


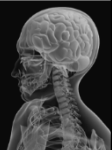
Neuroimaging

Spencer Johnson, O.D., F.A.A.O.
 Northeastern State University
 Oklahoma College of Optometry
 johns137@nsuok.edu



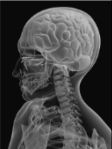
Disclosure Statement

- The presenter has no financial or nonfinancial interest in any of the products or services mentioned in the presentation



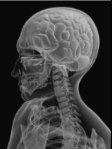
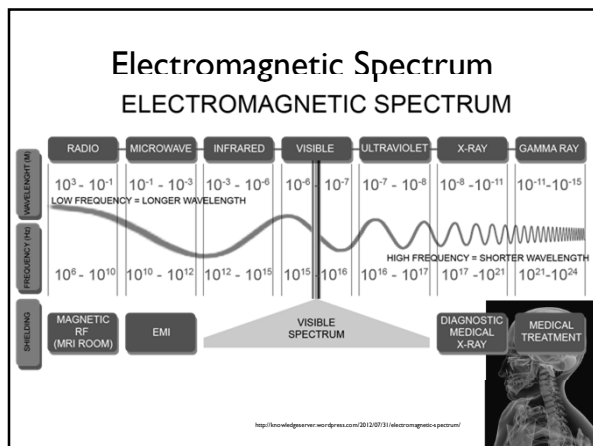
Neuroimaging

- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Angiography
- Ultrasonography




Neuroimaging

- Computed Tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Angiography
- Ultrasonography

X-rays

- Wilhelm Röntgen
- German physicist
- Credited as the discoverer of X-rays in 1895

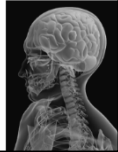


(March 27, 1845 to February 9, 1923)

X-rays



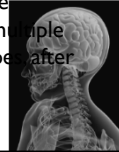
- *Hand mit Ringen* (Hand with Rings): print of Wilhelm Röntgen's first "medical" X-ray, of his wife's hand, taken on 22 December 1895



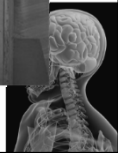
X-rays



- Won the first Nobel Prize in Physics in 1901.
- In honor of his accomplishments, IUPAC named element 111, Roentgenium, a very radioactive element with multiple unstable isotopes after him.



Pedoscope



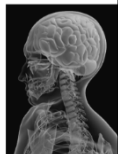
CT Scanner



http://www.zeiss.com/jep/m/multimedia/pressroom/2008/04/Tools_CTScanner

CT - Indications

- Orbital and sinus pathology/trauma (except optic nerve)
- Acute cerebral or subarachnoid hemorrhage
- Localization of metallic foreign body

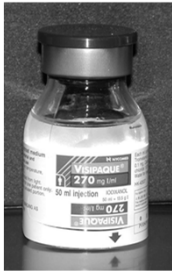


CT Ordering

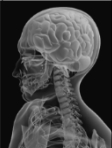
- Location
 - Orbit
 - Brain
 - Sinuses
- Iodinated Contrast
 - Without contrast
 - With and Without Contrast
- Presumptive Diagnosis



CT Ordering - Contrast



- Iodine Based
- Hard on the kidneys
- Visually translucent, radiographically opaque

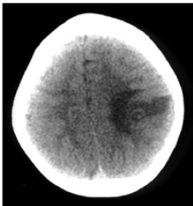


<http://www.usarmy.com/medications/volpage=270>

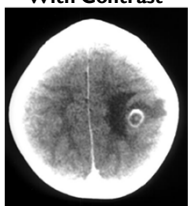
CT Ordering - Contrast

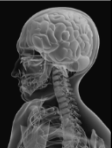
- Enhances Sensitivity and Specificity

Without Contrast



With Contrast

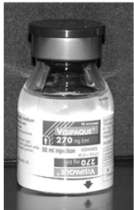
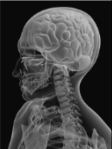




<http://www.bvaal.edu/med/med/pediatric/perjury44d1.html>

CT Ordering - Contrast

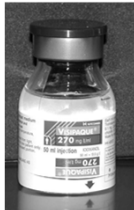
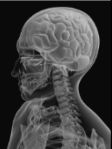
- Lab tests prior to scan if ordering contrast
 - Blood Urea Nitrogen (BUN)
 - Creatinine
 - Glomerular Filtration Rate (GFR)

<http://www.usarmy.com/medications/volpage=270>

CT Ordering - Contrast


- Contraindications
 - Allergy to iodine
 - Impaired renal function
 - Diabetes – must stop metformin 48 hours prior to scan


<http://www.usarmy.com/medications/volpage=270>

CT Ordering - Contrast


- Not indicated (may mask visualization) in:



Bony Injury



Acute Hemorrhage

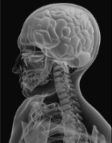


Localization of Foreign Bodies

BONE


BLOOD

BB

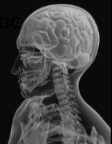


<http://slide4.blogspot.com/2013/03/absc-concomity-2012-04-04-dw.html>

Slice Size



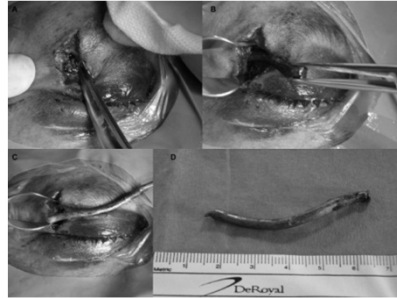
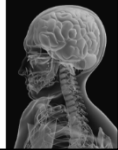
- Images can be provided in as thin as 0.5mm slices. Thin slice rendering is advantageous when trying to detect very small objects (i.e. metallic foreign body, bone fragments in the optic nerve, etc.)



