



*Common CLINICAL Mistakes and how to
avoid them: Lessons from ACR CT
accreditation*

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Learning Objectives

- Survey of the clinical component of the ACR CT accreditation process
- “Vital” Statistics
 - Analyze number of submissions for each category
 - Number of failures by category of submission
 - Most common reason(s) for failure by submission type
- What are take home points for practices looking to gain ACR accreditation

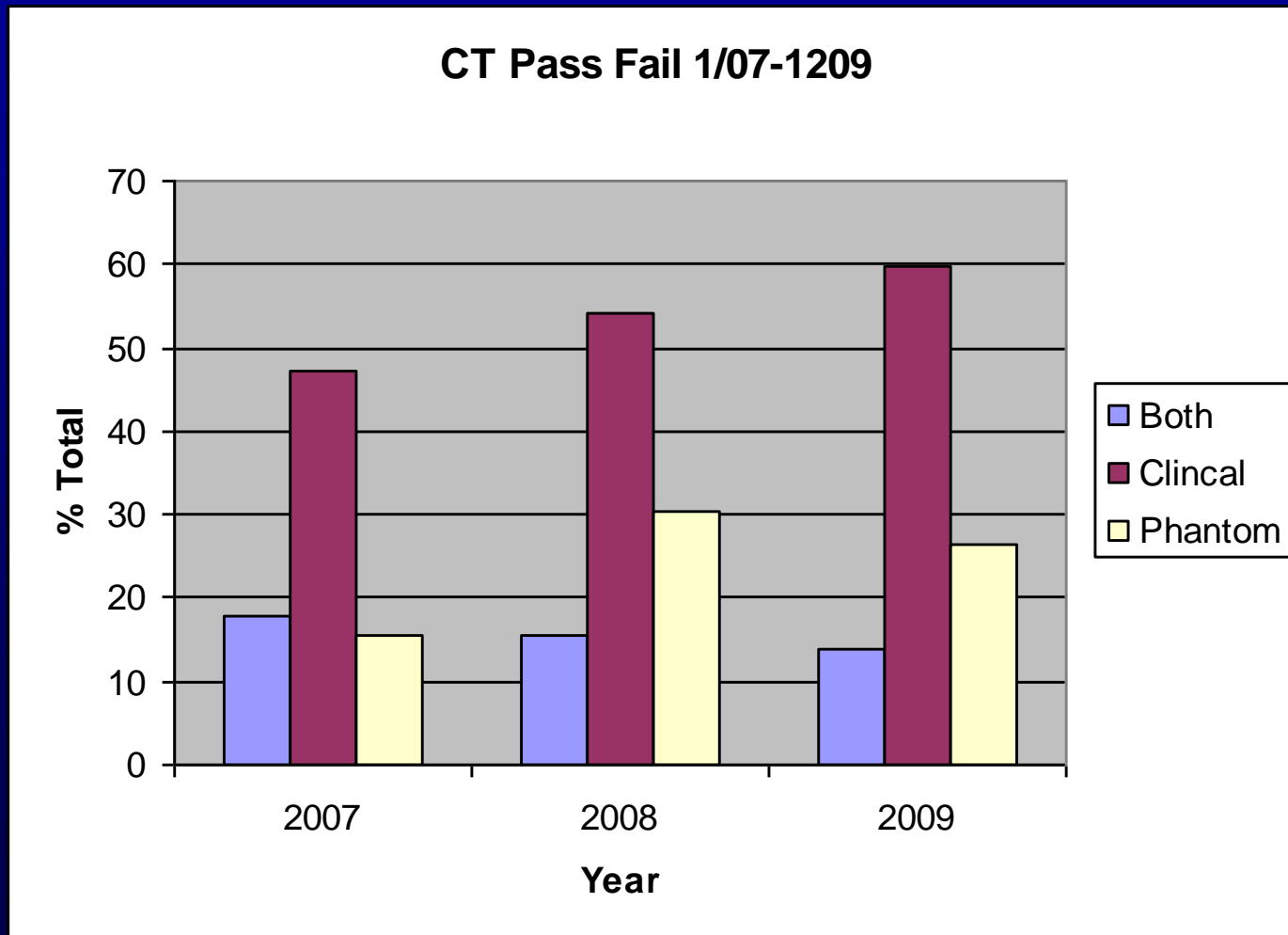


CT accreditation and reimbursement for services

- Section 135(a) Medicare Improvements for Patients and Providers Act of 2008
 - Designates organizations to accredit advanced diagnostic imaging services
 - ACR chosen as one of 3 national organizations to designate this accreditation
 - JACHO- accredits hospital sites
 - Intersocietal Accreditation Committee- many non radiology societal sponsors
 - Interpreting MD does NOT require ABR certification or formal radiology training. Dose values do not need to be reported
- Sites **MUST** be accredited by 1/2012 if they expect to obtain Medicare payment for services.



