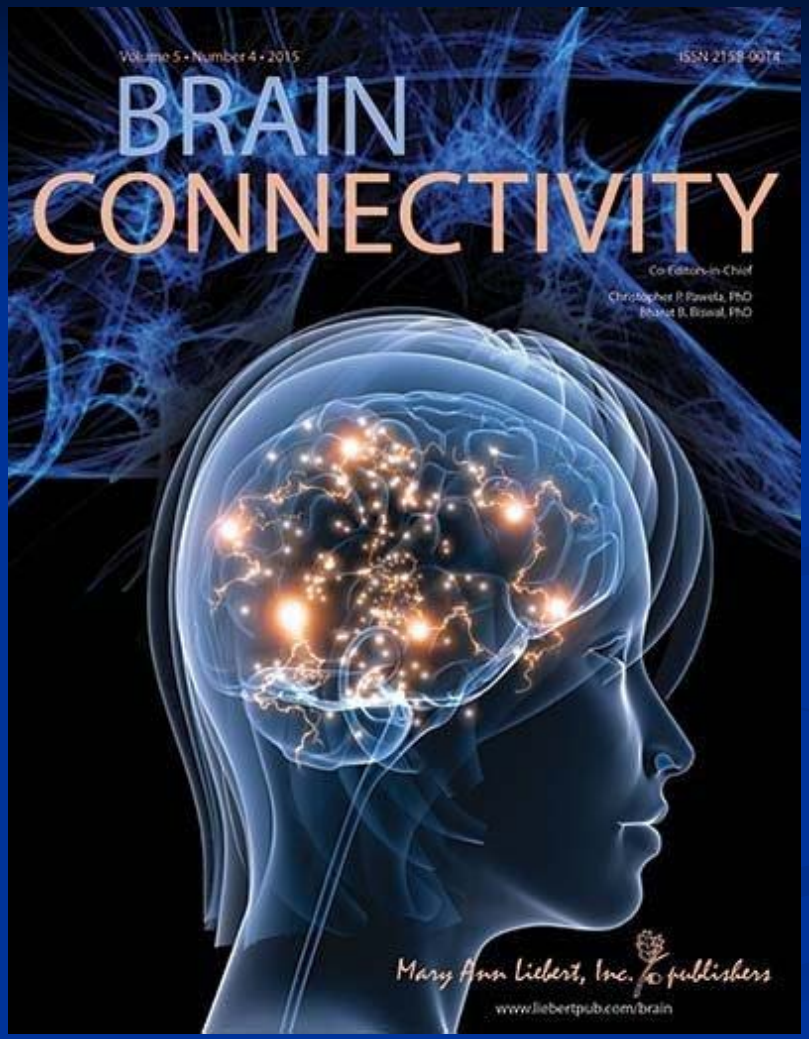
8th Annual
Joseph W. Howe
Oration in Diagnostic Imaging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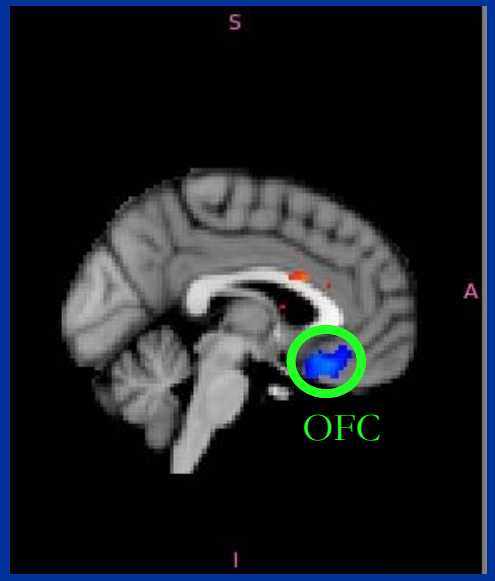
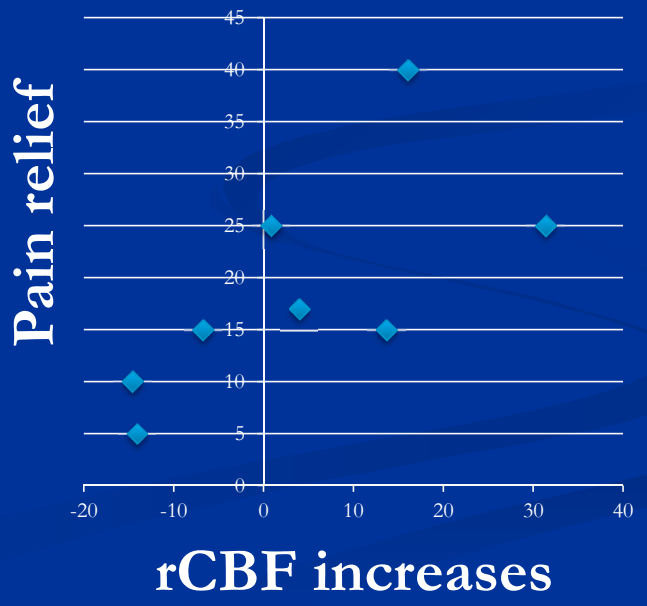
Results: MANIPULATION VISIT

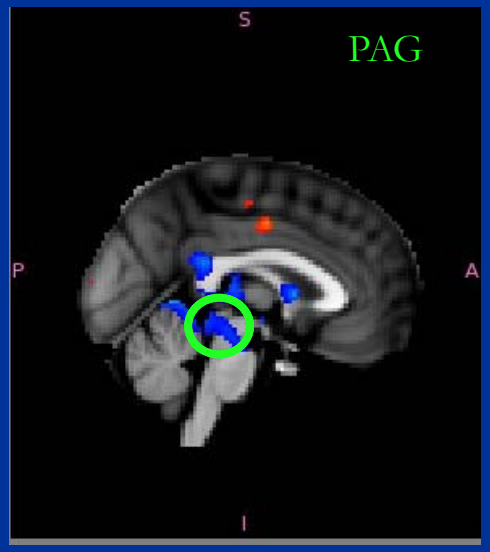
- The increases in the orbitofrontal cortex (OFC) correlated with the magnitude of relief

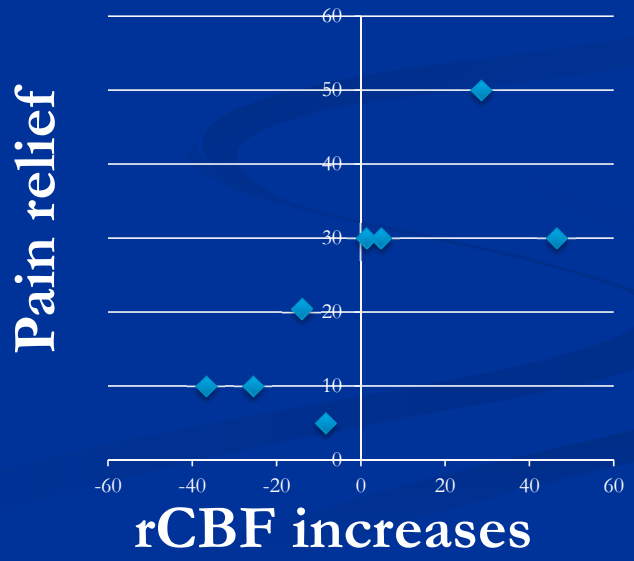




Results: MOBILIZATION VISIT

- The increases in the periaqueductal gray correlated with magnitude of relief





Victor Tong, DC, DACBR

- Graduated in 1979 from Logan College of Chiropractic.
- Radiology resident from 1980 to 1982 at Los Angeles College of Chiropractic (LACC), now known as Southern California University of Health Sciences.
- He trained under Dr. Joseph W. Howe and became a board certified chiropractic radiologist in 1983.

Victor Tong, DC, DACBR

- Dr. Tong has taught Radiology at three different chiropractic colleges for over 31 years
- From 1980 – 1989, Dr Tong taught at Los Angeles Chiropractic College & held the rank of Associate Professor.
- In 1985-1986, Dr Tong also taught part time at Pasadena Chiropractic College as Professor.
- From 1989 to 2011, Dr. Tong taught at Cleveland Chiropractic College with the rank of Full Professor

Victor Tong, DC, DACBR

- He currently maintains a private Radiologic Consultation practice in Southern California
- He also teaches Chiropractic Education seminars in California Nevada and Arizona.

Victor Tong, DC, DACBR

- Please join me in welcoming Dr. Victor Tong. His topic today is: "**Ethics in Chiropractic Radiology**"

ETHICAL ISSUES IN CHIROPRACTIC RADIOLOGY

Victor Tong, DC, DACBR

OUTLINES OF DISCUSSION

- What is ethics?
- What is medical ethics?
- How ethics contribute to growth & maturity of a medical discipline?
- Professional Ethics in Chiropractic Radiology
- Clinical Ethics in Chiropractic Radiology
- Research Ethics in Chiropractic Radiology
- Policy Ethics in established standards

WHAT IS ETHICS?

- System of moral codes, value systems in deciding what is right or wrong.
- Ethical issues are often times controversial and can be political
  - Abortion, euthanasia, medicinal marijuana, mandatory immunization, etc.
- Due to conflicts among our value systems, cultural, religious backgrounds & various local legal system. For example , blood transfusion, stem cell research, artificial fertilization, surrogate pregnancy, etc.
- Fairness doctrine. What is legally acceptable, and what is traditional acceptable can still be ethically unacceptable. For example, free medical care for undocumented immigrants. Medicare does not pay for chiropractic x-ray examinations.

WHO NEEDS ETHICS?
ALL TRUSTWORTHY PROFESSIONALS

- Clergyman – sex scandal
- Lawyers – corruption, power grab, unjust legislatures
- Doctors – patients get worse or die
- Military – coup, insubordination, unrest

WHAT SETS APART PROFESSIONALS FROM OTHER OCCUPATIONS?

- Social status – trustworthiness, credibility
- Economic status- affluent
- Leaders of society – highly respected
- Power of influence – high impact on others
- Set high standards for themselves and make policies for others

4 PRINCIPLES OF MEDICAL ETHICS- PATIENT CENTERED

- Autonomy - informed consent, HIPPA, SOAP documentation, EHR, etc.
- Justice – usual & customary, standard of care, reasonable fees, timely Dx , appropriate care treatment and improvement delivery.
- Beneficence- prevention or cure of diseases, alleviation of human suffering, screening mammogram, colonoscopy, etc.
- Non-maleficence – no damage to bodily structures and functions, complications, side effects, routine use of x-ray, CT increasing risk of cancer.

- https://web.stanford.edu/class/siw198q/websites/reprotech/New%20Ways%20of%20Making%20Babies/EthicVoc.htm

GROWTH & MATURITY OF ANY MEDICAL DISCIPLINE

- Professional ethics
  - negligence, misdiagnosis, fraud, professional misconduct, documentation.
- Clinical ethics
  - Effective delivery of clinical diagnosis & treatment, achievement of medical goal & objectives, evidence based practice, best clinical outcome, etc.
- Research ethics
  - Understand etiology, causation and associated risk factors, Cost and benefit analysis, best practice, meta-analysis of treatment method, experimental vs orthodox treatment method.
- Public policy ethics
  - Creation of gold standard for diagnosis, alternative treatment, Protocol for diagnosis, screening and prevention of diseases.

SWOT ANALYSIS FOR CHIROPRACTORS IN CA

Opportunities

- Longevity of Baby boomers increase
- Need for complementary alternative care is highest than ever
- Shortage of primary care providers
- Universal OBAMA care cover 30+ millions
- Military services open up
- Hospital privilege is feasible.
- Many options of specialty practice: sport injury, WC PI, Cash, wellness care radiology, pediatrics, veterinarian, etc.

Threats

- Increasing overhead cost of operation minimal wage going to $25/hr in 5 yr.
- Reimbursement rate is in decline
- PT has PhD program training in manipulation
- Acupuncturists and OMD are using manipulations
- Naturopaths got licensing recognition by CA state
- San Diego county has a Naturopathic school , started NMD program
- NP, PA are replacing MD in Kaisers and other hospitals

SWOT ANALYSIS ON CHIROPRACTIC

Strength

- Non invasive – desired by most
- Non painful compared to others
- Safe procedure – low malpractice
- Low overhead expense – table
- Autonomy – unlike PT, PA, RN, etc.
- Low barrier of entry

Weakness

- Lack of Unity – on what is chiropractic
- Subluxation theory outdated
- Philosophy & theory: non-scientific
- Lack of standards
- Isolated from main stream medicine
- Public image - Myths & misconceptions

ORIGIN OF THE CHIROPRACTIC RADIOLOGISTS

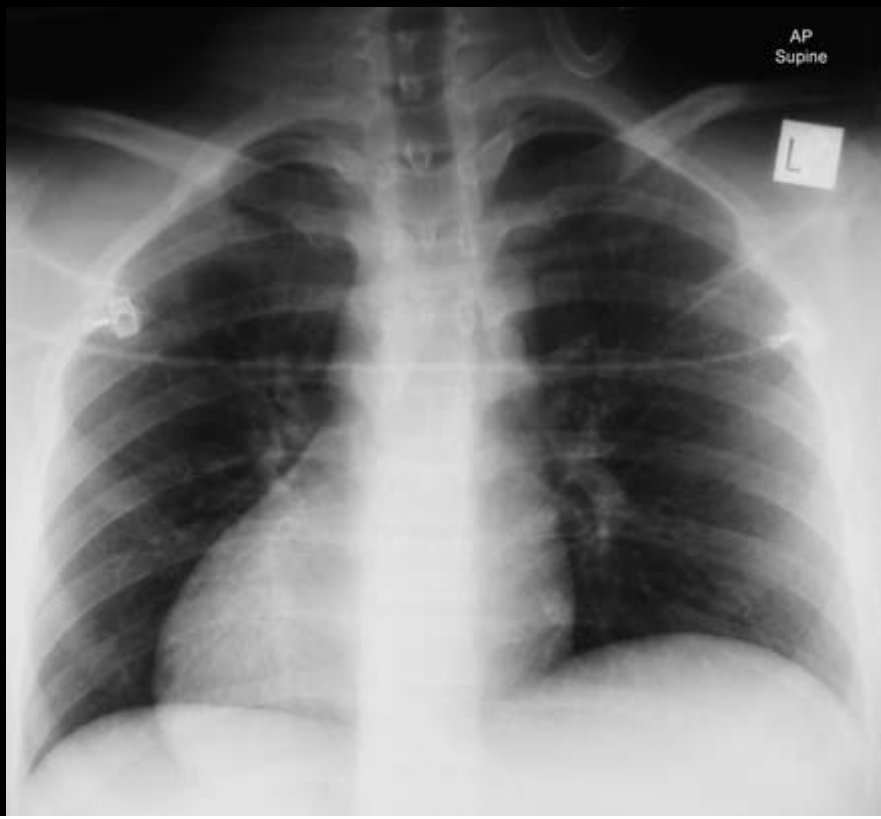
- Prior to Hospitals and medical facilities do not accept chiropractic referrals, refusing releasing x-ray record to chiropractors
- The chiropractors have to take and read x-ray ourselves
- There is a need of chiropractic diplomate programs
- After “Wilk vs AMA” case 1962-1987, discrimination is subtle but not over
  - Medicare still does not reimburse chiropractic x-ray
  - DACBR cannot bill for Medicare x-ray
  - Some hospital still refuses MR , CT referral from DC for lack of hospital previleges
  - Medical radiologist’s report frequently use statement like “no fracture and subluxation noted”.

1980’ RADIOLOGY EQUIPMENT

- View-boxes
- Spot illuminator
- Protector & ruler
- Marking Pencil & eraser
- Dictaphone

HX: CHEST PAIN

- Is the film OK?
- What does the doctor say?
- Is the patient going to be OK ?
- What needs to be done next?
- Would you have order another exam?



HX: JOINT PAIN

What is wrong?

SHOULD WE REPEAT THE FILM?

- Conform to current standard of care
- Fulfill obligation of proper record keeping
- Less litigation, liability
- Quality improvement for diagnosis
- Facilitate appropriate diagnosis

- Cost to patient, clinic, imaging center
- Time required of patient, staff
- Radiation dose to patient
- Delay for subsequent procedure in diagnosis and treatments

WHAT TO DO WHAT X-RAY POWER OUTPUT MAX OUT?

- Patient is 309 lb
- kVP, mAs setting is max out on machine

SOLUTIONS:

Using the same machine, same settings

- Apply Collimation
- Compression
- Recumbent position
- Refer to another facility with stronger unit

QUALITY OF X-RAY DEPENDS ON EQUIPMENT

- A case of 20 yr. old young man with severe strain of the low back after rolling down a slope.

- During church activity
- Roll down slope from ice-blocking
- Went to DC for treatment of LBP
- DC did not see any pathology
- No improvement after one week
- Patient went to another clinic

ANY LIABILITY?

- One week later
- X-ray repeated at imaging center
- found several fractures
- Patient has been adjusted by DC

DIAGNOSIS:

- Fractures at the transverse processes of L2, L3 and L4 on the right

DISCUSSION:

- Is it ethical to operate on equipment that is less than state of the art?
- Should there is legal requirement to outlaw old machine?
- Should the chiropractor be held accountable because he has an old x-ray machine.