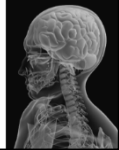
CT



Moretti et al. *Journal of Medical Case Reports* 2012, 6:91
<http://www.pediatriccasereports.com/content/6/1/91>



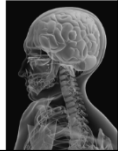
Moretti et al. *Journal of Medical Case Reports* 2012, 6:91
<http://www.pediatriccasereports.com/content/6/1/91>



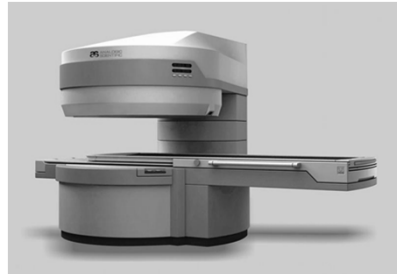
MRI



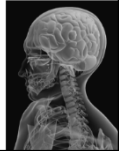
<http://www.bayhealth.org/bayhealth/ContentPage.aspx?cid=1149&news=823>



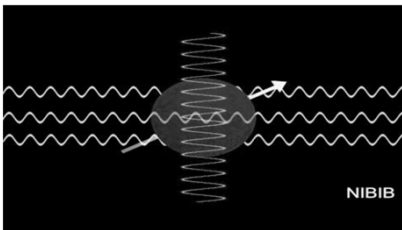
MRI



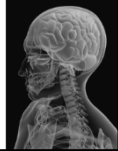
<http://www.made-in-italy.com/biomed/central/products/derby/QuintuTM/View/Class-Open-MR/Machine.html>



MRI: Excitation and Recovery of Spins

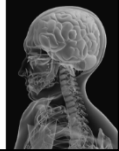


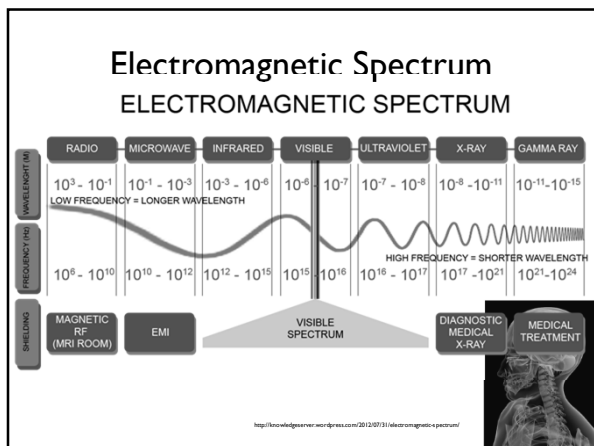
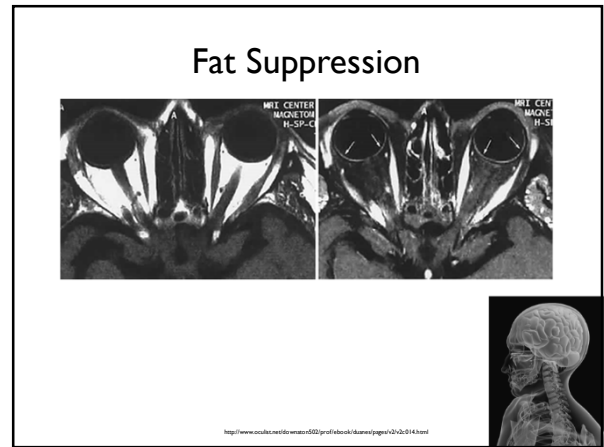
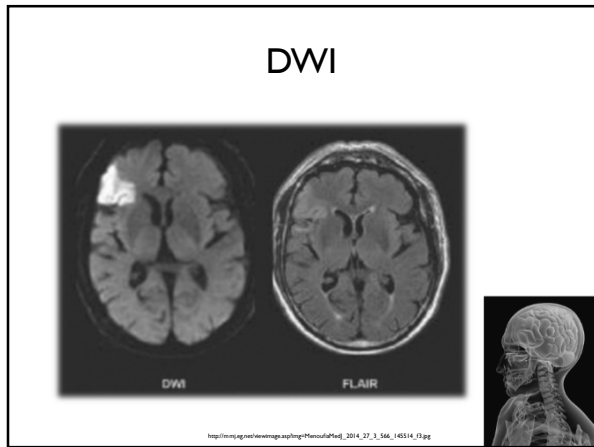
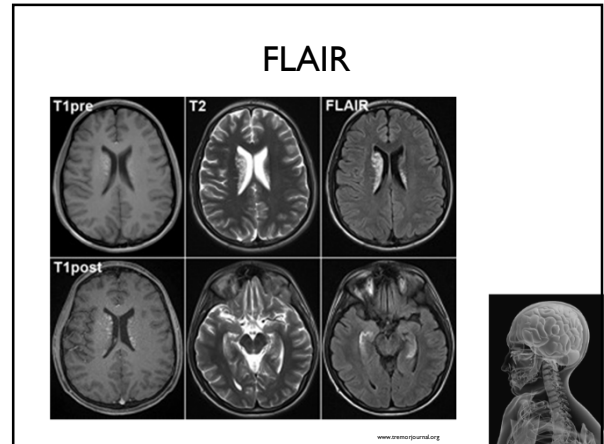
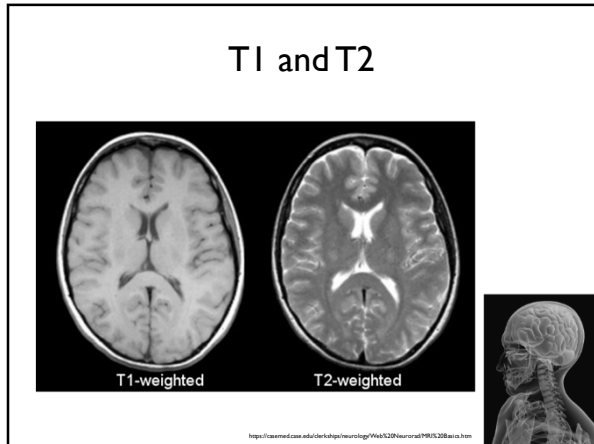
NIBIB