Clinical Errors are major source of failure





CT accreditation-Clinical Images-Overview

- Site must submit 1 examination from each of 3 areas
 - Head/neck
 - Chest
 - Abdomen/Pelvis
- If site examines pediatric patients (1-15 years) 1 of 3 submissions **MUST** be a pediatric case
- 1 examination **MUST** be a subspecialty examination
 - This can be adult or pediatric



CT accreditation Clinical Images: Head/neck

- Head
 - Headache, neoplasm
- Temporal Bone
 - Hearing loss
- Cervical Spine
 - Trauma
- Pediatric
 - Head-seizures
 - Sinus
 - Temporal Bones



CT accreditation Clinical Images: Chest

- Chest
 - Lung cancer
- Pulmonary Embolus
- HRCT
- Aortic Dissection
- Pediatric
 - Metastases, cough, infection
 - HRCT- diffuse lung disease



CT accreditation Clinical Images: Abdomen

- **“Routine”**
 - Lymphoma
 - Liver metastases
- **Known Renal Mass**
- **Known cirrhosis**
- **Suspected Pancreatic cancer**
- **Pediatric**
 - Routine abdomen- trauma
 - Renal or adrenal mass



CT accreditation

- ACR provides detailed instructions as to how the study should be performed
 - Clinical indication
 - Appropriate number(s) of images for each film sheet
 - Need for “scoutview” both plain and annotated
- **Clinical CT accreditation is a QA exercise; attention to detail and ability to follow instruction are as important as “nice” images**



CT Accreditation: Evaluation Parameters

- Technique
- Anatomic Coverage and Display
- Filming technique
- Artifacts
- Exam Identification
- Exam Protocol



CT accreditation; Components of Clinical Evaluation (1)

- Technique
 - Radiation dose as function of mAs, kVp, pitch
 - Reconstruction algorithm
 - Intestinal opacification
 - IV contrast timing
 - Appropriate use of ROI cursors
 - Appropriate vs. excessive acquisitions in same body region



CT accreditation; Components of Clinical Evaluation (2)

- Anatomic Coverage/Display
 - Complete z-axis coverage
 - Appropriate windows are displayed
 - EG- bone windows/soft tissue windows
 - Appropriate window/levels used
 - Proper DFOV
 - Includes patient centering
 - Ancillary image data windowed appropriately
 - Liver and lung windows



CT accreditation; Components of Clinical Evaluation (3)

- **Filming**
 - Number of images/sheet
 - BOTH annotated and Non annotated scout views are displayed
 - Film density



CT accreditation; Components of Clinical Evaluation (4)

- Artifacts
 - Missing slices
 - Scans with excessive motion



CT accreditation; Components of Clinical Evaluation (5)

- Exam Identification
 - Appropriate alpha numerics
 - Technologist name
 - Institution
 - Recon algorithm/kernel



CT accreditation; Components of Clinical Evaluation (6)

- Protocol
 - Concordance with submitted protocol
 - Adequacy of protocol
 - Proper exam submission



Scoring

- Each category scored 1(worst) to 5(best)
 - Check marks for each component of that category
- If site gets a single “1” or two “2” the submission fails
 - Reviewer may further elaborate in free text



CT Accreditation: General Assumptions

- Submitted case should reflect BEST available
- Film contrast/brightness should appear “true” to scanner output
- Alpha numeric information should be crisp, without gaps
- Slice width, slice interval, table position must be visible to the reviewer
- A protocol sheet must be included for each submission
- Protocols should be designed to answer clinical question with *minimal* radiation



Dose and accreditation: Critical Link

- Site **MUST** complete CTDIvol measurements for each SCANNER using site specific protocols for
 - Adult head: Routine head CT for evaluation of patient with headaches to exclude neoplasms
 - HRCT chest: CT exam of the chest for evaluation of diffuse lung disease
 - Adult abdomen: Routine oncologic CT survey of the abdomen for detection of possible liver metastases
 - Pediatric abdomen (assume pt. is 5 years old) abdomen for the evaluation of blunt trauma injuries
- These results are reported in Table 1 by the physicist.
- Site **MUST** report CTDIvol for each submission
- Not all scanners in field can report CTDIvol
 - Although most MDCT built >2002 can report this
 - CTDIvol measurements are **NOT** required to be included in the submission



Radiation Dose

- ALL reviewers are highly sensitive to the need for assuring the site uses technique parameters that deliver a low radiation dose without loss of quality
- However experienced CT radiologists cannot predict delivered dose (as CTDIvol) from
 - Visual inspection of the image
 - Factoring the reported kVp, ma, mAs