4 TYPICAL COMPONENTS OF A MALPRACTICE LAWSUIT

- Established duty and obligation
- Dereliction of duties
- Causation
- Damage/loss/suffering

WHAT SHOULD THE DACBR DO WHEN QUALITY OF FILM IS POOR?

- Refuse to read the films
- Recommend a repeat with tips for improvement
- Qualify limitation of the report due to suboptimal quality
- Report what can be seen

- What about the patients?
- What if the doctor repeatedly ignore your advise?

ANOTHER CASE OF POOR QUALITY FILM

- AP and lateral full spine taken
- Sent for second opinion due to mid thoracic pain

DIAGNOSIS: HIATAL HERNIA WITH REFLUX ESOPHAGITIS

- Epigastric mass overlapping heart
- Midline in location
- Finding is not definitive due to quality
- Recommend further confirmation with upper GI examination

SHOULD WE USE OLD FILM THAT IS SUBOPTIMAL?

- Patient came to CCC-LA clinic for care
- He brought with him old film taken by a local DC 10 miles from campus
- He desires a discounted chiropractic care
- Films were 14 x 17 AP and 10 x 12 lateral
- Intern wanted clearance to manipulate

LORDOTIC VIEW

DX PULMONARY TUMOR BIOPSY PROVEN TO BE BENIGN ADENOMA

CURRENT RADIOLOGY VIEWING EQUIPMENT

- High resolution monitors
- Server, computer & DICOM software
- Voice recognition dictation software
- Microphone
- Internet access

OPTIONS TO VIEW DIGITAL IMAGE FILE?

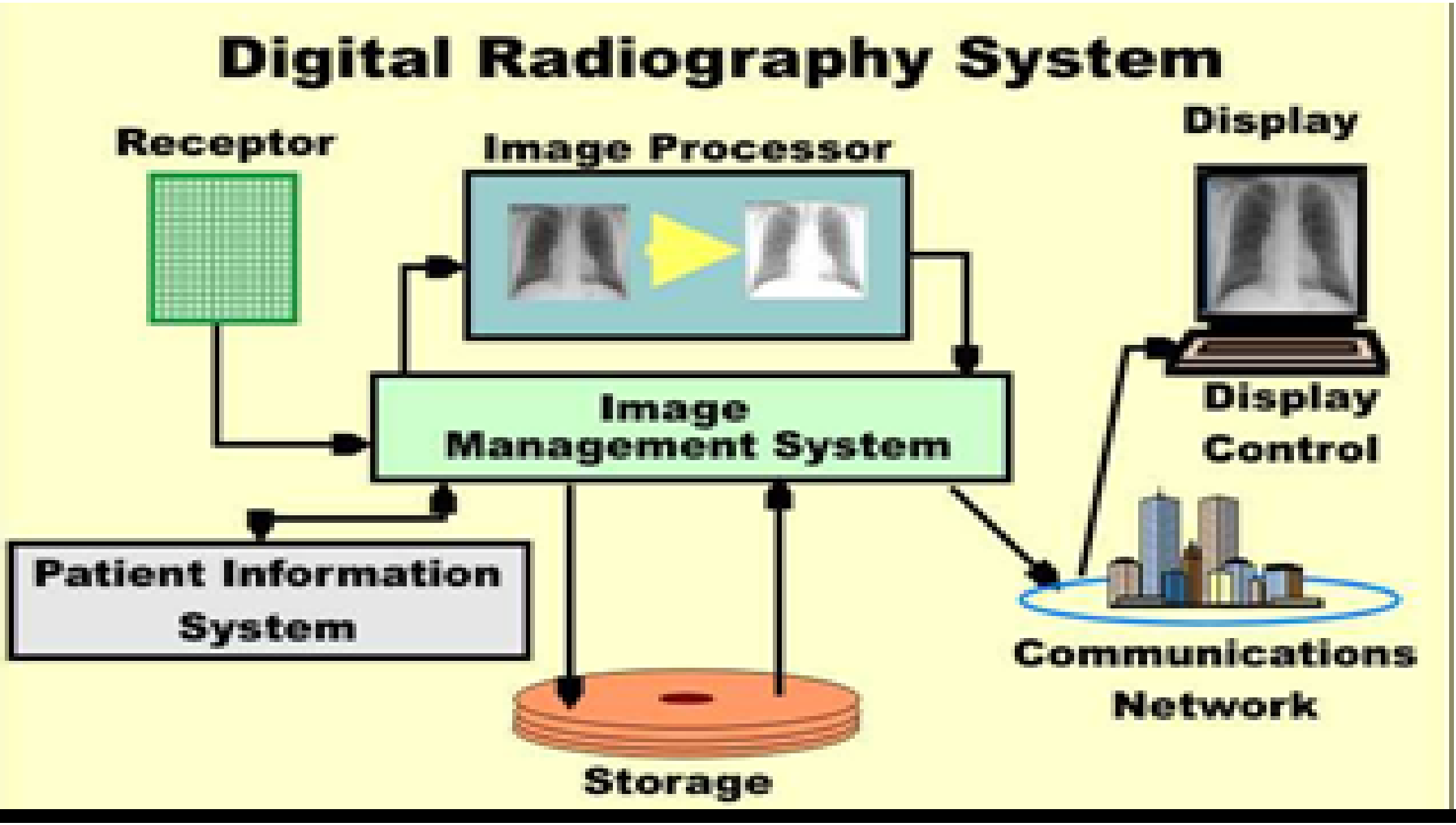
- Email in jpeg forma. Not HIPPA compliant, no image manipulation tools available. Not diagnostic
- Pseudo Cloud: free DICOM software, use laptop computer, or desktop computer with large monitors, Fast IPS. No need for static IP address, has tools, transmission not consistent.
- VPN set up: server, computer, DICOM software, IP address, fast IPS, dictation software, tools available, consistent transmission.
- PACS: server, computer, back up storage, static IP, DICOM software, Fast IPS
- Cloud base account: $ per study. Only need internet access., free soft ware.

CHIROPRACTIC DIGITAL RADIOGRAPHIC SYSTEM

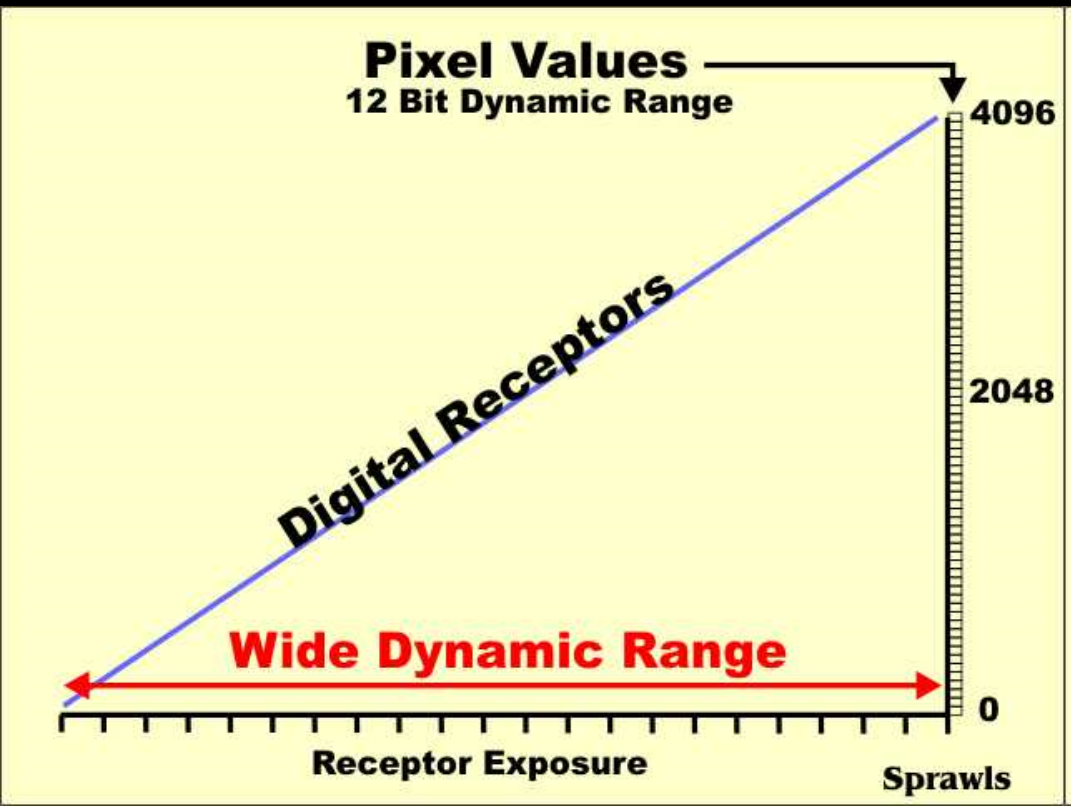
- Save time
- Save cost in films, processing chemistry
- Save space (dark room and film storage room no longer necessary)
- Better quality in diagnostic images
  - Wider dynamic range
  - Wider exposure latitude
  - Post exposure manipulation
- Easy and quick access to radiologist consultation
- Less radiation to patient ?

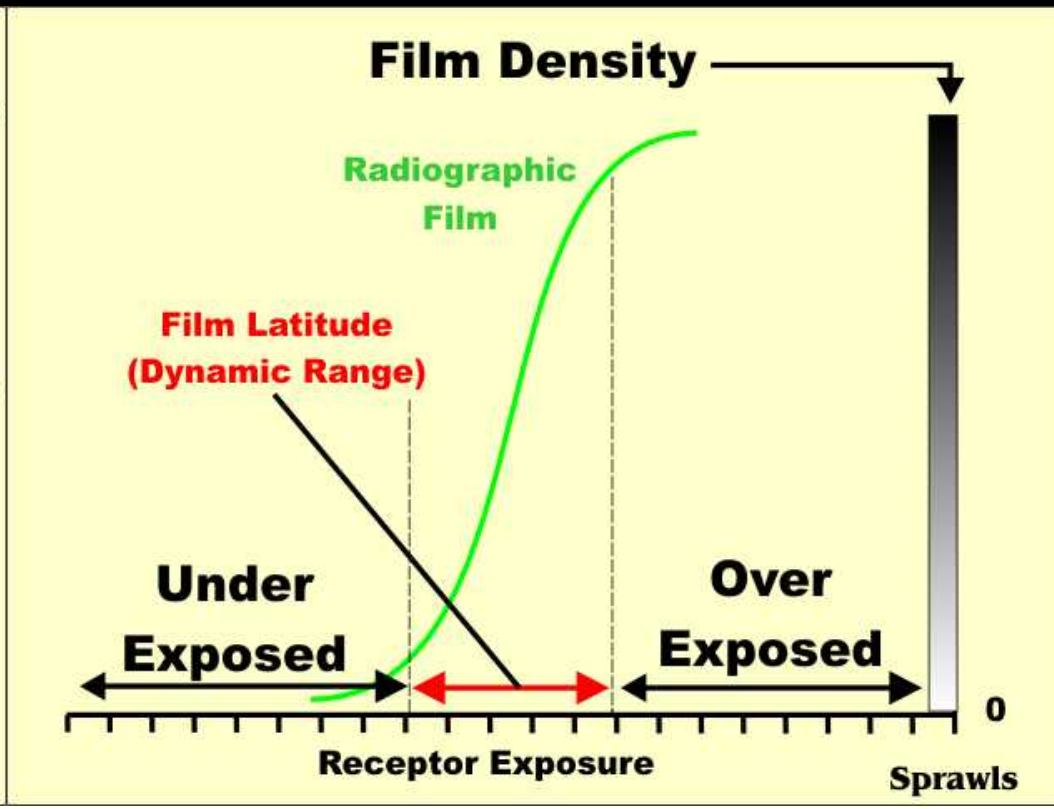
RAD DOSE PER PATIENT MAY NOT BE DECREASED

- Speed of many CR and DR are slower that original x-ray system.
- Images looks better overexposed than underexposed. “ DOSE CREEP”
- More examinations are done when there is less film cost
- Many bad exposures from motion artifacts, poor positioning get scraped and replaced unnoticed.
- Look at DICOM header for actual exposure.

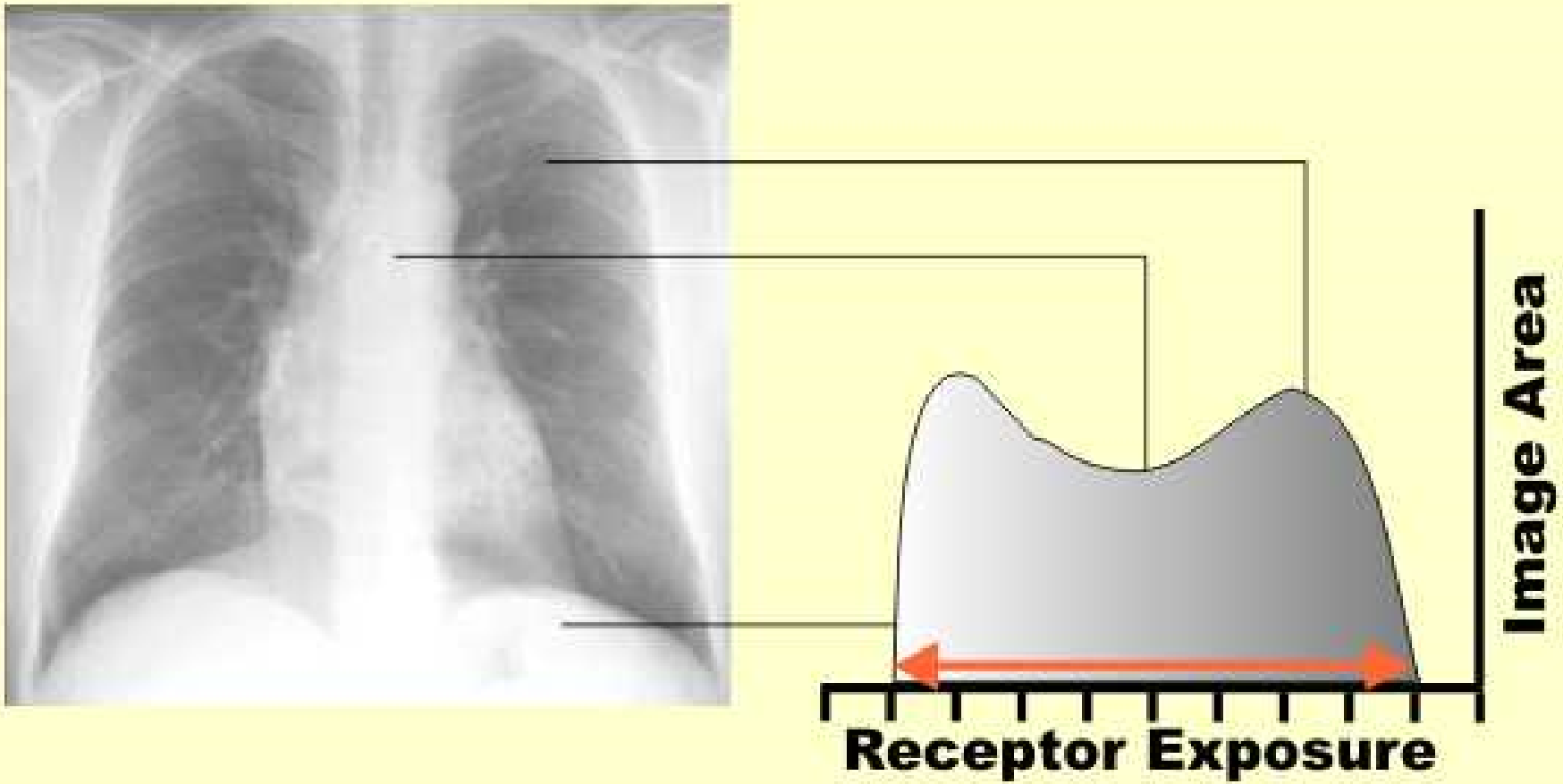

Digital Radiography System
Receptor
Image Processor
Display
Image
Management System
Display
Control
Patient Information
System
Communications
Network
Storage