MRI Sequences

- T1
- T2
- Fluid attenuation inverse recovery (FLAIR)
- Diffusion-weighted imaging (DWI)
- Fat-suppression/saturation






- ### MRI Indications
- Technique of choice for visual pathway
 - Optic nerve and optic nerve sheath
 - Pituitary tumors
 - Cavernous sinus pathology
-


MRI Ordering

- Location
 - Orbit
 - Brain
 - Sinuses
- Gadolinium Contrast
 - Without contrast
 - With and Without Contrast
- Presumptive Diagnosis



MRI Ordering - Contrast


- Lab tests prior to scan if ordering contrast:
 - Glomerular Filtration Rate (GFR)
- Concern of nephrogenic systemic fibrosis



<http://www.usamed.com/medications/vpage=270>

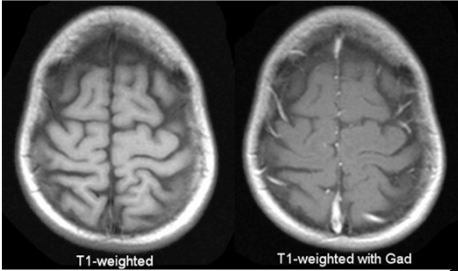
MRI Ordering - Contrast

- Gadolinium based - acquires magnetic moment when placed in an electromagnetic field
- Administered intravenously and remains intravascular unless there is a breakdown of the blood-brain barrier
- Only visualized on T1 weighted images. Enhancing lesions such as tumors and areas of inflammation will appear bright



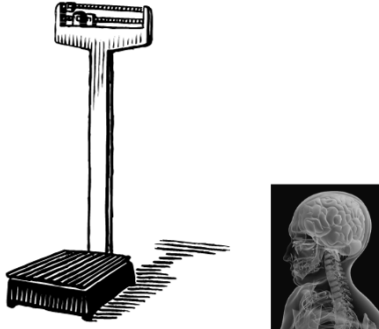
http://commons.wikimedia.org/wiki/File:Omniscan_vial.JPG

Contrast



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3280436/>

Table Limits



National Imaging Price Variances

Service	Region	High	Low	Variance	
				\$	%
MRI of Brain	Southwest	\$3,600	\$825	\$2,775	336%
MRI of Brain	Northeast	\$3,500	\$1,540	\$1,960	127%
MRI of Lumbar Spine	Southwest	\$2,500	\$560	\$1,940	346%
MRI of Brain	Southwest	\$2,200	\$425	\$1,775	418%
PET Scan of Base of Skull to Thigh	Southwest	\$3,000	\$1,240	\$1,760	142%
MRI of Lower Extremity	Southwest	\$2,400	\$800	\$1,600	200%
CT Scan of Pelvis with Contrast	Southwest	\$1,800	\$230	\$1,570	683%
MRI of Lower Extremity	Northeast	\$2,200	\$710	\$1,490	210%
CT Scan of Abdomen with Contrast	Southwest	\$1,800	\$320	\$1,480	463%
MRI of Lumbar Spine	Northeast	\$2,250	\$790	\$1,460	185%

www.theglyphstore.com