Prediction of Delivered Dose

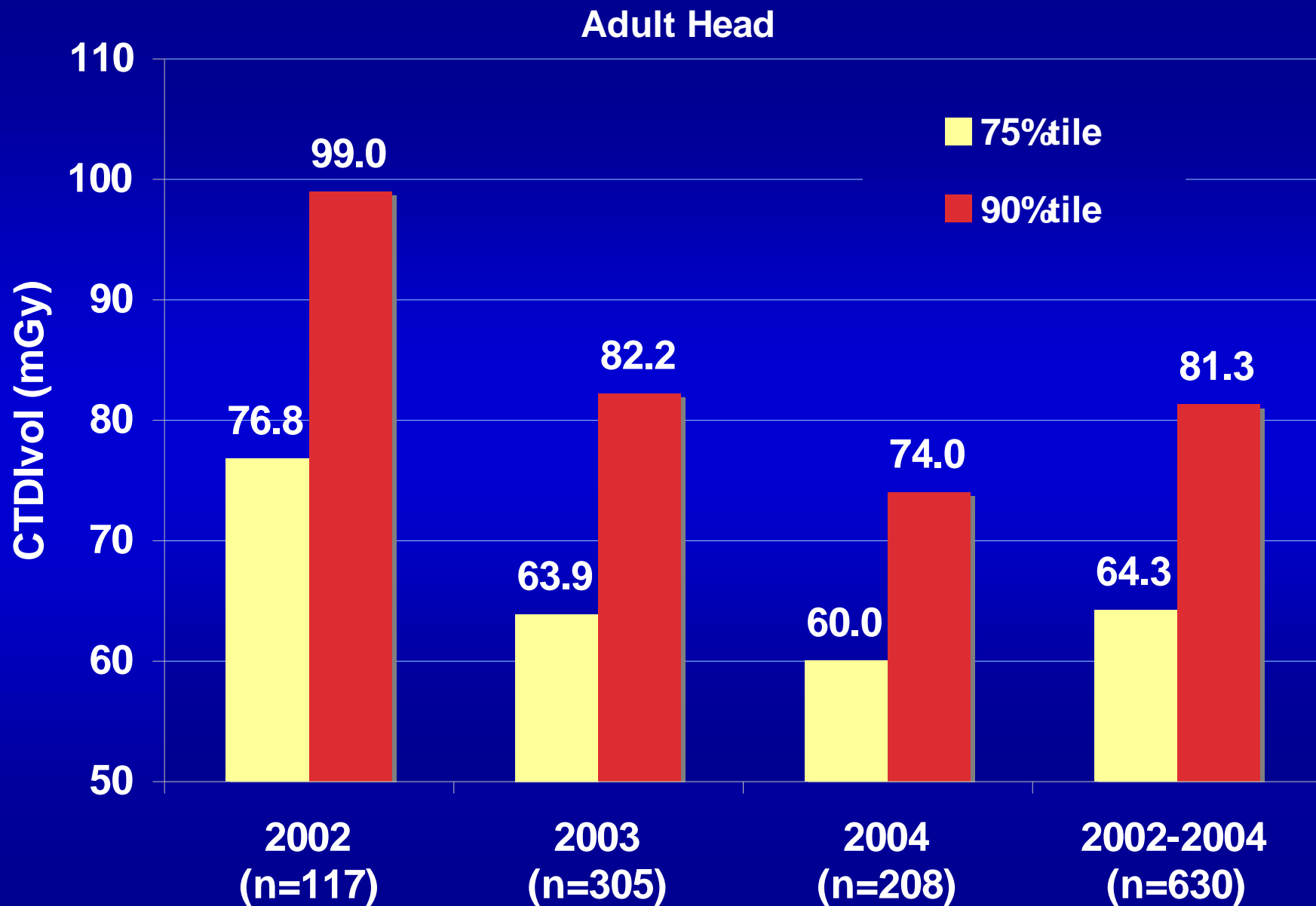
Zeman et al RSNA 2006

- Using kVp and mAs values on the images allowed recognition that submitted study **EXCEEDED** diagnostic reference level (DRL) in 21.3% (2002-4 values)