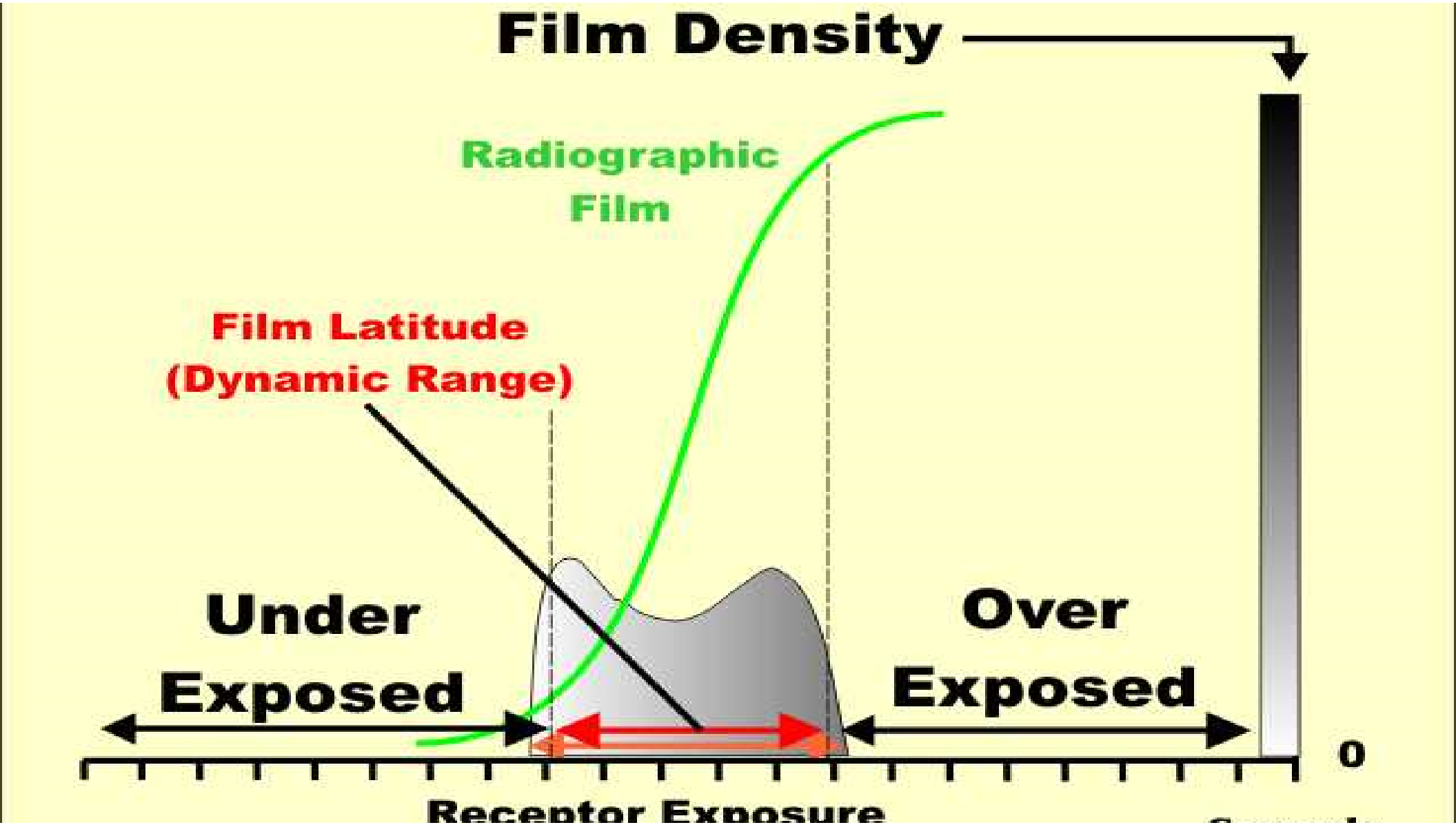
DIAGNOSTIC ADVANTAGE OF DIGITAL SYSTEM



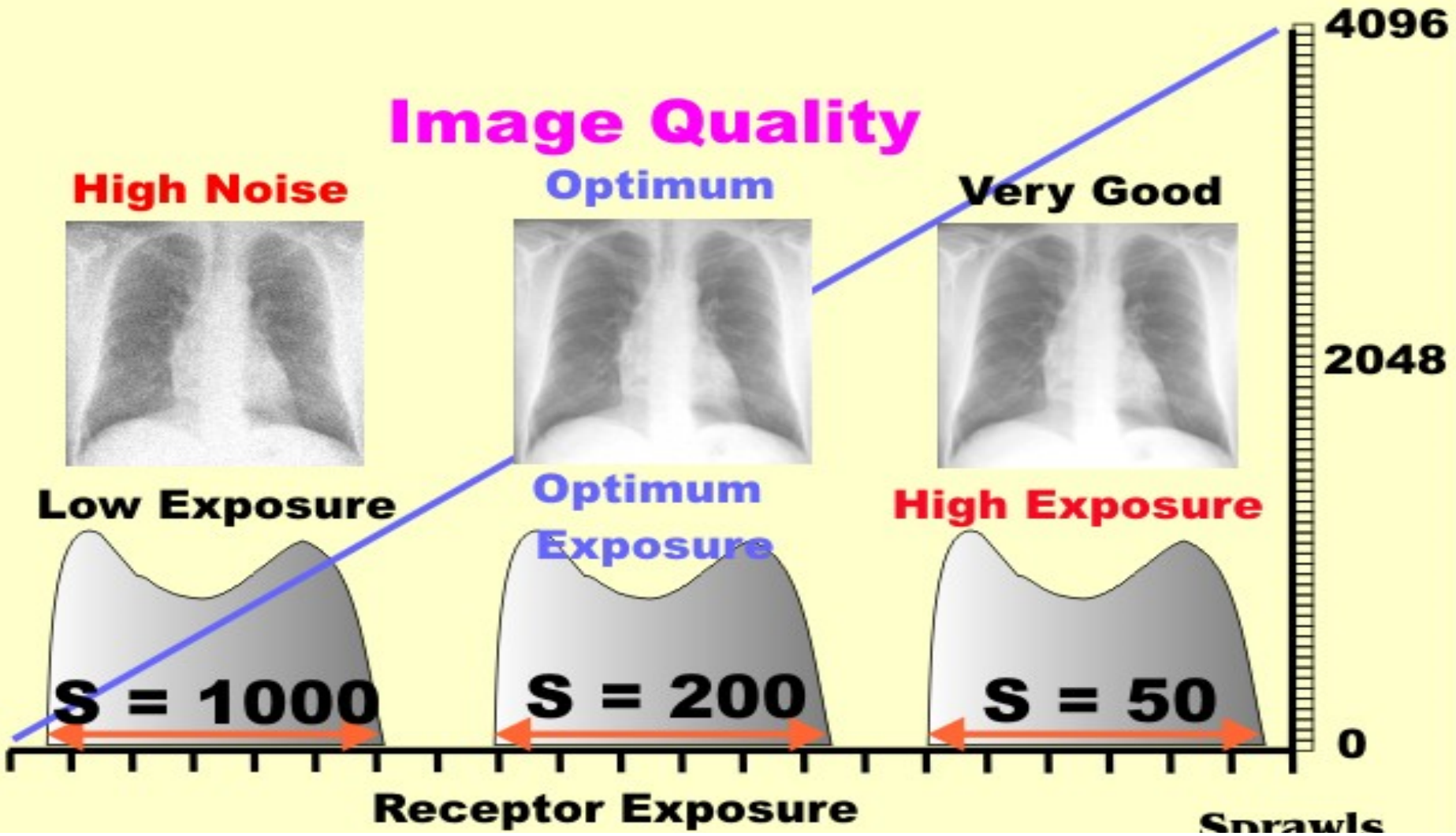


Range of Exposure to the Receptor Histogram




Film Density
Radiographic Film
Film Latitude (Dynamic Range)
Under Exposed
Over Exposed
0
Receptor Exposure

Effect of Exposure on Image Quality



A CASE OF DIGITAL EQUIPMENT UPGRADE

- DC spent $20,000 on a DR system
- Kept the original x-ray tube
- He though DR is better the CR
- So the radiographic quality must be excellent.


L SPINE
03/25/2015
11:02:00
R
10cm

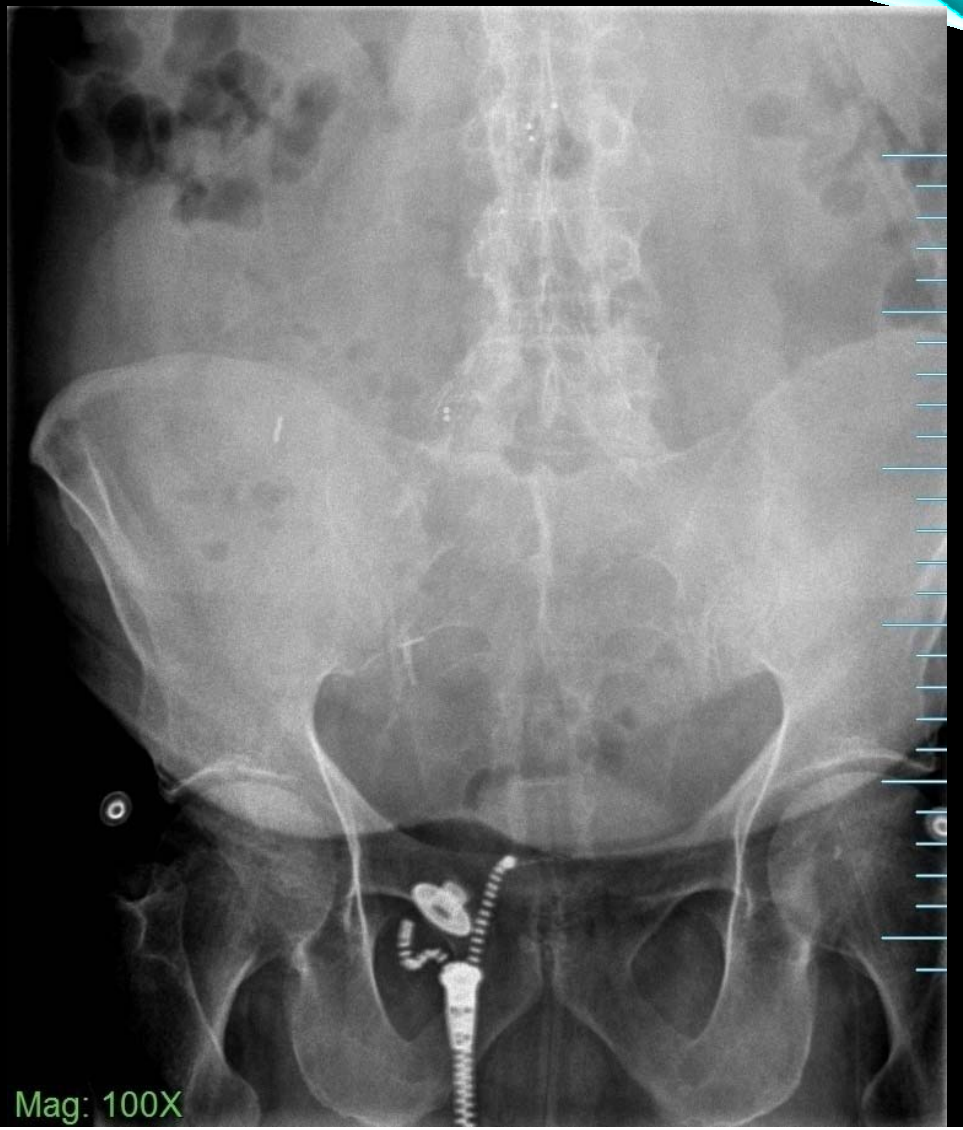

L SPINE
03/25/201
11:02:0
R
10cm

NOT ALL DIGITAL IMAGES ARE DIAGNOSTIC

- Motion artifact
- Clothing artifact
- Image receptor defect
- Under-penetration

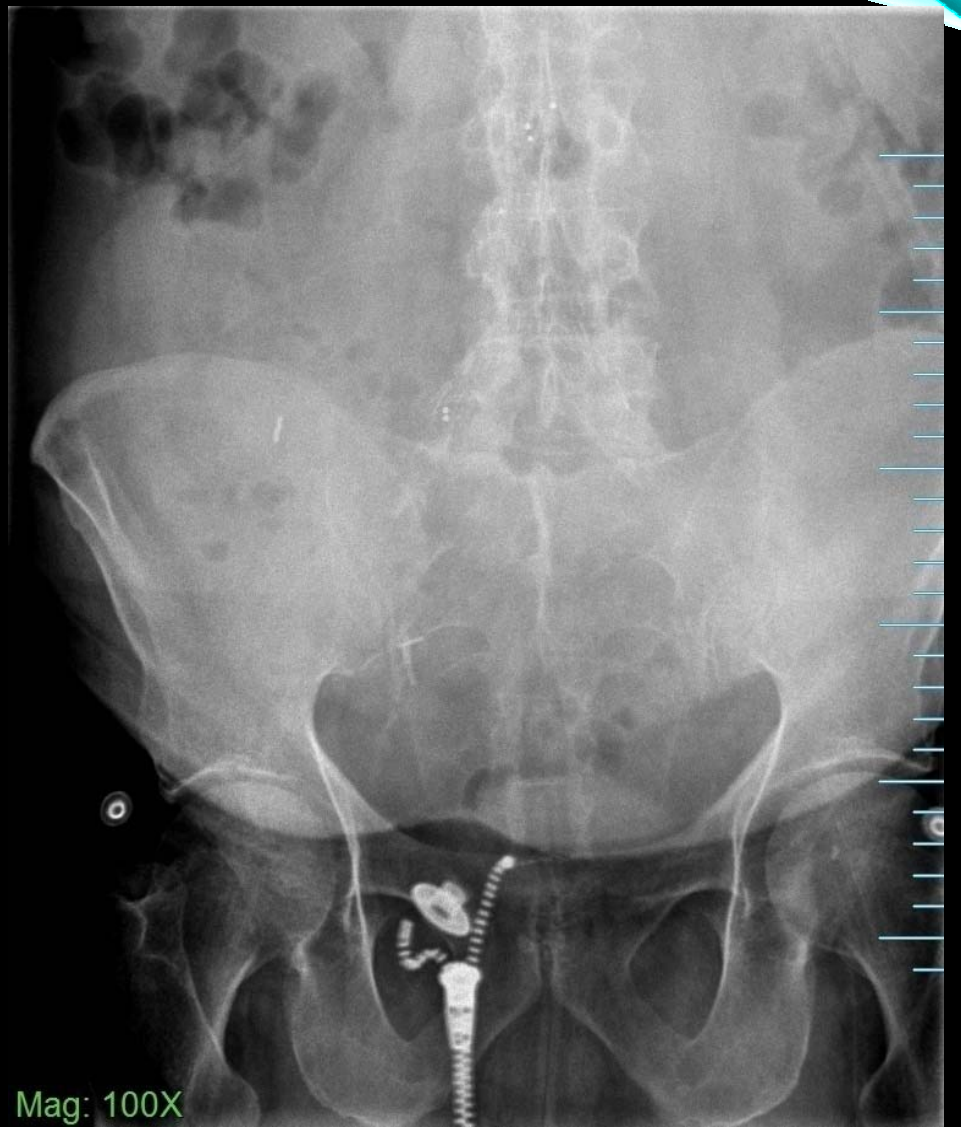
ANOTHER DC USING CR ANYTHING UNUSUAL?

- Elderly male with recurrent LBP
- Digital is supposed to be better.



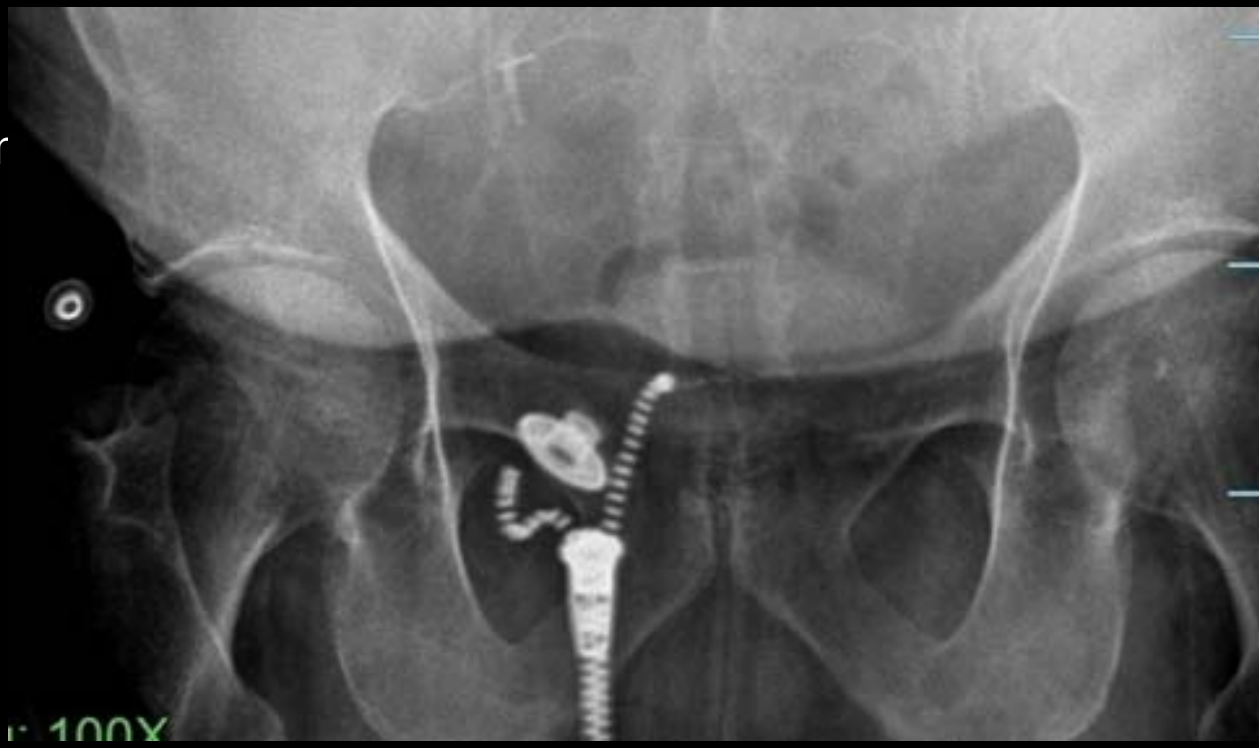
ZIPPER LESION?

