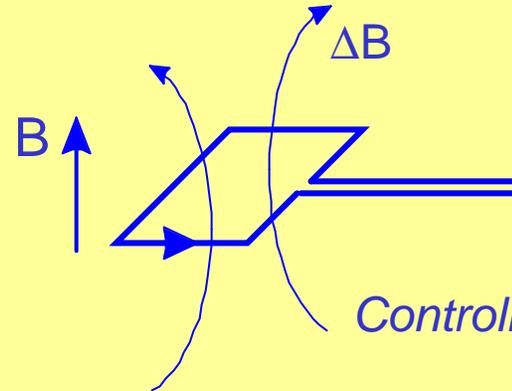
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Methods for Tip Tracking and Intravascular Imaging

Field inhomogeneity based visualization

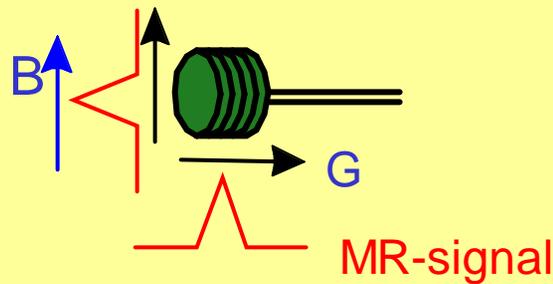


Susceptibility artefact

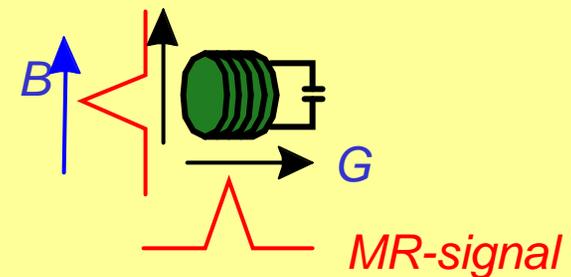


Controlled inhomogeneity

MR tracking



Active coil



Passive coil

Coils on a 6.5F catheter



Capacitors

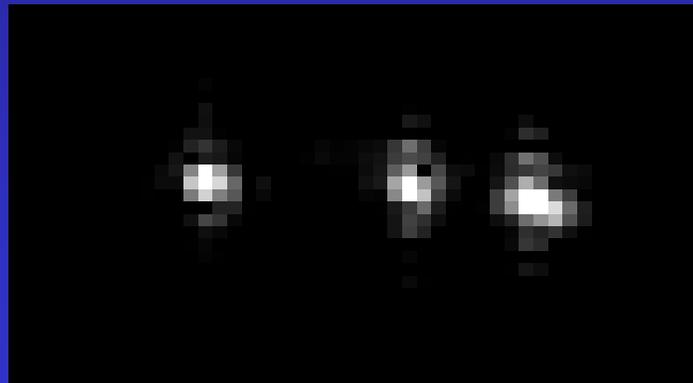
L1

L2