- Performance **DECREASED** to 13.1% success in predicting that the delivered dose was too high using post 2008 standards.
- **mAs is NOT the proper measure of CT dose.**



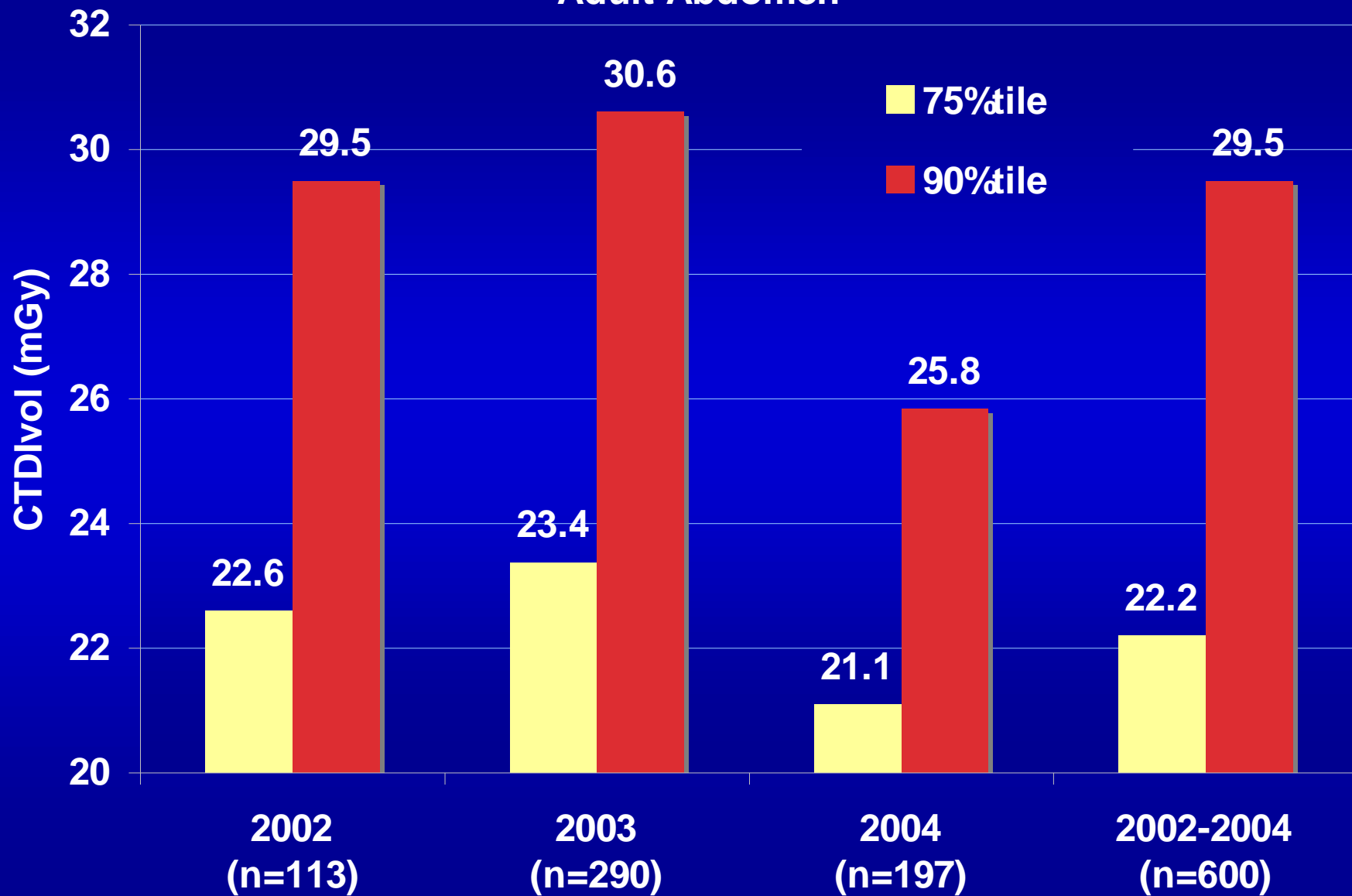
Dose is decreasing – (at least the numbers are getting smaller!)