- Stipple ca++ behind the pubic bones
- Oval shaped radiopacity above the pubes
- Laminated radiolucent halo within
- Artifacts could have easily block the pertinent x-ay findings for the case.



CHRONIC URINARY OUTFLOW OBSTRUCTION

- Chronic prostatitis=>calcificatior
- Hypertrophy of prostate=> obstruction
- Urinary stasis => bladder stone formation
- Risk of urinary track infection



POINT OF ETHICAL DISCUSSION

- Old habits die hard, lots of films are suboptimal in quality.
- Should digital system be mandatory. Money cannot buy professionalism
- Gowning procedure is skipped, Quality assurance program not done, etc. Should chiropractic x-rays be better off taken at imaging centers?
- Lack of professionalism is negligence, Should state Board issue penalty/citation.
- Lack of professional ethics may jeopardize clinical outcome, increase risk of malpractice

FINALLY, HERE IS A BETTER LOOKING LUMBAR SPINE STUDY

- Ignoring the clothing artifact
- Can you find any suspected lesion?

SOME OF THE OPTIONS FOR A CHIROPRACTOR WHEN RADIOGRAPHIC LESION IS SUSPECTED

- Refer patient to family physician, managed care organization
- Refer patient to the Orthopedist for biopsy / surgery
- Refer patient to a neurologist for second opinion exam
- Refer the patient to seek specialist of his/her own choice
- Send the films to a radiologist
- Continue to treat the patient, because " it is probably nothing"

ON CLOSE UP, THERE IS CIRCULAR DENSITY

DX: A BUTTON ARTIFACT

- For diagnostic accuracy and for the sake of the patient, it is best to have professional read on all films whether the primary doctor think it is normal or not.
- Most chiropractic interns are trained to have radiologists read all the films for them during their internship. For some reasons, not many retain the habit.

ETHICS IN CHIROPRACTIC RADIOLOGY

Professional ethics

- Not much critical thinking required
- Follow all necessary steps to do what we are expected to do
- No cutting corners

Clinical ethics

- Critical thinking required: x-ray or not
- Evaluate which is the best action for the patient after initial clinical assessment : minimal or complete study
- Apply the appropriate protocol: for Diagnosis /treatment or referral

Professional ethics

- Lack of marker, wrong ID
- Wrong film size
- Artifact from clothing
- Underpenetration, overpenetration.
- Poor patient position
- Patient moved
- Records are lost
- Maintenance of cassette, chemistry
- Upgrade equipment to digital, EHR

Clinical ethics

- Failure to order x-ray, MRI
- Order too much x-ray and MRI
- Order the wrong type of imaging modality
- Order the wrong area of x-ray
- Failure to refer to other specialists
- Financially motivated self referral
- Conflict of interest in MR referral
- Neglect the standard of care, ignore established guideline & protocols, best practices

CLINICAL ETHICS

- Was good physical examination performed?
- Was there sufficient medical history?
- Proper consideration of other alternative when x-ray is not the best option; e.g., US, MRI, CT, etc
- Proper selection of patient for x-ray
- Is the exam relevant to the patient's need?
- Application of radiographic protocols; including the right views
- Proper selection of the right type of radiographic examination; ankle vs foot, for example
- Does the exam contribute to accurate, reliable dx with high level of sensitivity and specificity?
- Are the equipment of high standard?
- Are interpretation done by professionals?

AP FILM ONLY

- Do you see anything wrong?
- What kind of film do you think it was?

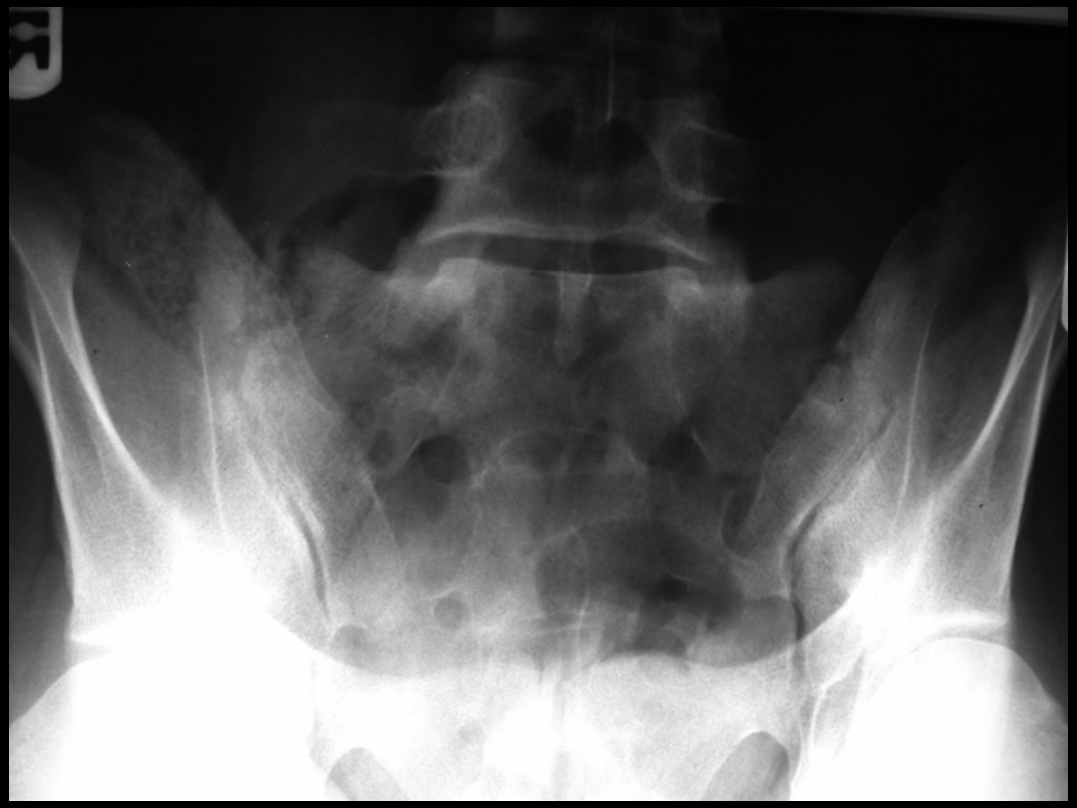
AP FULL SPINE FILM

- Elderly female with 14 x 36 film
- Thoracic tightness and chest pain
- Lumbar area is underpenetrated
- pulmonary effusion
- Meniscus sign at the diaphragms
- Right upper lobe infiltrate
- Proven to have pulmonary metastasis

WRONG TYPE OF FILM ORDERED

- Should not have taken AP full spine
- Luckily for the doctor (or the patient)
- The AP FULL SPINE was not collimated
- Factors allows visualization of lung conditions
- For other patients with similar situation, diagnosis would have been missed by the same doctor.
- There is a lack of professionalism plus an inappropriate selection of examination on the part of the doctor.

EXERCISE OBJECTIVE: FIND THE LESIONS COMPARE 2 SECTIONAL FILMS: WHICH ONE HAS PATHOLOGY ?



- AP lumbar does not allow adequate visualization of SI joint
- Suspect sacroiliac fusion is logical

- Second film show sacroiliac joints to be open and normal bilaterally

DX: NORMAL SACROILIAC JOINTS

- Both films belong to the same patient
- Projection angulation of certain film may not disclose all pertinent facts
- Selectin of the types of views within the sectional study is equally important
- If patient symptoms are located at SI joints, frontal angulated spot become more important.
- When we order films from imaging center, it may be necessary for ordering physicians to be very specific, e.g, mandating upright AP knee, include AP lumbosacral spot, include flexion, extension lateral films, etc.

PHYSICAL EXAM & HISTORY SHOULD PRECEDE RADIOGRAPHIC EXAMINATION

- A young adult male patient seek help with college clinic Monday morning
- He was robbed Friday night at inner city LA.
- He has bruises on his face, neck and back pain
- Physical examination shows limited ROM in the neck, shoulder
- There is also crepitus on neck soft tissue upon palpation.

- Which radiographic examination is ordered first?
  - Cervical
  - Shoulder
  - Chest
  - Thoracic

WHAT IS YOUR DX?

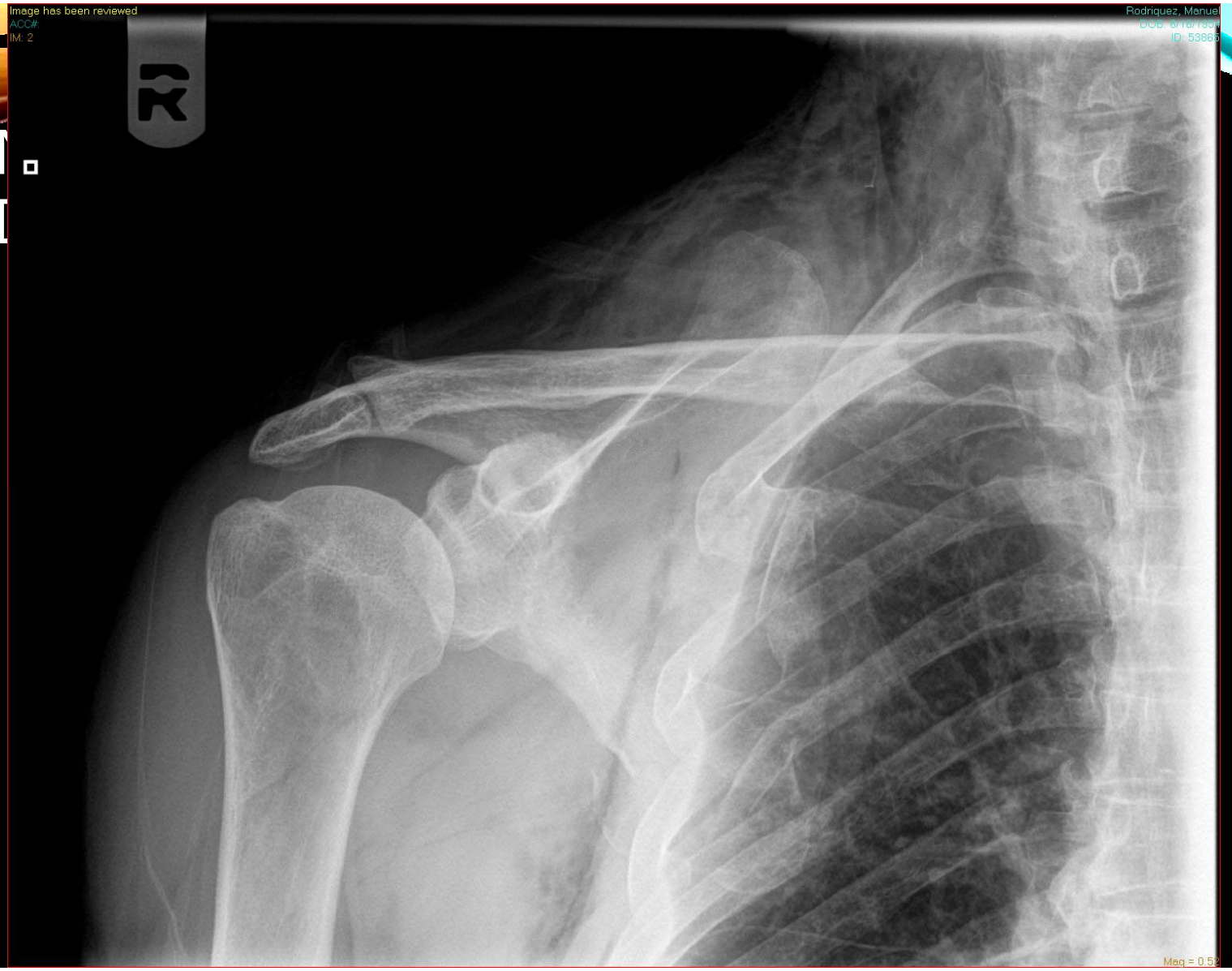
- Chest film shows linear streaky radiolucent shadows at the soft tissue next to the thoracic cage

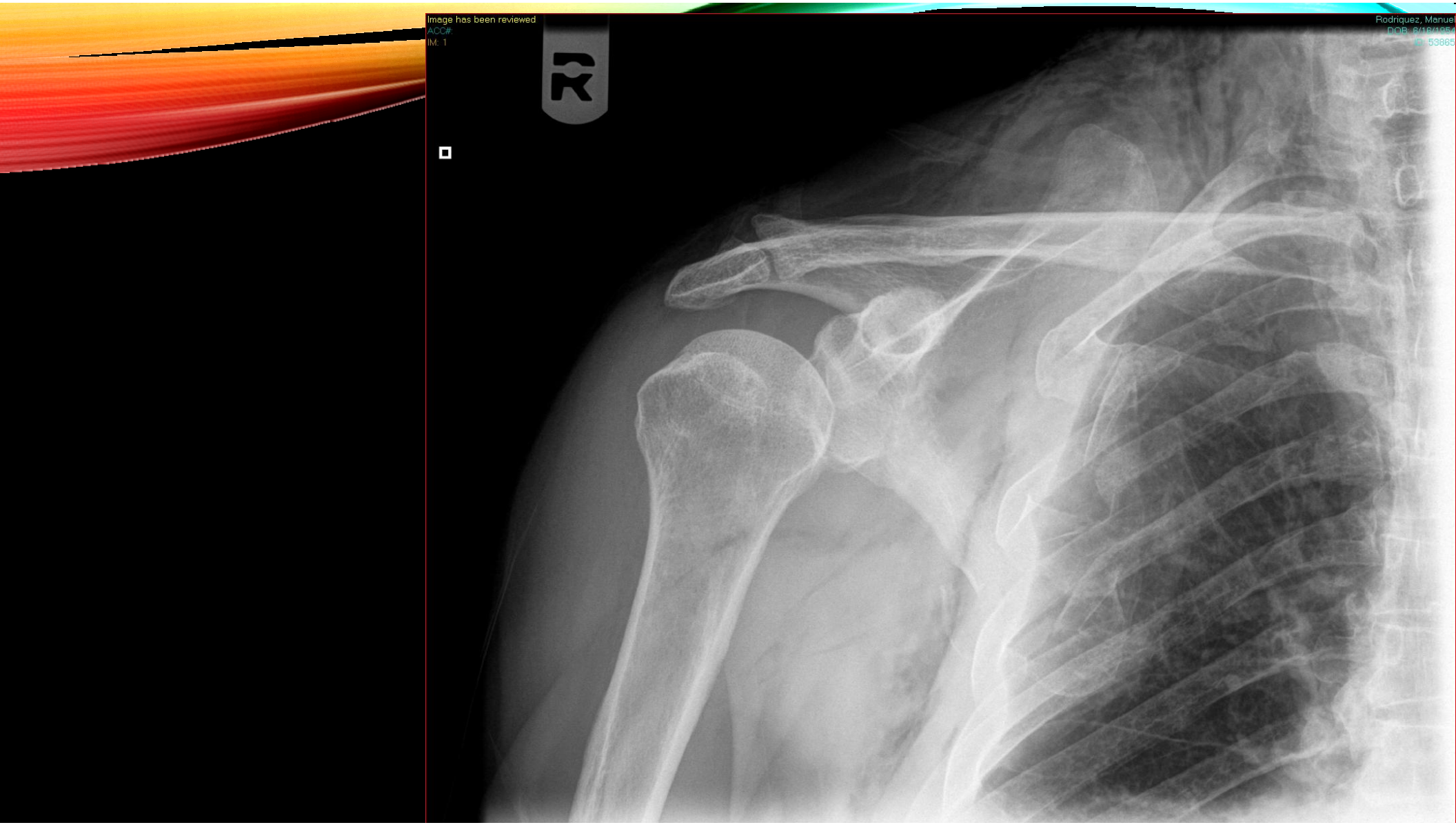
WHAT ELSE WOULD YOU DO SINCE YOU SUSPECT SUBCUTANEOUS EMPHYSEMA?