L3

D1

D2



Heating ...
can be a problem

Solution .. optical

MR localization of an Endoscope



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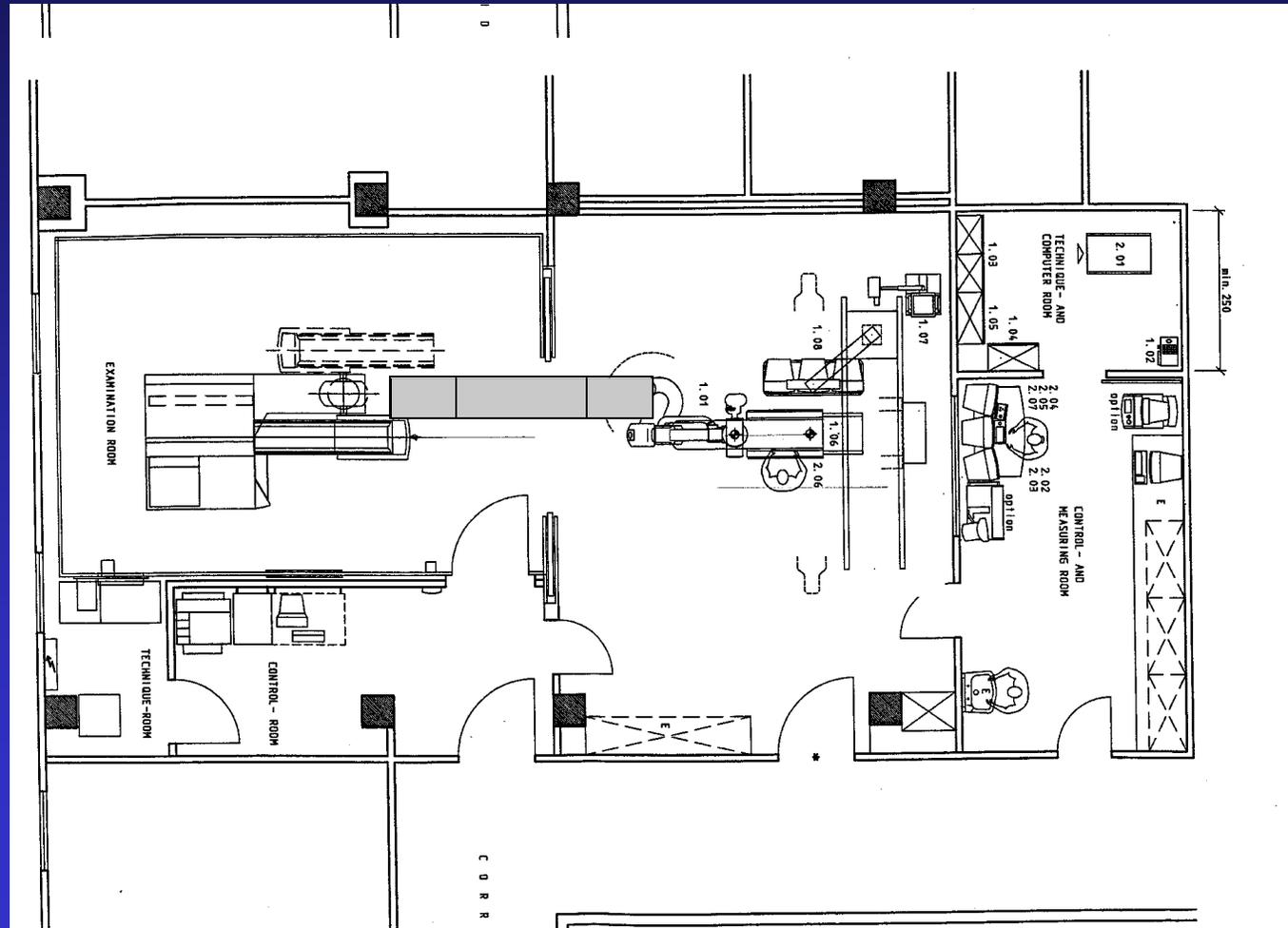
MR and C-Arm Combination



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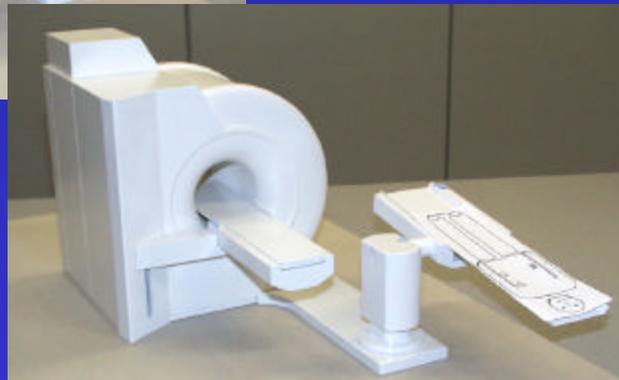
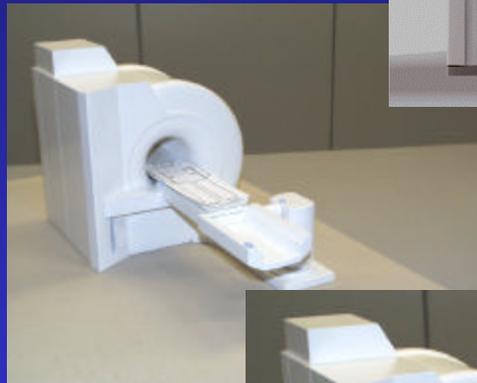
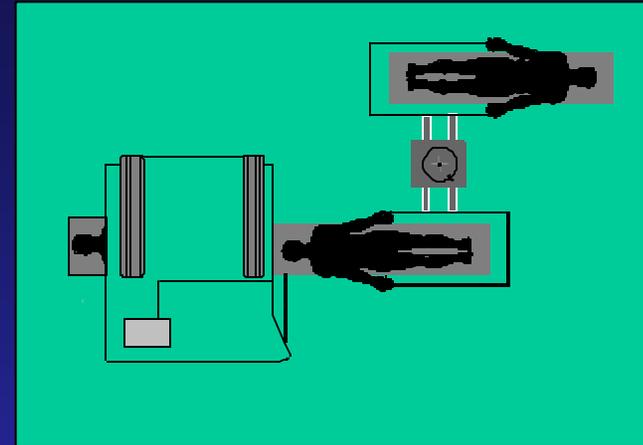
MR - X-ray C arm installation - Frankfurt and Houston