YEAR	% Of submissions > Recommended RV		
	Adult Head	Adult Abdomen	Pediatric Abdomen
2002	50	8.2	16.4
2003	32.4	7.6	13.7
2004	23.5	4.4	9.0



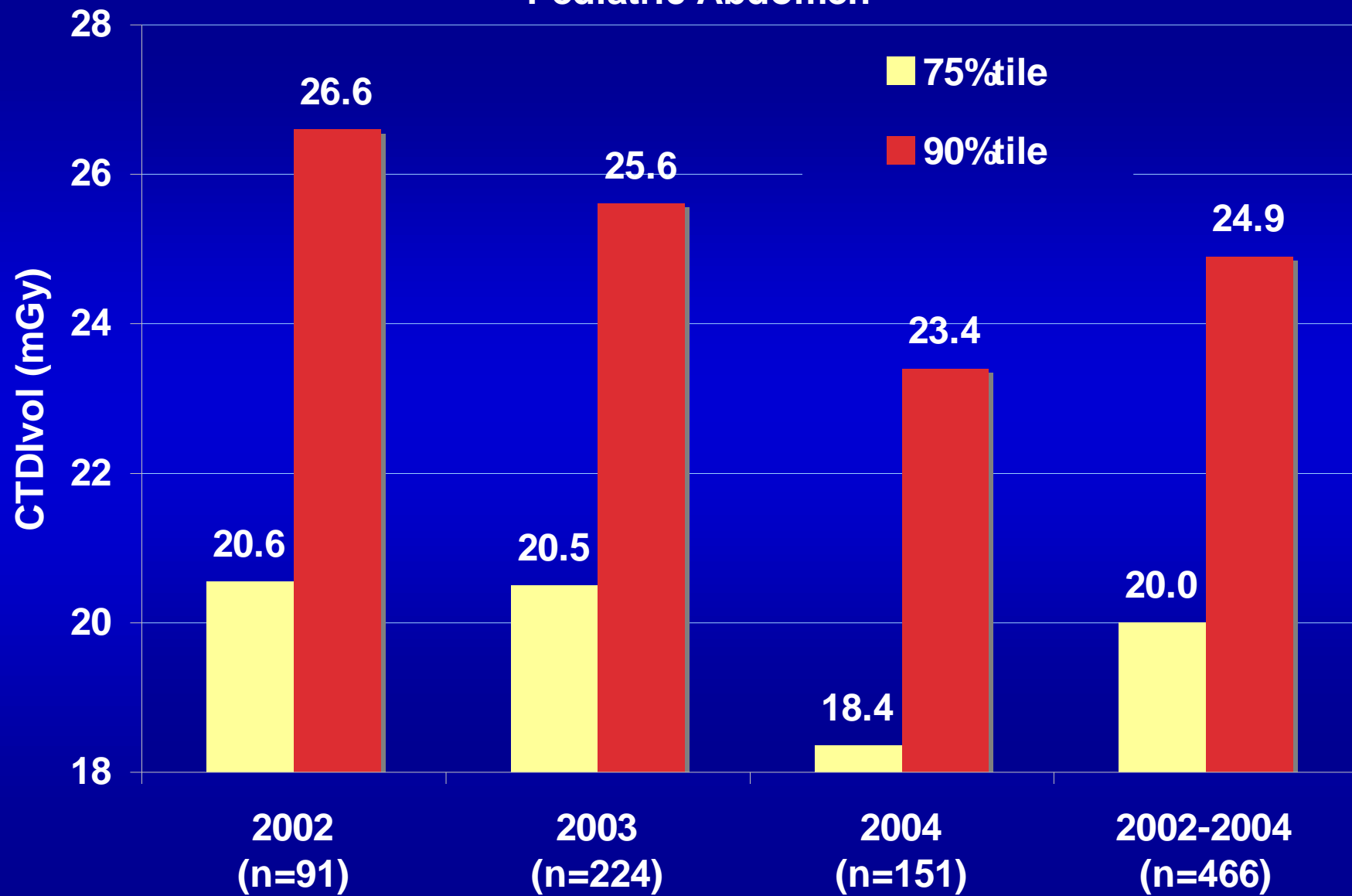


Adult Abdomen





Pediatric Abdomen





Clinical Accreditation: Vital Statistics

- Between 1/2007-12/2009
 - Total Exams submitted- 16384
 - Total Failures (all cycles)- 2075

% Failures- Initial and Renewal			
Year	% Fail on 1 st attempt	% Fail on 2 nd Attempt	% Fail on 3 rd attempt
2007	36% initial 26% renewal	16% initial 10% renewal	12.5% initial 15% renewal
2008	37% initial 27% renewal	12% initial 18% renewal	16% initial 33% renewal
2009	33% initial 26% renewal	10% initial 10% renewal	No data



Failures by Submission Type- Routine Studies 2007-2009

Exam	# Submissions	# Failures	%
Abd CT Adult	3265	369	11.3%
Chest CT-Adult	1959	75	3.8%
Head CT Peds	1716	158	9.2%
Head CT Adult	1709	265	15.5%
Sinus Peds	1015	96	9.5%
Abd CT Peds	685	69	10.1%
Chest CT Peds	74	2	2.7%
Totals	10423	1034	9.9%