- Full spine
- Shoulder
- Ribs
- Two of the above
- All of above

DX: SUBCUTAN.
WHAT SHOULD

- Examine the shoulder
- Ship to ER
- Refer to Ortho

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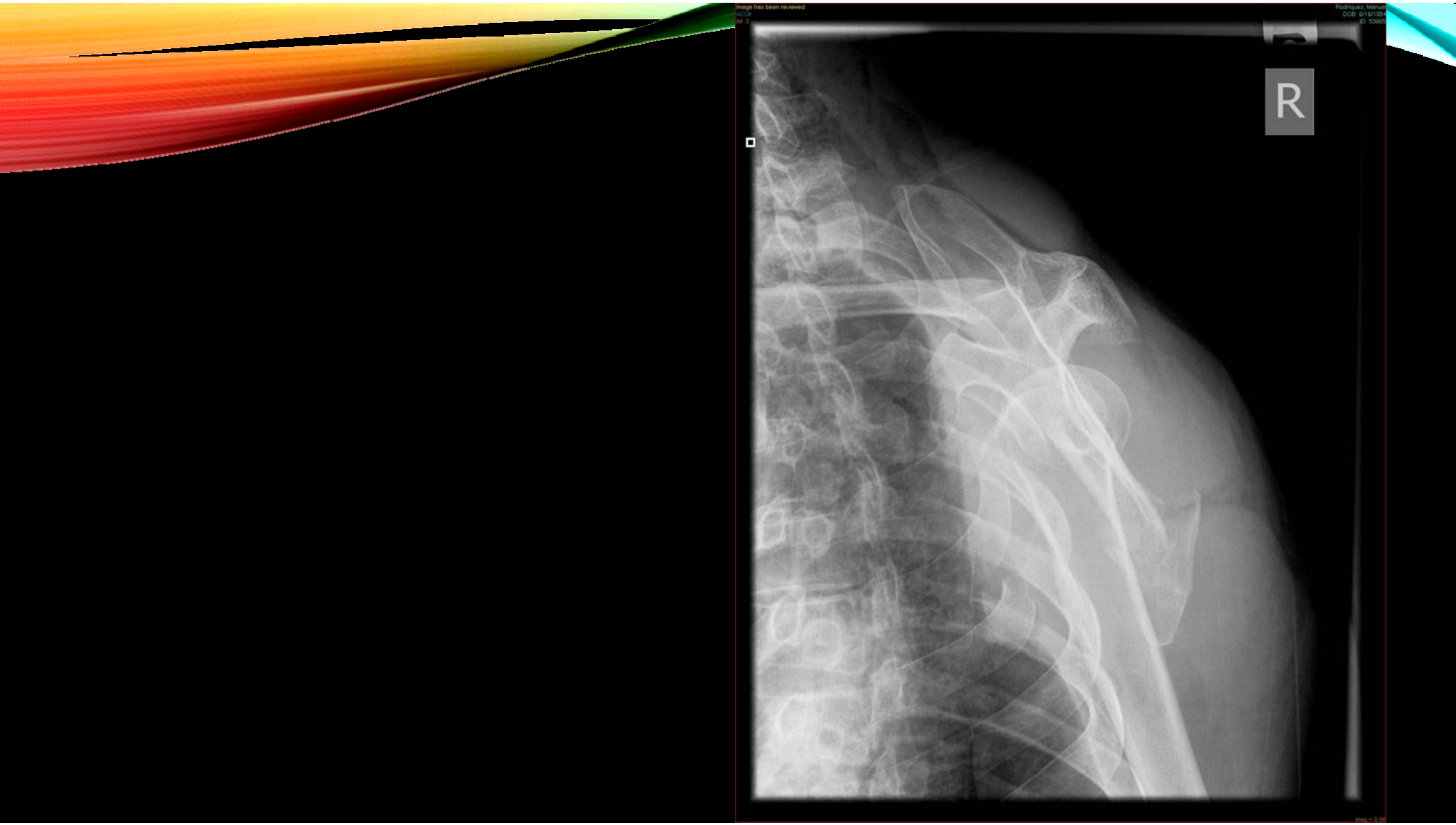
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SHOULDER STUDY

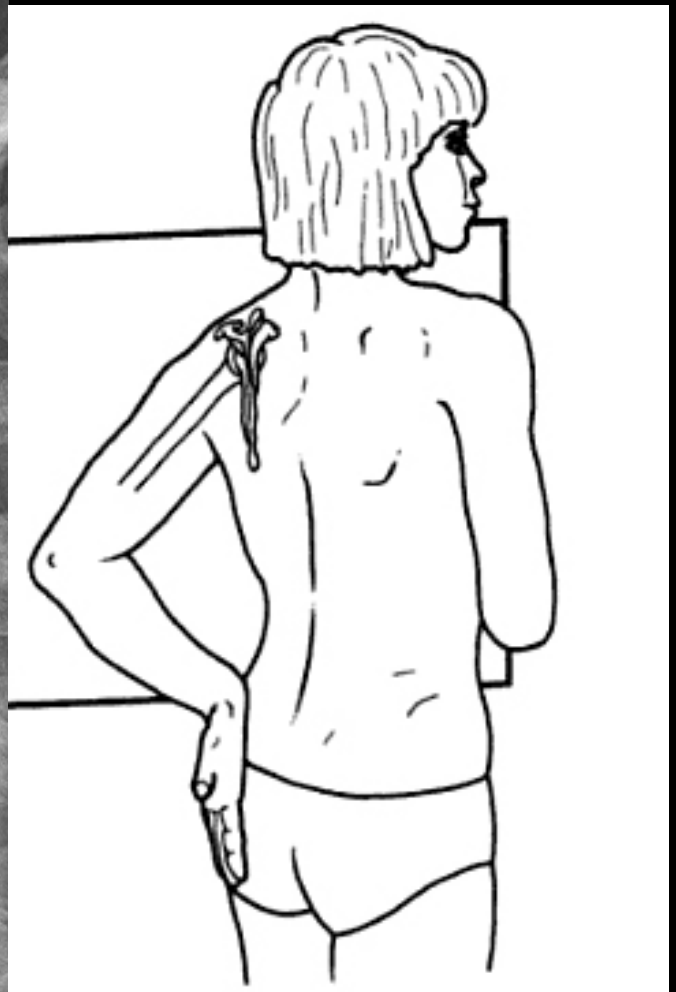
Non-traumatic protocol

- AP internal rotation
- AP external rotation
- ABER: Baby arm

Traumatic protocol

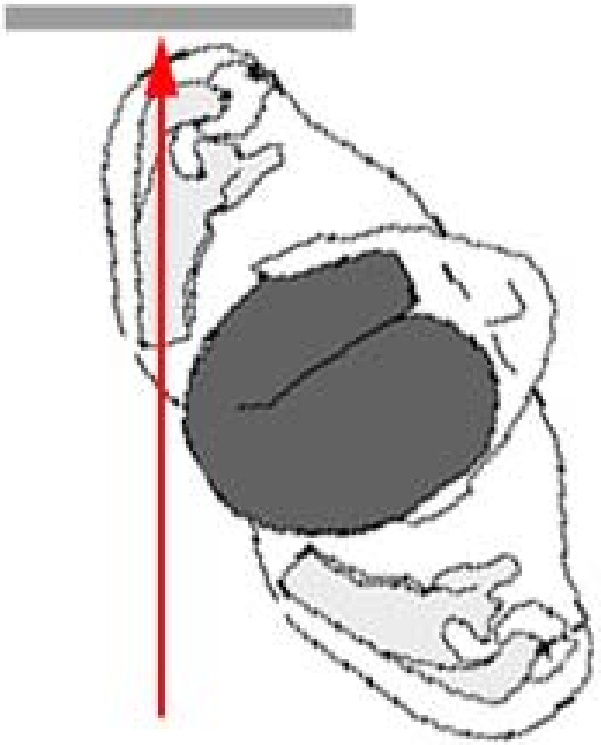
- AP neutral
- Lateral scapula Y-view
- Optional: weight bearing AP
- Optional: axillary view


R
M.J.FULLER
M.J.FULLER



Positioning

- Humerus moved back
- Hand on hip
- Scapula 90 degree to cassette
- Central ray parallel to scapula



position

Arm by the side

No movement needed

RADIOGRAPHIC GUIDELINE FOR CHIROPRACTIC CREATED BY ACCR AS EARLY AS 1984

- Should not be routinely performed without clinical need
- No free x-ray should be given without observable clinical need. Ad of free x-ray to potential patients shall be accompanied by statement of health hazard associated with ionizing radiation.
- Avoidance of split screen radiographic technique.
- Repeat x-ray should not be taken without significant clinical indication
- Pregnant females should not be radiographed unless there are significant symptoms
- Radiographs should be taken with appropriate use of gonad shielding, filters
- Females with reproductive potential should be radiographed only when there is clinical need and preferably within the first 10 days of menstrual cycle.

CLINICAL INDICATIONS FOR RADIOGRAPHY BY ACCR

- Significant Trauma (MVA, WC, litigation)
- Unexplained weight loss
- Unrelenting pain
- Evolving neurological deficits
- History of cancer, steroid use, IV drug user, blood thinner, or endocrine disorder
- Pin point tenderness at the spinous process
- Loss of joint play suggestive possible fusion, block vertebra, transitionl segment.
- Step defect in spinous alignment suggestive of spondylolisthesis
- Significant scoliosis
- Patient over 50 yrs of age
- Suspect spinal instability

The Canadian C-Spine Rule

For alert (GCS = 15) and stable trauma patients where cervical spine injury is a concern

1. Any High-Risk Factor Which Mandates Radiography?

Age $\geq$ 65 years
or
Dangerous mechanism *
or
Paresthesias in extremities

↓ **No**

2. Any Low-Risk Factor Which Allows Safe Assessment of Range of Motion?

Simple rearend MVC **
or
Sitting position in ED
or
Ambulatory at any time
or
Delayed onset of neck pain ***
or
Absence of midline c-spine tenderness

Yes →

No → **Radiography**

↓ **Yes**

3. Able to Actively Rotate Neck?

45° left and right

Unable → **Radiography**

↓ **Able**

No Radiography

* **Dangerous Mechanism:**
- fall from elevation $\geq$ 3 feet / 5 stairs
- axial load to head, e.g. diving
- MVC high speed (>100km/hr), rollover, ejection
- motorized recreational vehicles
- bicycle collision

** **Simple Rearend MVC Excludes:**
- pushed into oncoming traffic
- hit by bus / large truck
- rollover
- hit by high speed vehicle

*** **Delayed:**
- i.e. not immediate onset of neck pain

NEXUS CRITERIA FOR LOW RISK INJURY

- National emergency x-radiographic utilization study
- 5 criteria for low probability of injury
  - No midline cervical tenderness
  - No focal neurological deficit
  - Normal alertness
  - No intoxication
  - No painful distracting injury

THE JOURNAL OF CHIROPRACTIC EDUCATION 2007 FALL 21 (2): 144-152

Spinal Radiographic Views

Area	Minimal series	Supplementary views
Cervical spine	AP lower cervical, neutral lateral	AP open mouth Flexion/extension
		Obliques
		Pillar
Thoracic spine	AP, lateral	Swimmer's lateral
Lumbar spine	PA (or AP), lateral	Spot angled lumbosacral
		Spot lateral lumbosacral
		Obliques
		Flexion/extension
Pelvis	AP	
Full spine	PA (or AP) for scoliosis	Right and left lateral bending
		Sectional laterals

Extremity Radiographic Views

Area	Minimal series	Supplementary views
Shoulder (nontrauma)	AP internal and external rotation (baby arm)	AP neutral and transthoracic lateral or Y view o
A/C joints	AP weightbearing and nonweightbearing	Bilateral comparison
Elbow	AP and lateral	Oblique (medial or lateral)
		AP with hand pronation
Wrist	PA, medial oblique, lateral	PA with ulnar deviation
		Lateral oblique
		Norgaard's (ball-catcher's) projection
Hand	PA, medial oblique, lateral	Single finger views (PA and lateral)
Hip (nontrauma)	AP or AP pelvis and frog leg	True lateral hip
Knee	AP and lateral	Tunnel Sunrise
Ankle	AP, medial oblique, lateral	
Foot	Dorsoplantar, medial oblique, lateral	For toes, use a sponge to straighten out the toes.
		Axial view calcaneus

CHIROPRACTIC PATIENT WITH A MASS AT THE DORSUM OF THE WRIST

- Treatment include
  - Acupuncture
  - Manipulation of the wrist

A FEW WEEKS LATER, MASS DISAPPEAR

HOW DOES IT WORK? WHICH METHOD OF TREATMENT WORK BEST?

- Is x-ray necessary?
- Is there a need for D Dx?
- How does the DC cure the patient?
- Which Tx method works the best?
- Which Dx method is the best?

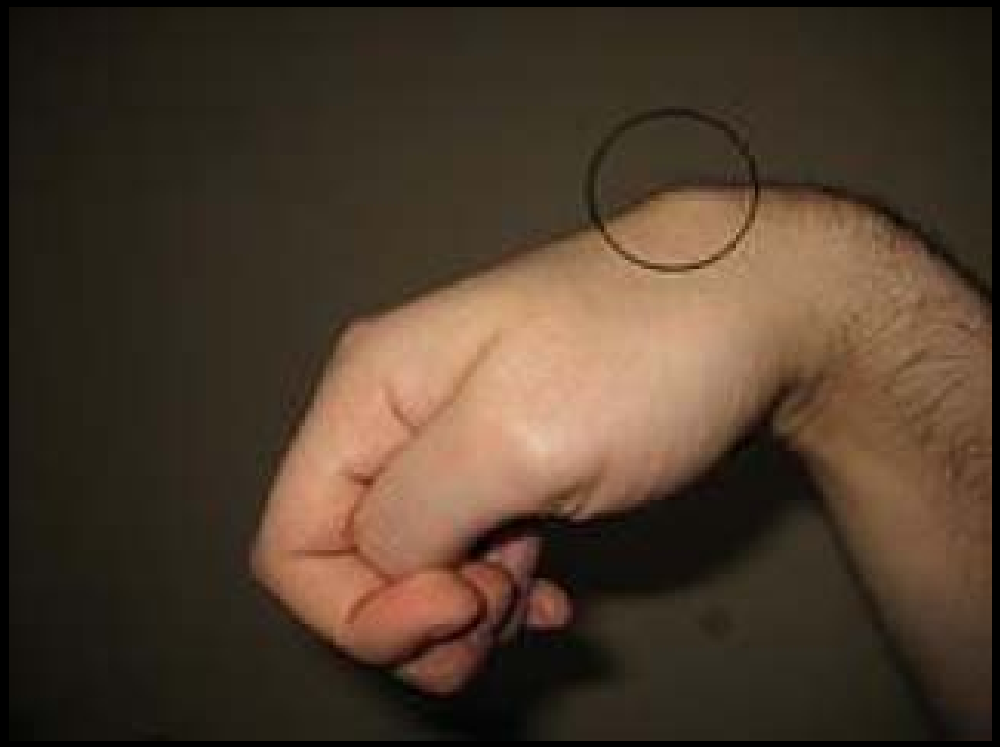
ANOTHER WRIST CASE

- 55 yr old male
- Recurrent wrist pain with prolonged exercises

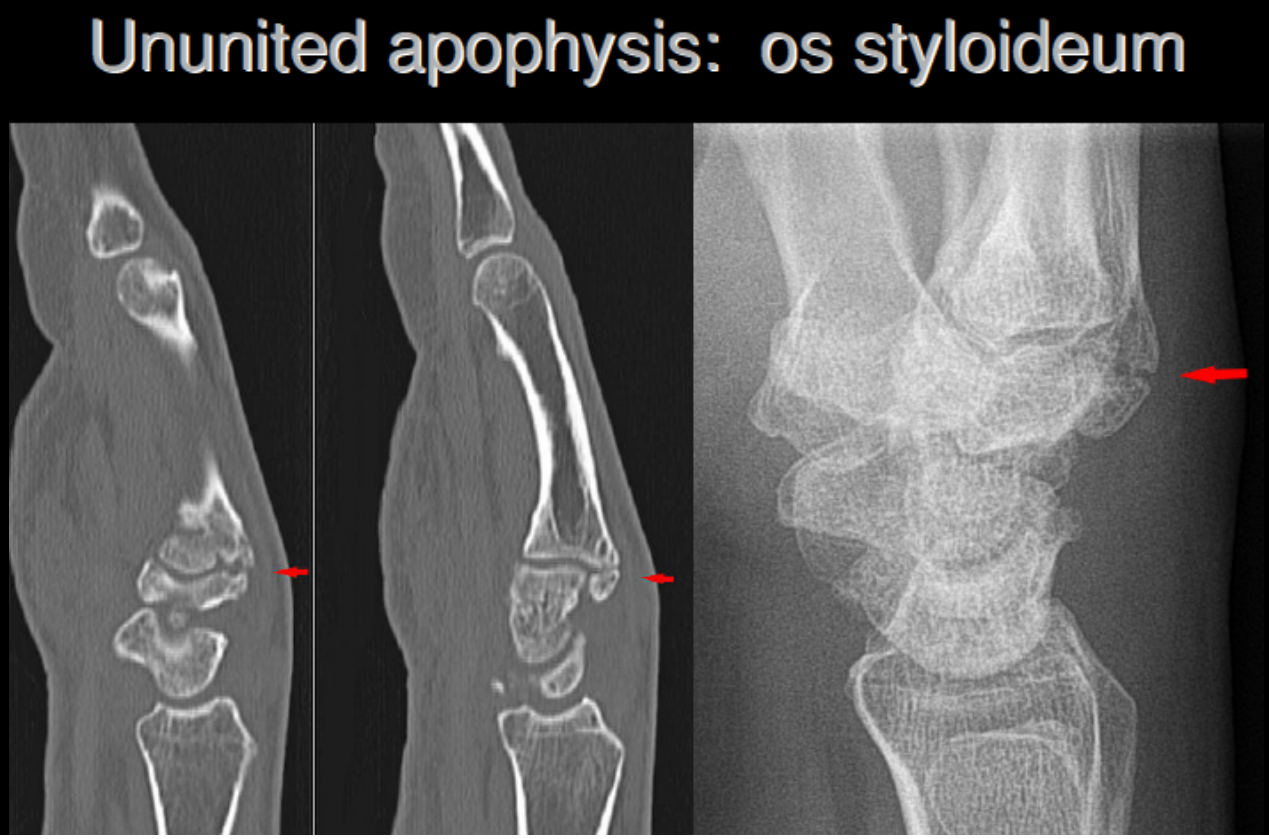
DX: CARPAL BOSSING

ANOTHER SIMILAR MASS EFFECT OF THE WRIST

- Hard lump has always been there
- Painful with full range of motion
- Lump is immoveable



X-RAY AND CT WERE ORDERED TO PROVE THAT IT IS A BONY MASS



HOW ABOUT OTHER ALTERNATIVE CHOICES?