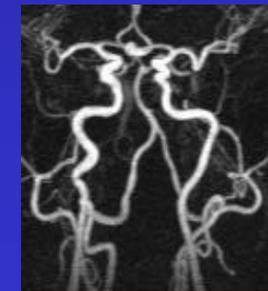
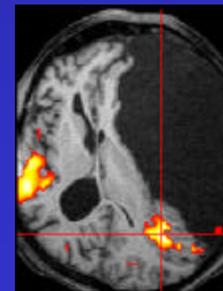
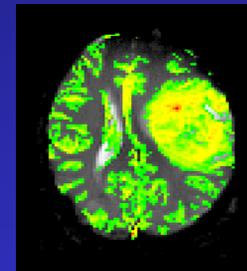
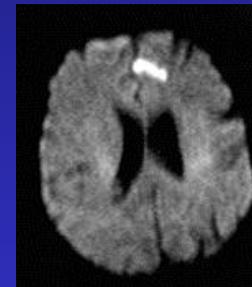
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1.5T surgical MR suite



Mitable



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UCLA - Neurosurgery
Methodists - Neurovascular
Case Western - Cardiovascular

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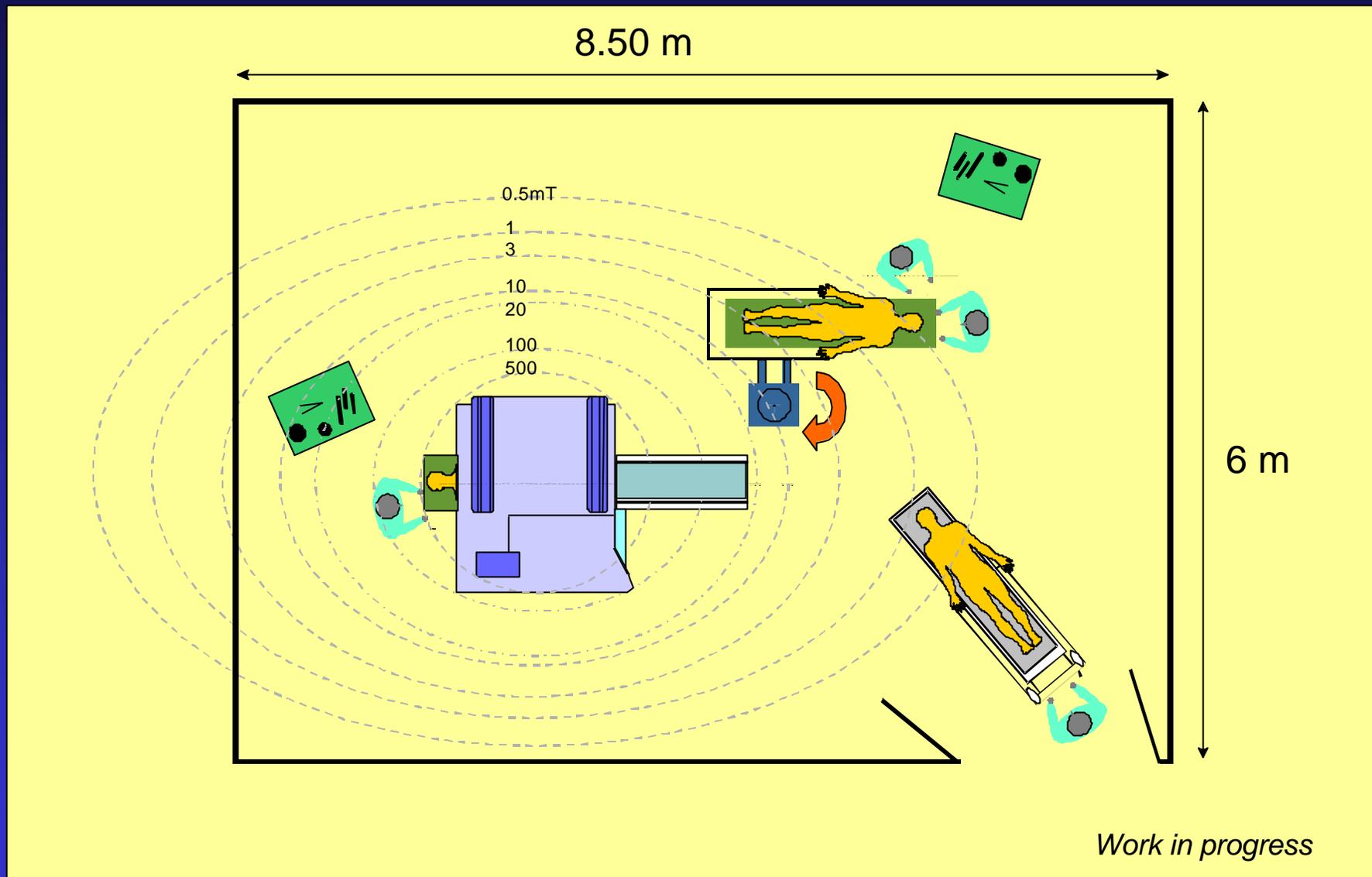
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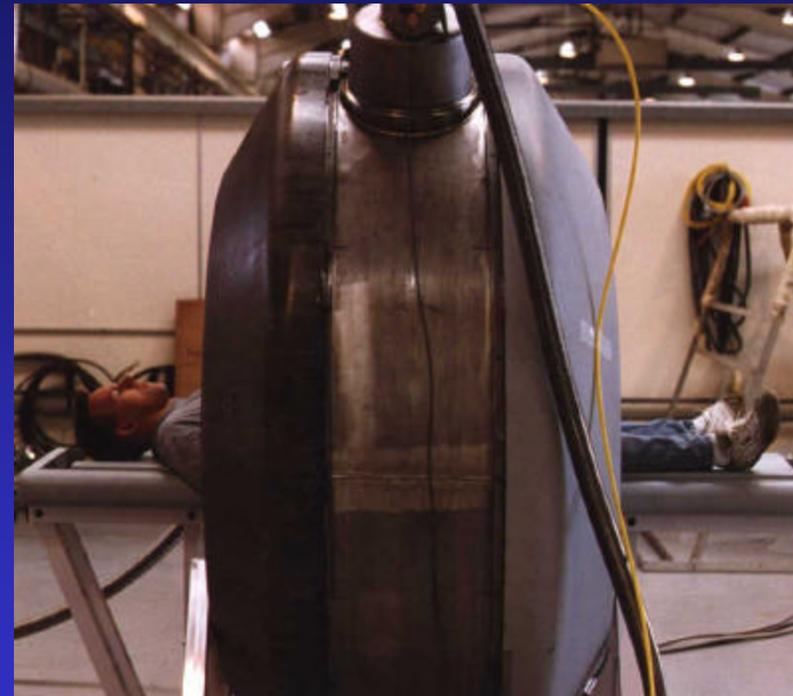
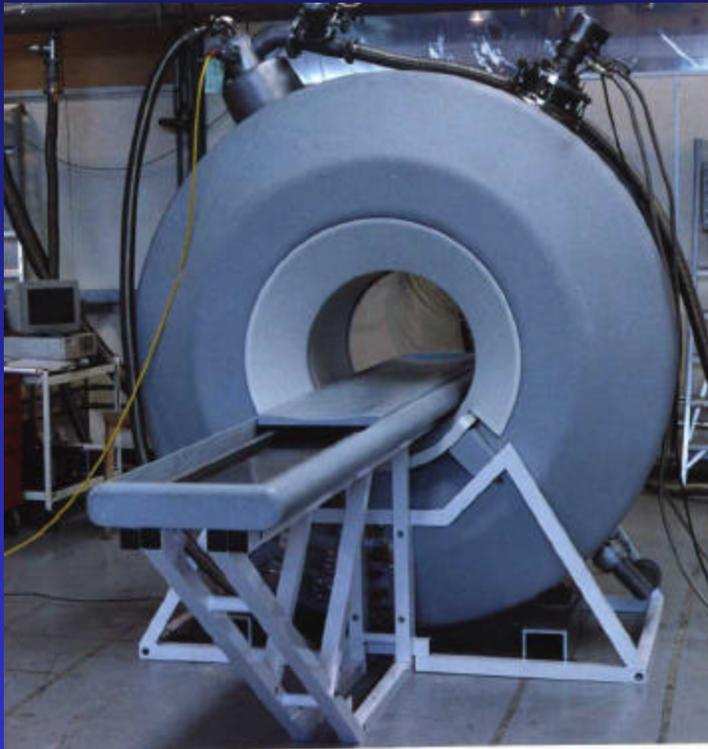
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Ultra-short Interventional Magnet ?



1 - 1.5 T - High performance and patient access

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High Field Open

1T Performance
and “open” patient
access



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The Interventional and Intraoperative MR Program



Availability & what works for NIH ?

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Major Siemens Interventional and Intraoperative partners and Study Group participants :

Case Western / U Hospitals of Cleveland

UCLA

U of Erlangen

U of Regensburg

U of Heidelberg

Massachusetts General Hospital

University of Virginia

The Methodist Hospital - Houston

Thank You