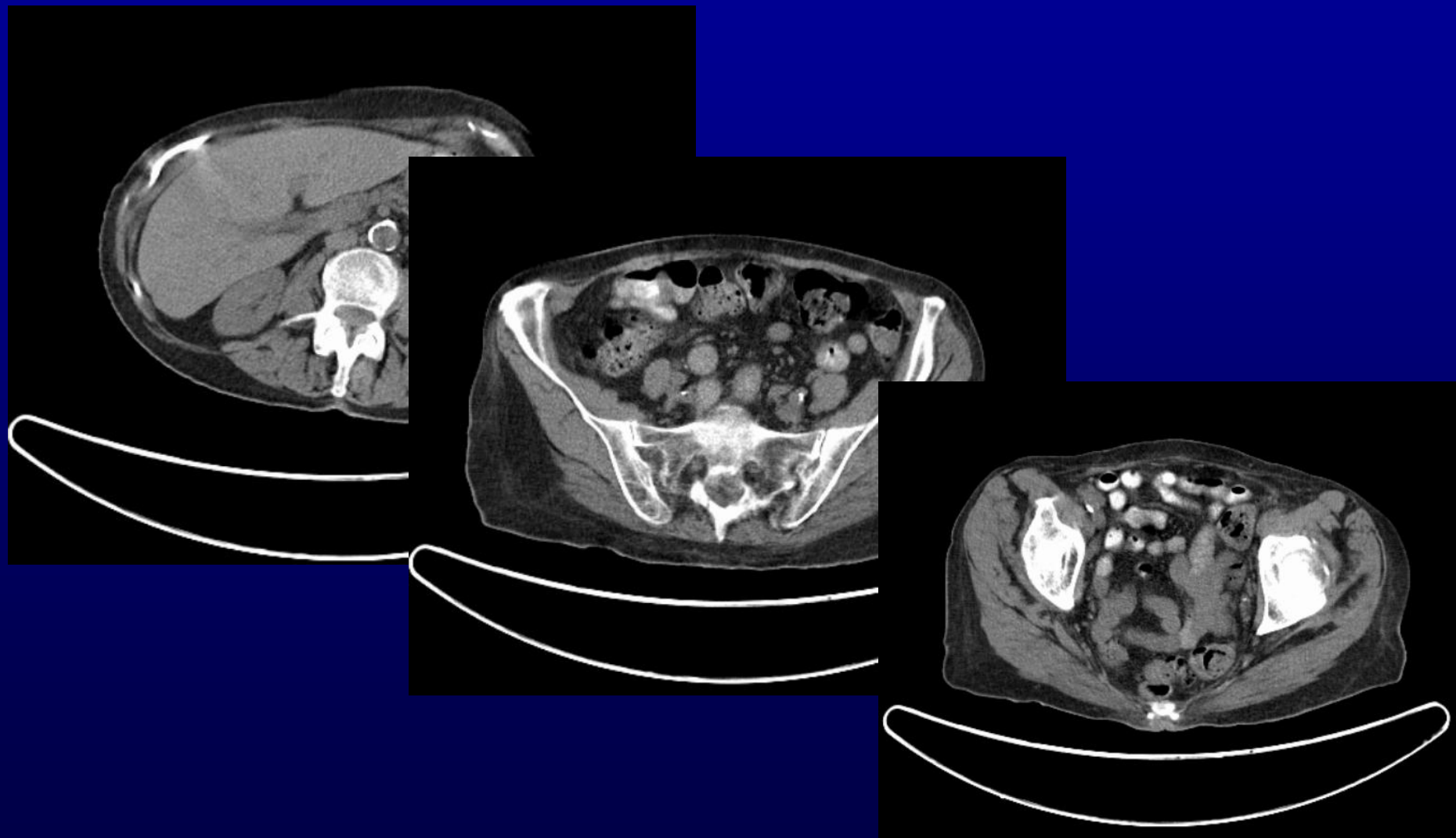


Common reasons for failures-routine

Exam	Top Deficiency	% Exams failed that included this deficiency
Adult Abdomen	IV Contrast Volume	37.1%
	IV contrast delay (too early/late)	26.4%
	Inappropriate Oral Contrast	41.4%
	Inappropriate contrast phase	30.0%
	Excessive sequential images through body part	28.8%
Adult Head	IV Contrast Volume	52.1%
	mAs inappropriate for examination (too high/low)	21.3%
	Excessive sequential images through body part	10%
Peds Head	mAs inappropriate for examination (too high/low)	67.7%
	Excessive sequential images through body part	12%

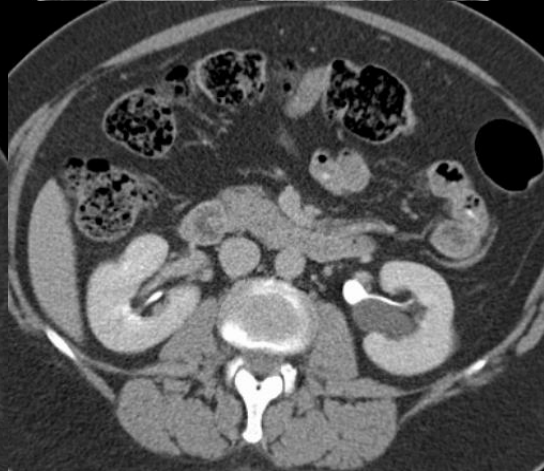
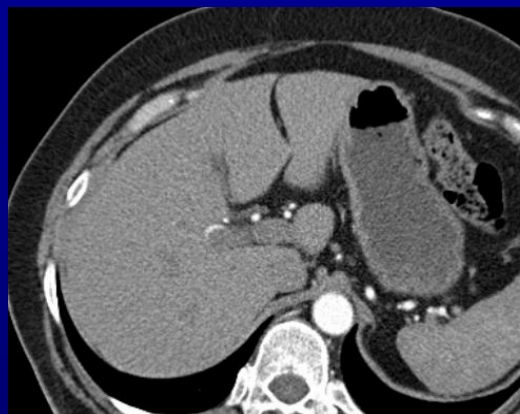