- MRI, ultrasound, etc.

CLINICAL ETHICS: FIRST DO NO HARM

- How much radiation are we introducing to the patient?
- Risk vs benefit analysis/comparison

- Imaging up especially when there is insurance coverage
- Liability protection- fear of lawsuit
- Teaching cases
- Poor quality equipment and technique

RADIATION DOSE COMPARISON

Low dose:	0.1-1 mSv	Randon exposure from background rad	
X-ray of chest (two views)	0.1	12 days	Presurgery X-rays needed only for people with a history of lung or heart disease (or those at risk) or before chest surgery.
Mammogram	0.4	7 weeks	Needed every two years for women ages 50 to 74.

RADIATION DOSE COMPARISON

Medium dose: 1-10 millisieverts background rad dose equivalent(Randon)

X-ray of spine	1.5	6 months	Rarely needed in first month back pain.
CT of head	2	8 months	Not needed for most head injuries. CTs usually aren't needed for a concussion.
CT of spine	6	2 years	Rarely needed in first month of back pain.

RADIATION DOSE COMPARISON

High dose :	10-20 millisievert	Background rad dose equivalent (Randon)	
CT colonoscopy	10	3 years	Not as accurate as standard colonoscopy.
CT of abdomen and pelvis	10	3 years	For possible appendicitis or kidney stone, ask whether ultrasound can be used.
CT angiography (of the heart)	12	4 years	1 in every 1,300 60-year-olds may get cancer as a result, so it probably shouldn't be used for screening.
CT of abdomen and pelvis repeated with and without contrast	20	7 years	"Double scans" are rarely necessary; fewer than 5 percent of patients should receive one.
PET with CT	25	8 years	It exposes patients to very high radiation doses, so make sure

RESEARCH ETHICS

- When almost every medical procedure have inherent risks & benefits
- Research is to gain knowledge regarding all aspects of medical procedures
- Help clinical decision making that is rational, logical and most efficacious.
- Help develop best practice, or evidence based practice
- Not all research are objectives
- Research designs could be flawed
- Conclusion are not always fair and balance
- Extremely high degree of critical thinking and scrutiny are needed for appropriate interpretation.

UTILIZATION OF CT

- 3 million in 1980
- 20 million in 1995
- 60 million in 2005
- Current estimate of 0.4% of all cancers are from CT radiation exposure
- With increase in routine screening of lung cancer in smokers, virtual colonoscopy and coronary artery scans, the rate of CT related cancer may go up to 2 %
- 15,000 cancer / year estimated because of radiation dose from CT alone. Consumer report Mar, 2015

RESPONSE TO CANCER INCREASE LINKED TO CT

- Use of multiple detector helical CT that are faster in acquisition time and less rad dose
- Consider alternative imaging options; e.g., US, MR, etc.
- Reduce use of CT in non-high-risk patients
- Continue to order CT for high-risk patients in ED, even if 30% are negative (thought to be unnecessary)
- Track radiation dose received by patients with government regulation
- NB: need to increase use of CT in patient s with acute headache and possible subarachnoid hemorrhage, because up to 19% of SAH patients are neurologically intact. 75% of missed SAH is because CT not ordered.

- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2672242/

JUSTIFICATION FOR USE OF CT IN EMERGENCY ROOM

- Mean lifetime attributable risk for all cancers with respect to radiation: 0.81% +/- 0.54%
- Mean lifetime attributable risk of cancer-related mortalities: 0.44 +/- 0.72%
- Actual manifestation of the cancer is 35, 40, 45 yrs. later.

- Mortality rate of traumatic brain injury: 25% -50%
- Impact is so minimal that it is almost non-existent.

- http://www.medscape.com/viewarticle/763207 May 2012

POTENTIAL OVERUSE / ABUSE

- Financial incentives
- Fear of lawsuits
- Uninformed physicians
- Misinformed patient
- Patient demand
- Lack of regulation
  - CMS in 2016 will cut reimbursement of scanners that don't meet most recent safety standards. Estimate to be 1/3 of the nation's imaging centers.

FROM 1970 - 1980

- Lots of full spine, most Chiropractic students have full spine films taken on themselves
- Debate on whether full spine is diagnostic
- Some sectional studies
- Extremities are mostly for trauma cases

FULL SPINE RADIOGRAPHY

- Spinography
- Suboptimal diagnostic quality is common
- Taylor literature review in JMPT 1993
  - With proper patient selection, attention to technique details, full spine can be an effective diagnostic and analytical procedure, with an acceptable risk/benefit ratio.
  - Reliability of certain spinographic parameter has been established
  - Validity and relevance issues remain questions

- http://europepmc.org/abstract/med/8228649

RISE & DECLINE OF FULL SPINE RADIOGRAPHY

Rise in Popularity

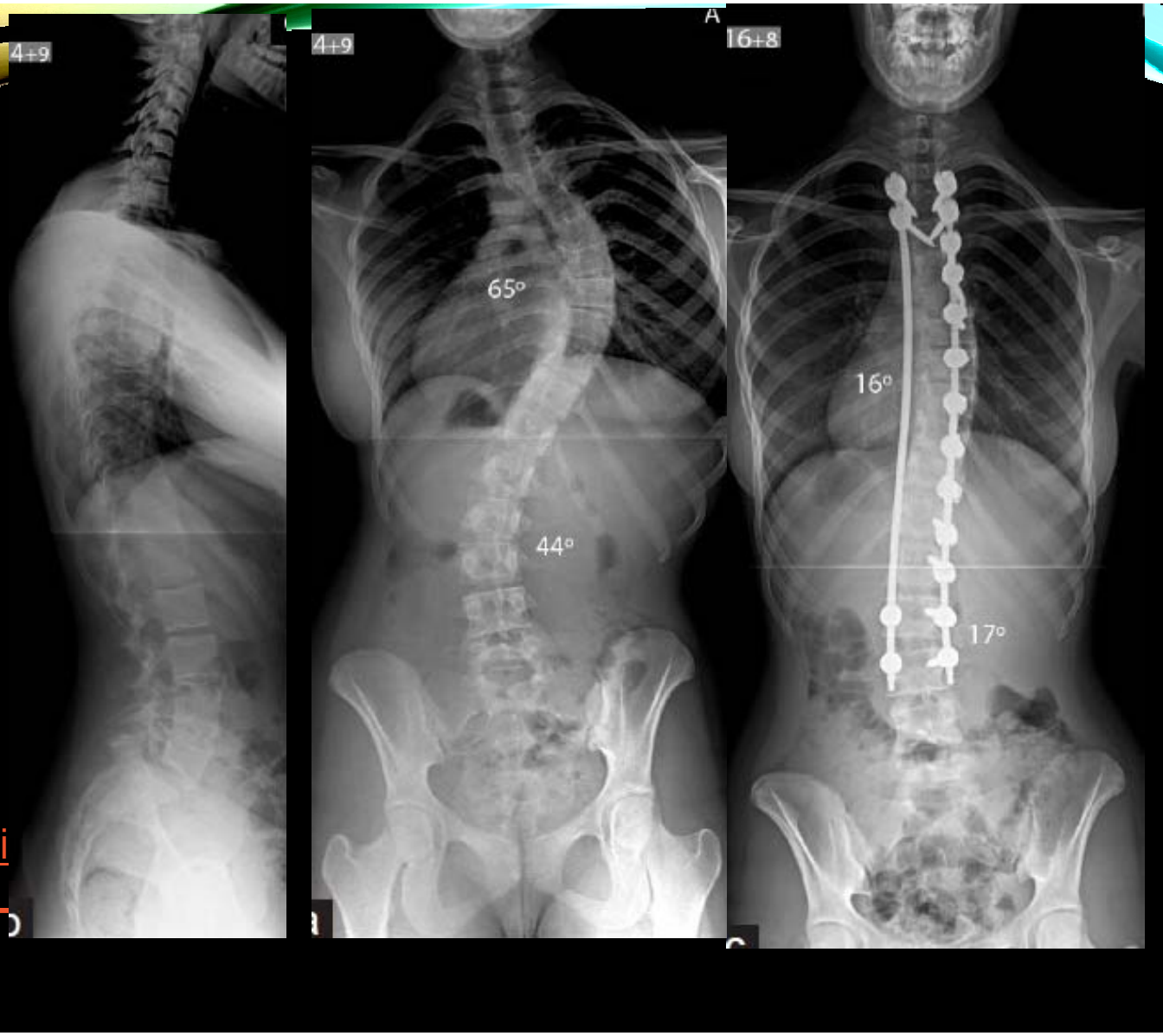
- Simple system to take 2 films on everyone,
- X-ray used as a profit center
- Use of x-ray marking systems
- Patient education
- Tradition for chiropractic to take x-ray of patient's spine

Decline in Popularity

- Third party payer like WC and managed care don't reimburse FS.
- Difficult to obtain diagnostic quality
- Risk of malpractice
- Digital full spine equipment cost more , financially impractical.
- Less school teach technique that requires full spine x-ray marking

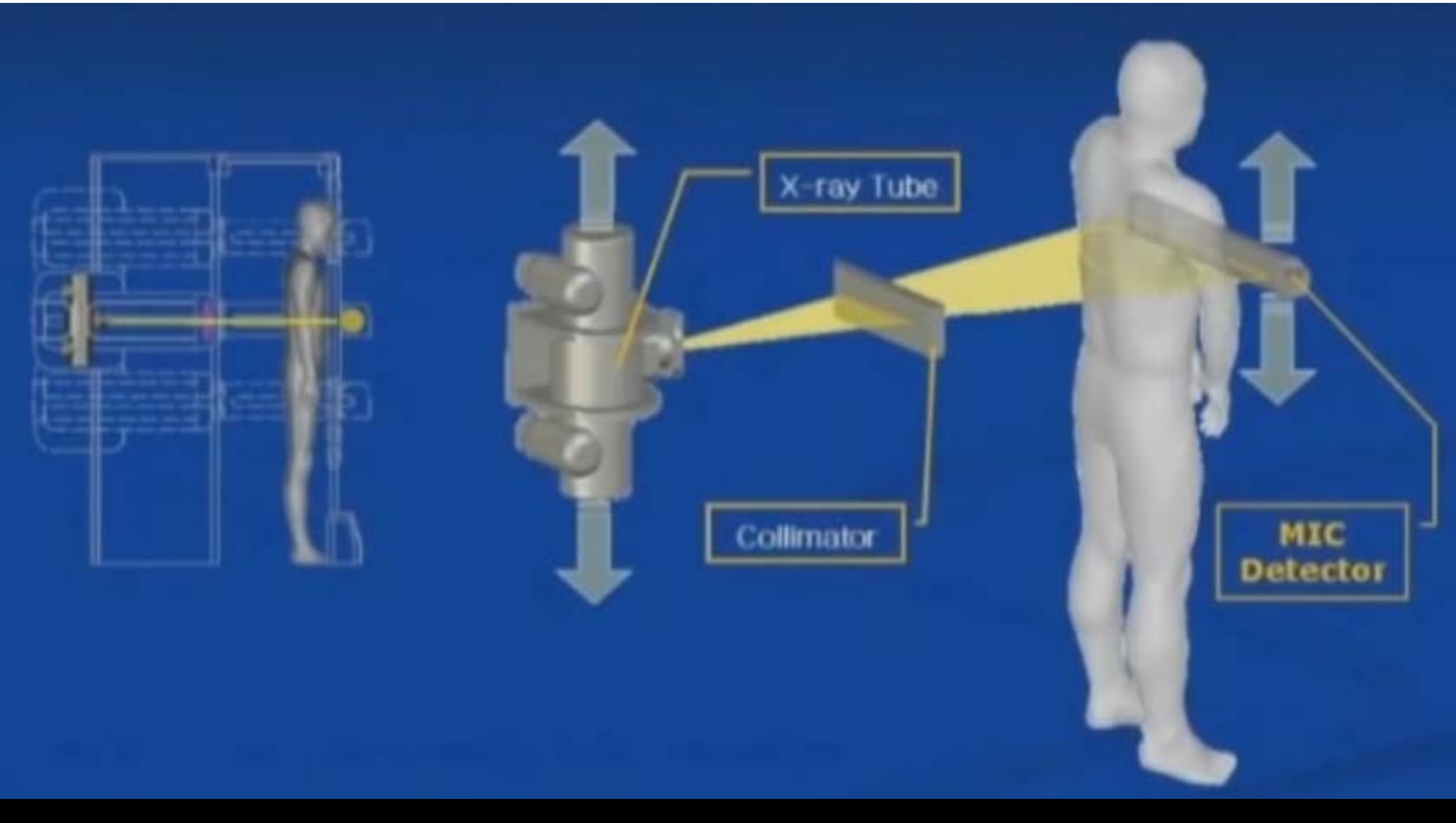
FULL SPINE

- Acceptable for scoliosis
- Can be diagnostic if patient's body mass and shape are evenly distributed.
- Can be Digitally acquired & more likely to be diagnostic
- Cannot always see all subluxations, because VSC is not always shown on x-ray
- http://www.ijoonline.com/viewimage.asp?img=IndianJOrthop_2013_47_3_219_111493_u2.jpg