Clinical Example: Poor oral contrast





Inappropriate contrast timing





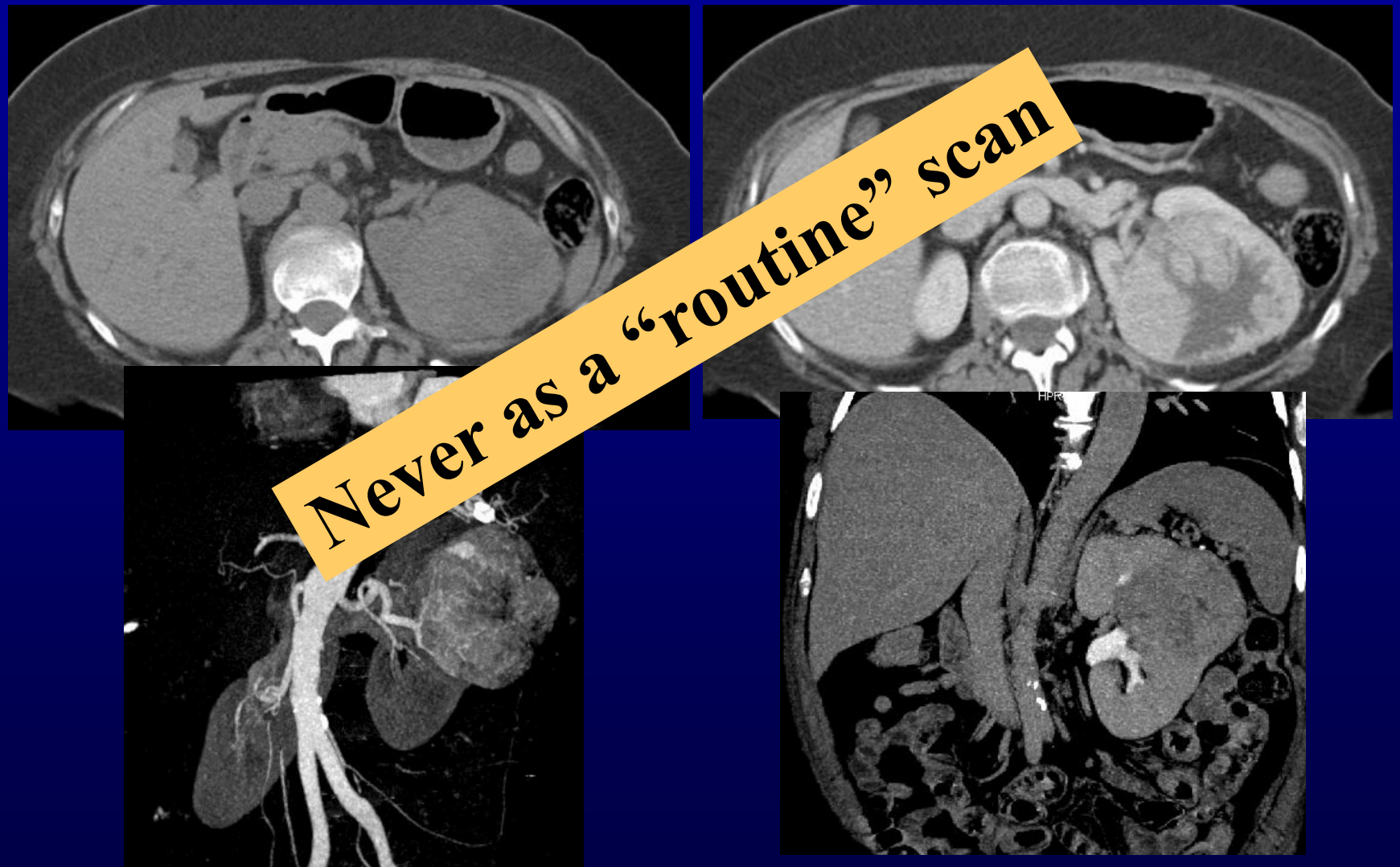
Effect of excessive sequences

Total mAs 14525 Total DLP 2203

	Scan	KV	mAs / ref.	CTDIvol	DLP	TI	cSL
Patient Position F-SP							
Topogram	1	120				5.3	0.6
N_C KID	2	120	250 / 250	16.94	434	0.5	1.2
Contrast					121 ml	0.0 ml/s	
PreMonitoring	3	120	40	5.41	5	0.5	0.6
I.V. Bolus					121 ml	0.0 ml/s	
Monitoring	4	120	40	43.26	42	0.5	0.6
CTA KID	12	120	240 / 240	18.36	454	0.5	0.6
NEPHR120sec	13	120	225 / 240	17.26	836	0.5	0.6
UROGR.	14	120	219 / 225	16.79	432	0.5	0.6



When is this protocol justified?





Failures by Submission type-Specialty Studies 2007-2009

Exam	# Submission	# Failure	%
Pulmonary Embolus	2158	229	10.6%
Renal Mass	1172	515	43.9%
HRCT Chest	1097	101	9.2%
Temporal Bones	306	39	12.7%
Pancreatic Carcinoma	304	59	19.4%
Known Cirrhosis	160	18	11.3%
Aortic Dissection	136	16	11.8%
Temporal Bones Peds	133	19	14.3%
C-spine Peds	59	6	10.2%
HRCT Chest Peds	11	0	0.0%
Adrenal Renal Mass- Peds	3	2	66.7%
Totals	5961	1041	17.5%



Common Reason for failure: Specialty

Exam	Top Deficiencies	% Exams failed that included this deficiency
Renal Mass	Inappropriate or no use of ROI measurement	37.1%
Adult PE	Slice thickness >3mm	30.8%
	Excessive Sequential Images	23.3%
	Lungs not completely scanned	52.3%
	>12:1 film format	57.4%