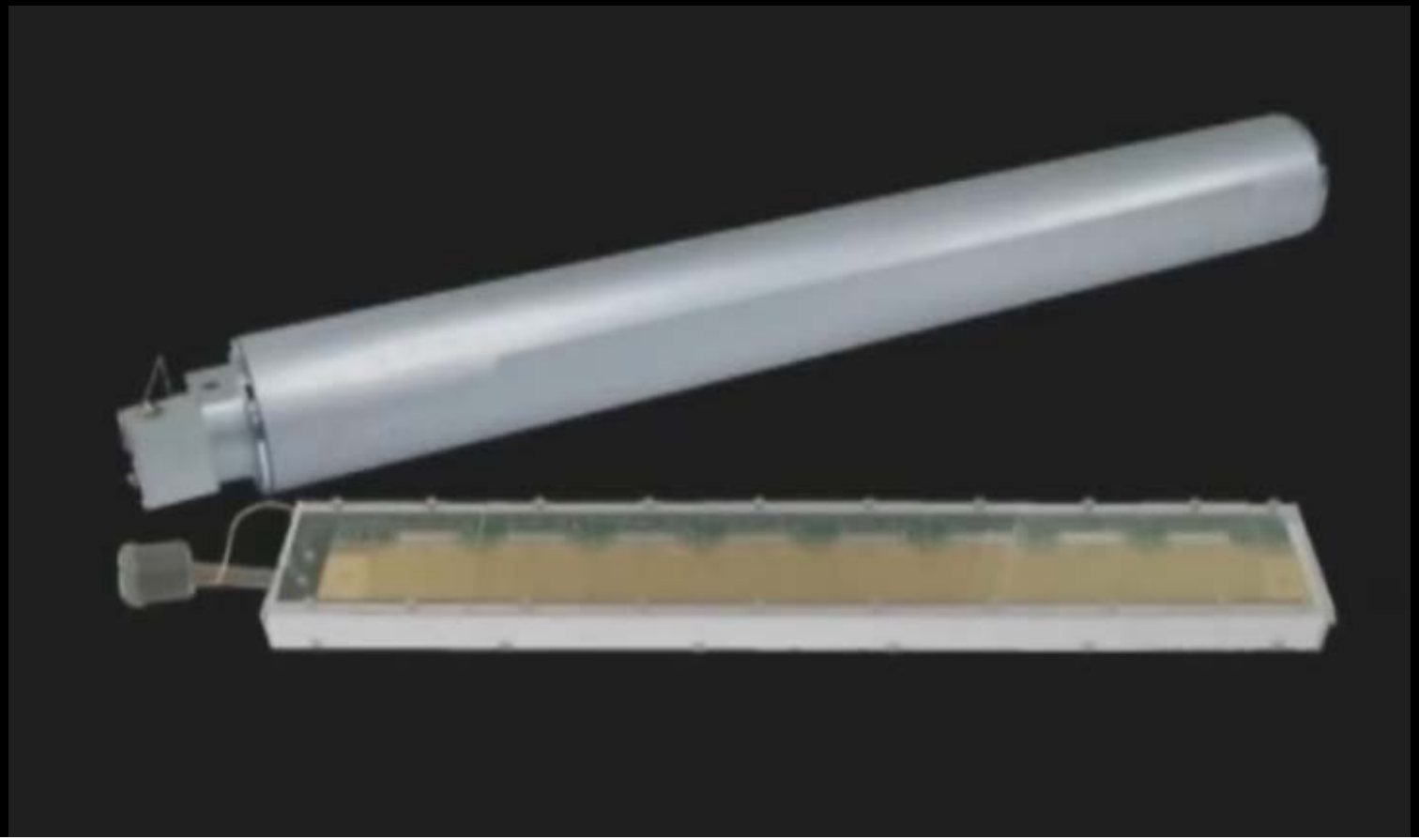


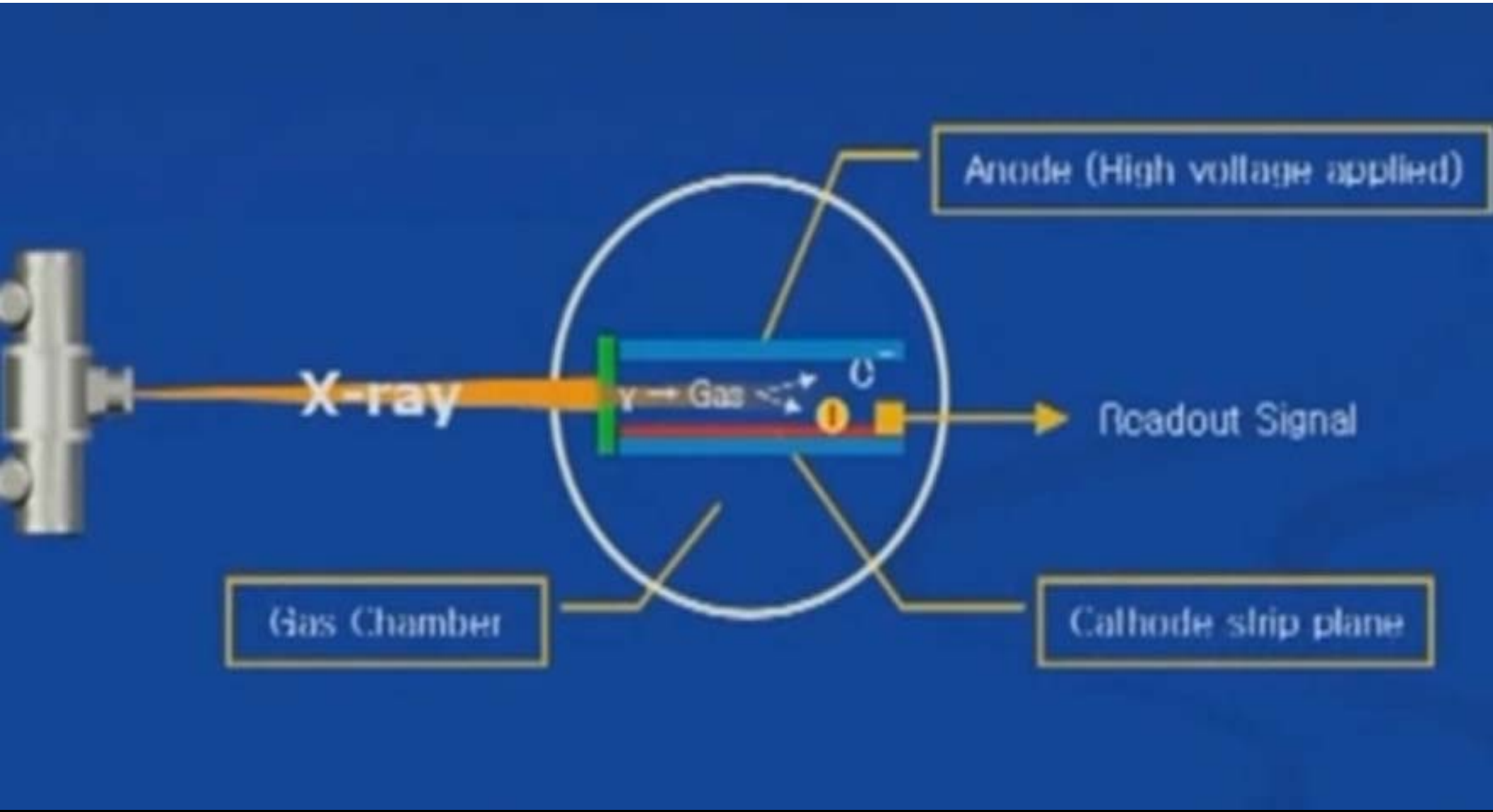
DIGITAL FULL SPINE/LONG BONE
M

http://www.gobizkorea.com/catalog/product_view.jsp?blogId=jbs&objId=875268


X-ray Tube
Collimator
MIC
Detector

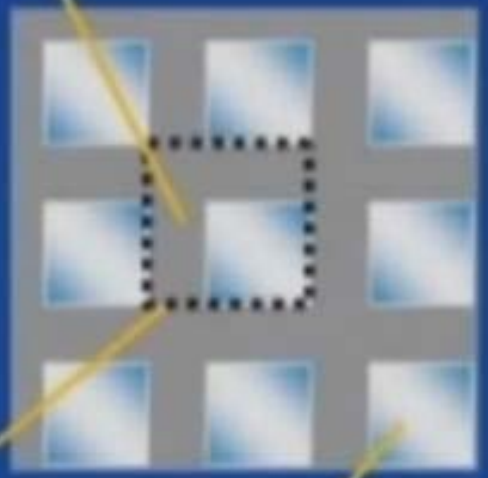
MSGC DECTECTOR




Anode (High voltage applied)
X-ray
Gas
e⁻
Readout Signal
Gas Chamber
Cathode strip plane

Flat Panel Detector

Dead zone



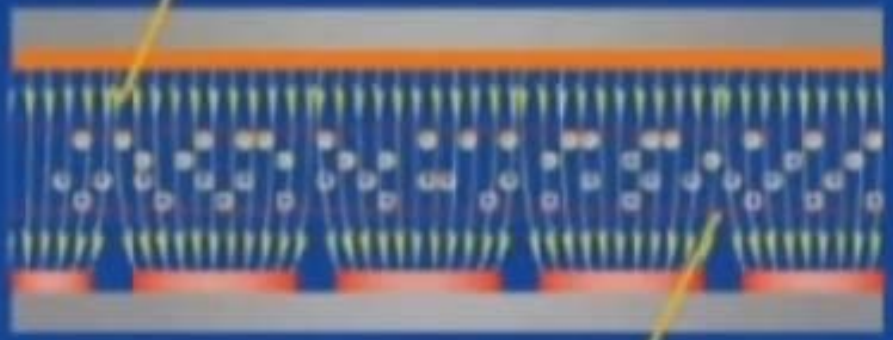
Pixel size

Effective sensing area

Effective sensing area : ~70,80%

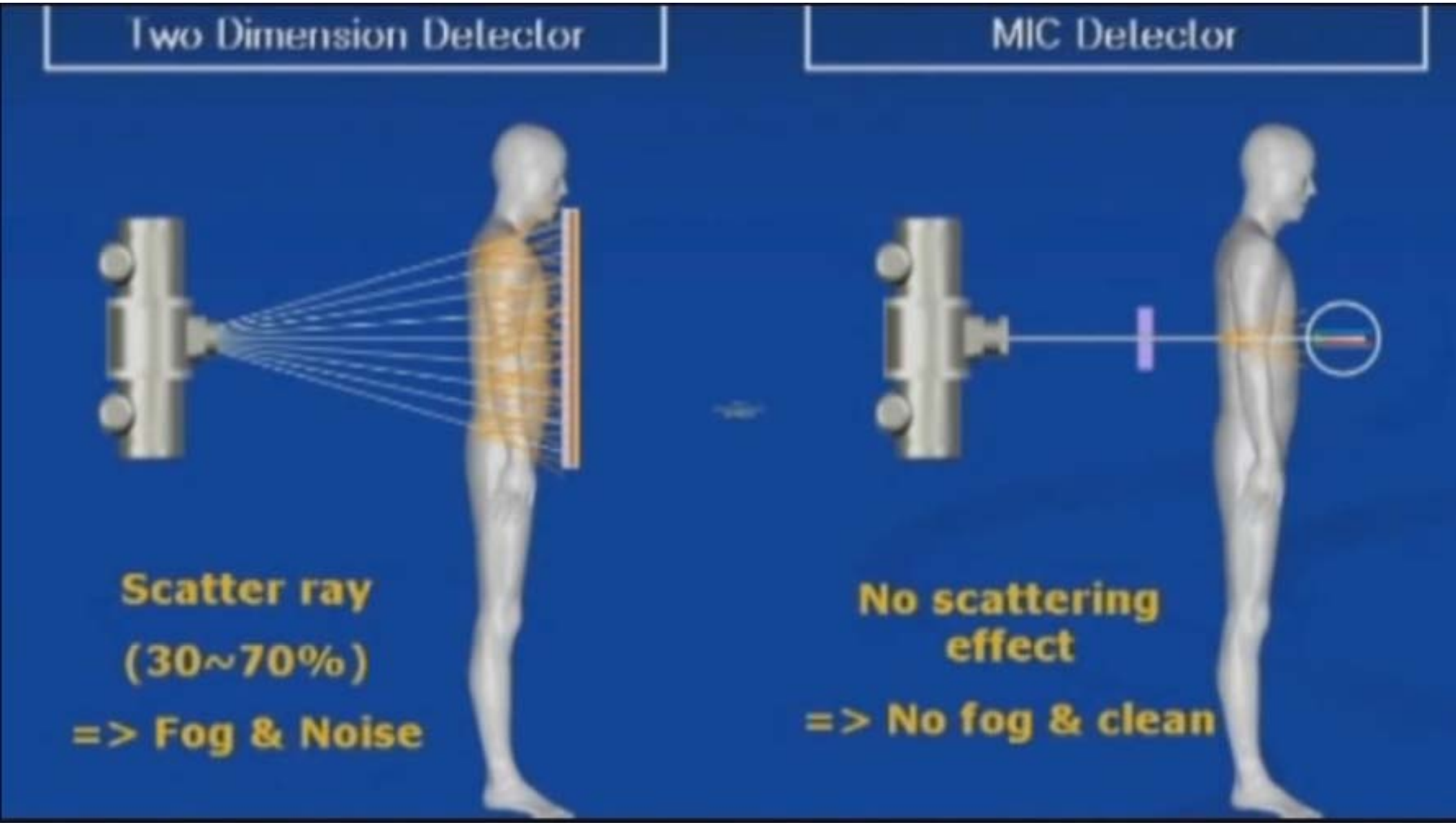
MIC Detector

Electric field lines



No dead zone

Effective sensing area : ~100%


Two Dimension Detector
MIC Detector
Scatter ray
(30~70%)
=> Fog & Noise
No scattering
effect
=> No fog & clean

Two Dimension Detector

Exposure time

: 1/100 ~ 5/100 sec

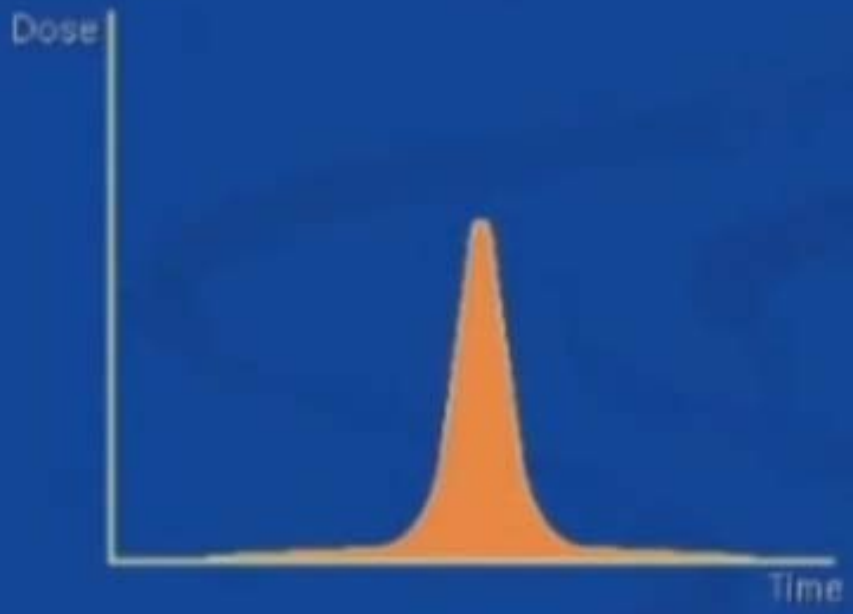
≒ 100 ~ 400 μGy

MIC Detector

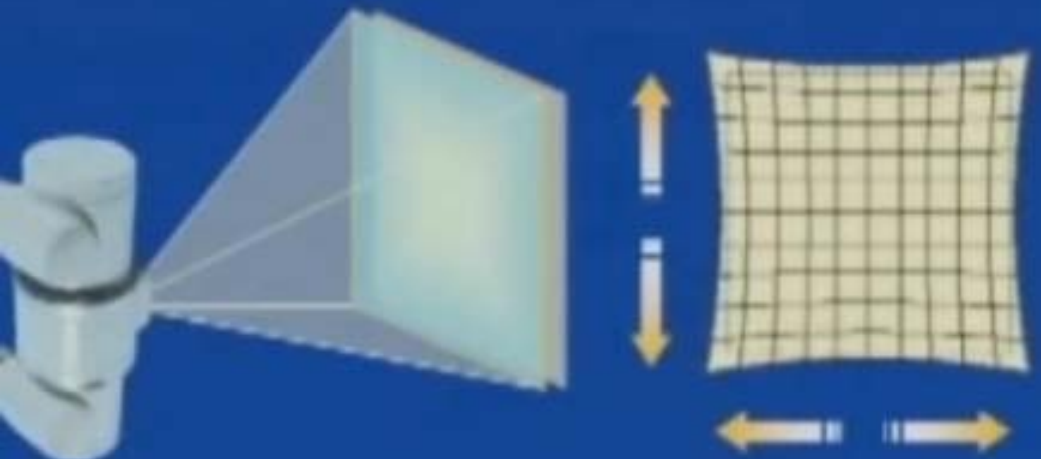
Exposure time

: 1/1000 ~ 5/1000 sec

≒ 60 ~ 80 μGy



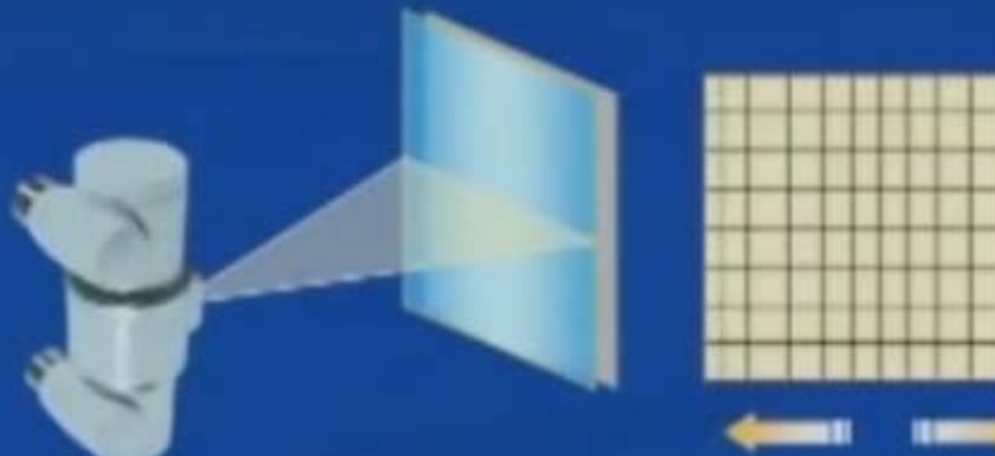
Two Dimension Detector



Distortion

* **Vertical : Magnify**
* **Horizontal : Magnify**

MIC Detector



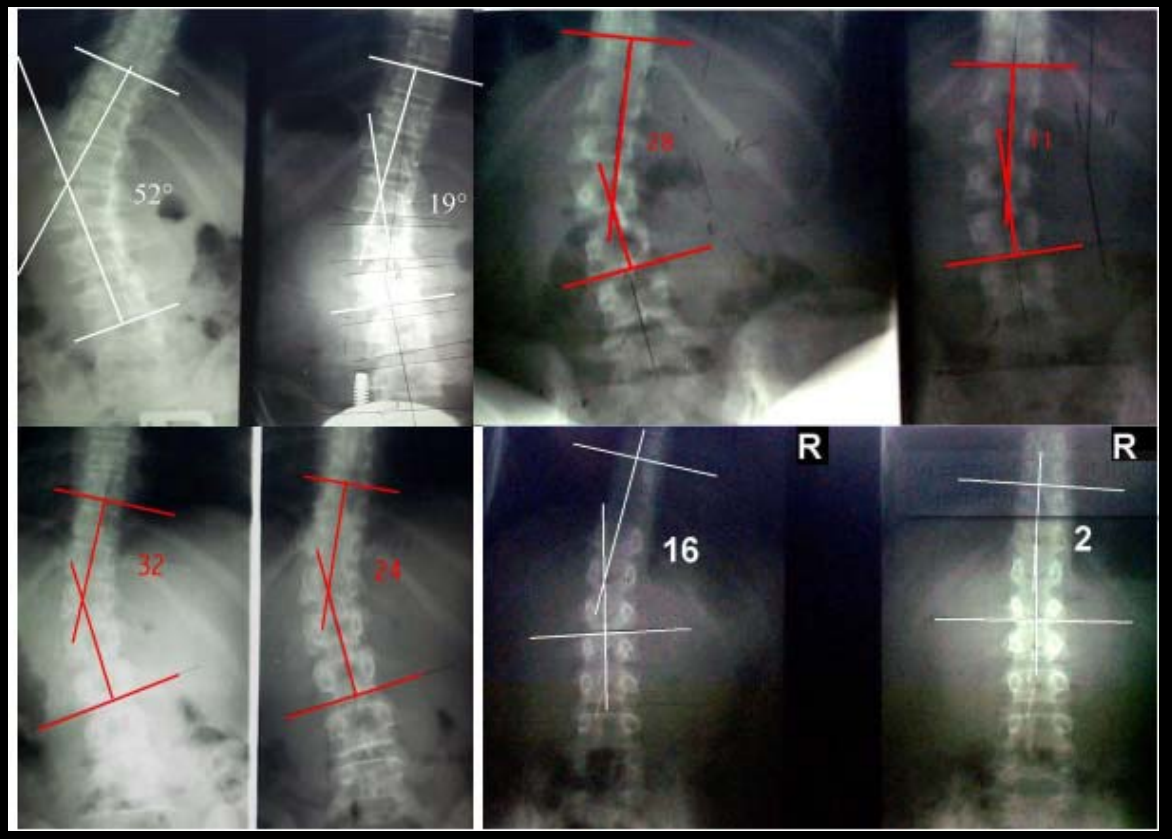
Distortion

* **Vertical : Real size**
* **Horizontal : Magnify**

TWO TYPES OF FLAT PANEL DETECTORS IN DR SYSTEMS

- 1 indirect conversion FPDs
  - outermost layer is scintillator: phosphor screen (caesium iodide or gadolinium oxysulfide)
  - detector: amorphous silicon photodiode
  - convert x-ray to light and then to charge, hence indirect FPDs
- 2 Direct conversion FPDs
  - Outermost layer: high voltage bias electrode
  - Detector: amorphous selenium
  - Convert x-rays to charge directly

- 19 patients with scoliosis
- Manipulation & rehab therapy 4-6 week
- Cobb angles decrease by 17 degree
- BMC musculoskeletal disorder 2004: 5:32



- http://www.ncbi.nlm.nih.gov/pmc/articles/PMC520751/

MANUAL THERAPY FOR ADOLESCENT IDIOPATHIC SCOLIOSIS A SYSTEMIC REVIEW

- Scoliosis 2008, 3:2
- By Michele Roman & Stefao Negrini
- Found 145 texts, but only 3 were chosen as relevant for inclusion.
- Lack of sufficient date to draw any conclusion regarding efficacy of manual therapy for treatment of adolescent idiopathic scoliosis.

ACA POSITION STATEMENT

- **What is the treatment for scoliosis?**

- There are generally three treatment options for scoliosis—careful observation, bracing, and surgery. Careful observation is the most common "treatment," as most mild scolioses do not progress and cause few, if any, physical problems. Bracing is generally reserved for children who have not reached skeletal maturity (the time when the skeleton stops growing), and who have curves between 25 and 45 degrees. Surgery is generally used in the few cases where the curves are greater than 45 degrees and progressive, and/or when the scoliosis may affect the function of the heart, lungs, or other vital organs.

- Spinal manipulation, therapeutic exercise, and electrical muscle stimulation have also been advocated in the treatment of scoliosis. None of these therapies alone has been shown to consistently reduce scoliosis or to make the curvatures worse. For patients with back pain along with the scoliosis, manipulation and exercise may be of help.

- Most people with scoliosis lead normal, happy, and productive lives. Physical activity including exercise is generally well-tolerated and should be encouraged in most cases.

- https://www.acatoday.org/content_css.cfm?CID=2189

WHAT HAPPEN WHEN ETHICS IS VIOLATED?

- Loss of credibility, Image tarnished, reputation is ruined
- Likelihood for excessive regulation, legislative reform
- Internal regulation is almost always better than external government regulation

REVIEW OF EMPIRICAL LITERATURE SELF REFERRAL FOR DX IMAGING

- Two types of self referrals
- 1. physicians that are non-imaging specials refer radiological procedures to be done in their own office; e.g., orthopedists, cardiologists, podiatrists, and chiropractors.
- 2. physicians refer patients to outside imaging center that they have a financial interest or tie, from joint venture, entrepreneurial partnership, etc.

OWN-SITE SELF REFERRING PHYSICIANS

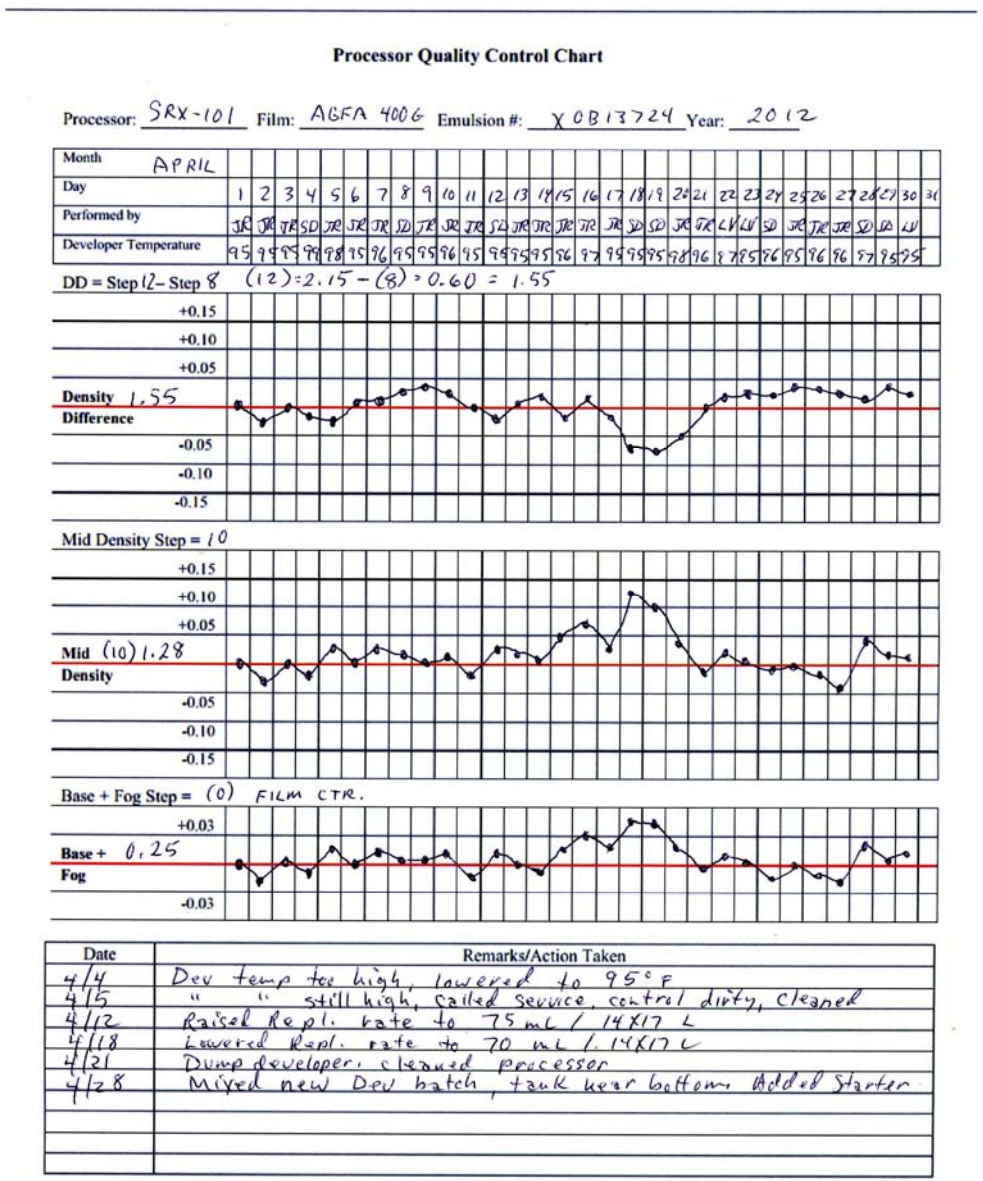
- UTILIZATION RATE of imaging from patients of self-referring physicians is 2.11-11.1 times as high as those from non-self-referrers
- COST incurred is 3.0 – 17.1 times higher per episode of imaging procedures
- UNACCEPTABLE QUALITY- 60% of spine x-ray from chiropractor, 18% from orthopedists, and 17% from radiologists (Pennsylvania Blue Shield study)
- EQUIPMENT CONDITION & PATIENT SAFETY INSPECTION FAILURE RATE –(by Blue Shield in Massachusetts privilege programs)
  - 55 of 256 chiropractors
  - 41 of 179 podiatrists
  - 1 of 130 orthopedic surgeon
  - 5 of 40 OBGYN
  - 1 of 84 primary care
  - 1 of 33 cardiologist
  - 2 of 16 other specialists
- http://www.ajronline.org/doi/full/10.2214/ajr.179.4.1790843

RADIOLOGICAL HEALTH BRANCH CA STATE HEALTH DEPARTMENT

- Enforcement: inspection of DC x-ray operation in 2013
- Mandate a Quality Assurance Program for Darkroom Processor owner
- Cost of new equipment and training can cost $1500

QUALITY CONTROL PROGRAM FOR DARKROOM

- Monthly processor QC chart
- Base fog density
- Mid density (speed)fluctuation
- Density difference (contrast) fluctuation



Processor Quality Control Chart

Processor: SRX-101 Film: AGFA 4006 Emulsion #: X0B13724 Year: 2012

Month	APRIL																													
Day		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Performed by		JR	JR	JR	SD	JR	JR	JR	SD	JR	JR	JR	SD	JR	JR	JR	JR	JR	SD	SD	JR	JR	CH	LH	SD	JR	JR	JR	SD	SD	LH	
Developer Temperature		95	95	95	96	98	95	96	95	95	96	95	96	95	95	95	96	97	95	95	95	96	98	96	85	86	85	96	96	97	95	95

DD = Step 12 – Step 8 (12) = 2.15 – (8) = 0.60 = 1.55

Density Difference: +0.15, +0.10, +0.05, 1.55, -0.05, -0.10, -0.15

Mid Density Step = 10

Mid Density (10) 1.28: +0.15, +0.10, +0.05, -0.05, -0.10, -0.15

Base + Fog Step = (0) FILM CTR.

Base + Fog: +0.03, 0.25, -0.03

Date	Remarks/Action Taken
4/4	Dev temp too high, lowered to 95°F
4/5	" " still high, called service, control dirty, cleaned
4/12	Raised Repl. rate to 75 mL / 14X17 L
4/18	Lowered Repl. rate to 70 mL / 14X17 L
4/21	Dump developer, cleaned processor
4/28	Mixed new Dev batch, tank near bottom. Added Starter

RESULTS:

- Few DC convert their equipment into CR or DR digital system
  - If there is enough patient volume to justify the financial investment
  - Tend to take more x-ray examinations after the switch
- Other DC give up their x-ray equipment and refer all imaging outside
  - Reimbursement from insurance is lower than before
  - Patient flow is low
  - Chemistry cost is a fixed cost
  - Plenty of imaging centers nearby
- Most other DC postpone their buying of the equipment until they are inspected by the Health Department. Then they would rush out and purchase the QA program
- Overall: less and less x-rays are taken by chiropractors. X-ray machine is no longer a profit center

CONCLUSION:

- If our profession is to survive, we have to prove our contribution, or value created for our patients each and every single day.
- Adherence to some of the very basic ethical principles in our daily practice with a patient-centered approach is the one of the way to guarantee that we don't lose sight of what our ultimate mission, gaols and objectives ought to be.
- Getting results for the patient is not enough for our scientific minded community.
- We need to continue with research to understand why and how thing works, what else can work better, bring better results to our patients
- In the process of ethical research, we can shape protocol, change policy and influence the community we serve in a positive way.

THANK YOU FOR YOUR ATTENTION

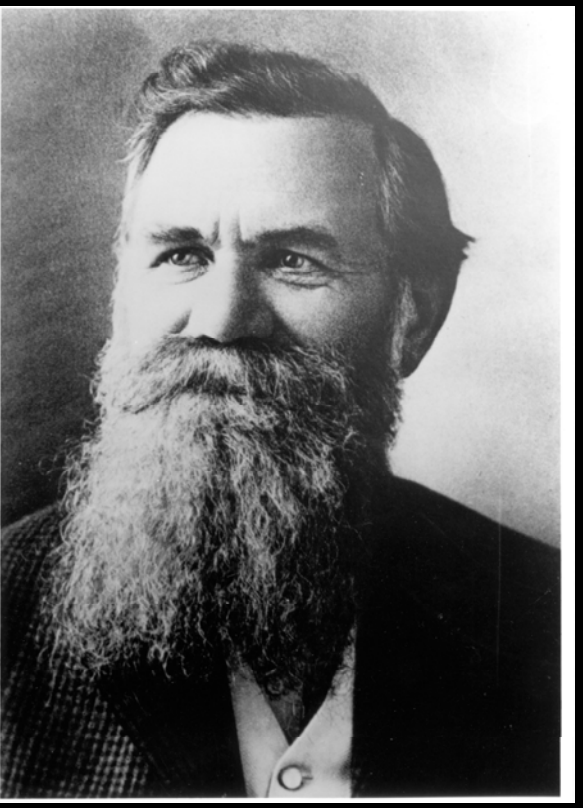
DIGITAL X-RAY EQUIPMENT

- Save cost: on films and dark room services
- Save space: no need for a dark room
- Improve quality of the films: better contrast
- Repeat exposure rate: decreased
- Radiation exposure per projection: may actually increase

CAN DIGITAL X-RAY EQUIPMENT GUARANTEE BETTER QUALITY?

- CR Computed Radiography
- CCD DR: Charge Coupled Device
- Flat panel DR: use a thin Film Transistor (TFT)that capture the electrons , generated by ionizing radiation.

HISTORIC CHANGES IN CHIROPRACTIC RADIOLOGY



Chiropractic & Radiology are distinctly separate disciplines

D. D. Palmar was a magnetic healer

- restored hearing of Harvey Lillard in 1895
- Spiritual healer that emphasizes universal intelligence.
- Almost consider chiropractic as a religion

Wilhem Conrad Roentgen was a German Physicist

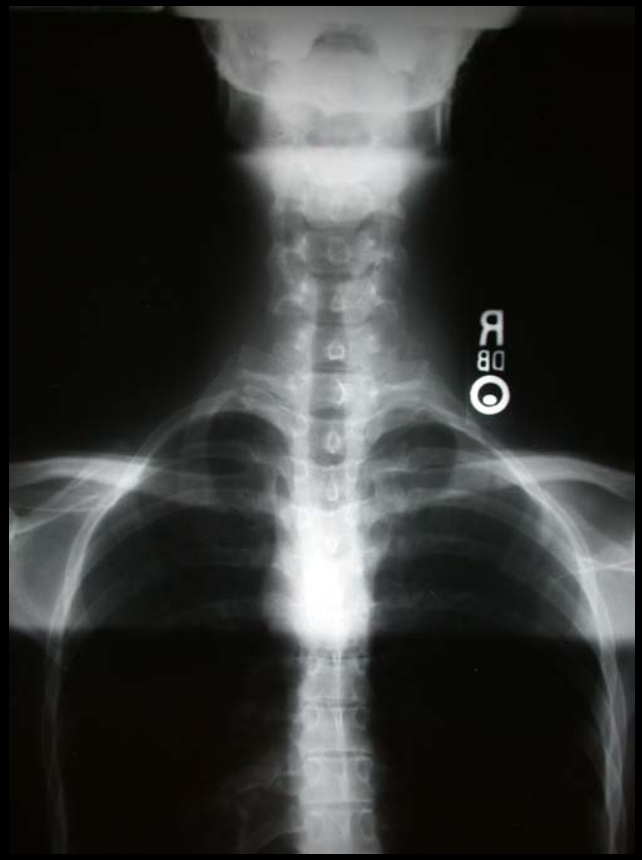
- Accidentally discovered x-ray with cathode tube on Nov 8, 1895
- First scientist that systematically studied x-ray

RESISTANCE TO THE MARRIAGE

- Joy Loban, DC taught philosophy class in Palmar College in 1910
- Led a group of 50 students, walked out of Palmar School of Chiropractic
- Started another Universal College of Chiropractic UCC
- Due to introduction of radiograph betraying the philosophy of subluxations
- Finding subluxation is supposed to be by hands only
- Ironically, UCC moved to Pittsburg years later and eventually perfected the split screen full spine radiography.

- http://www.dynamicchiropractic.com/mpacms/dc/article.php?id=53318
- Stephen M. Perle & Larry Wyatt, Chiropractic dynamic Jul15 2008 vol 25, issue 15

SUBOPTIMAL QUALITY SERIES



JUVENILE MALE

- Only AP lumbar film taken
- Scoliosis is mild
- Incidentally find an artifact
  - Prior surgery
  - Body piercing
  - Swallowed a pen
  - Clothing artifact
  - Rectal foreign object

IS THE DOCTOR LIABLE FOR DELAYED MISDIAGNOSIS OR PAIN AND SUFFERING?

- Usual and customary
- Standard of care
- Use of best practice