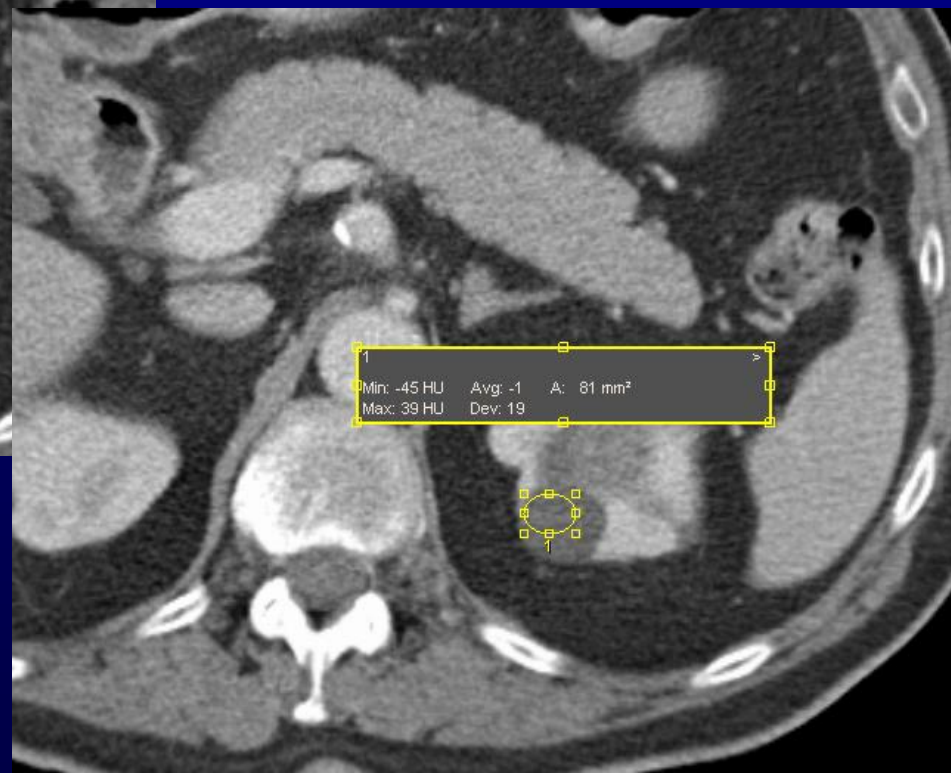


Renal Mass example: No cursor





Renal Mass example: Inappropriate placement



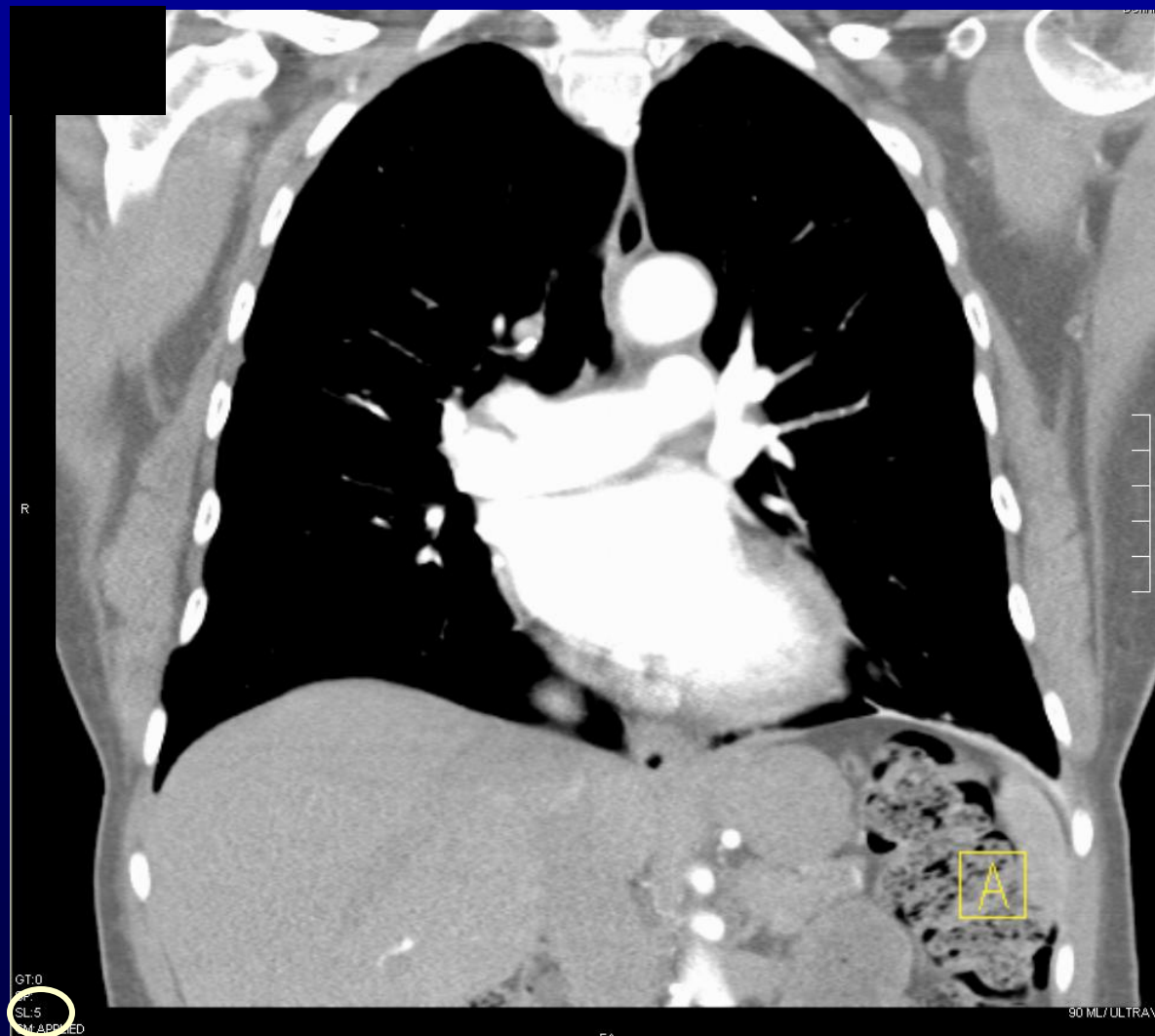


Renal Mass example: Correct placement





Failure: PE protocol





5 pointers for radiologists- from a “battle tested” reviewer

- 1. Follow directions CAREFULLY
 - I will fail you for errors such as wrong number of images/film, not providing scouts etc.
- 2. Follow your protocol
 - IF there is a mismatch, between what you say you do and you submit, I will fail you
 - Correlate the values your physicist enters in table 1 with your clinical work- this communication is crucial
- 3. Submit a set of images that you would like to “show-off” your practice
 - Cases that appear to be thrown together to satisfy an exam type will trigger me to look for objective reasons to fail you
- 4. Do **NOT** try to over scan with multiple phases unless it is indicated
 - I will assume you get multiphase acquisitions on every case that comes through the door- and that means you are delivering too much dose, and you will fail
- 5. Delegate one of your techs to choose the best case, assure compliance with protocol
 - Radiologists are generally too busy (or at least perceive themselves to be) to look at the detail needed for an ACR submission
 - The same tech should be empowered to collect the submissions at all of the sites in your “enterprise”