



POW!

CT-PROTOCOL OPTIMIZATION WORKSHOP

OPTIMIZE TODAY. EMPOWER TOMORROW.



C-TECC

CT Education and Collaboration Collective



BAM!: Building and Modifying CT Protocols

Scanner specific instructions

Examples:

- Info you get from your apps person
- Info you read out of the scanner's user manual

Indication specific instructions

Examples:

- # phases for various indications
- Timing delays

Information our techs memorized

Examples:

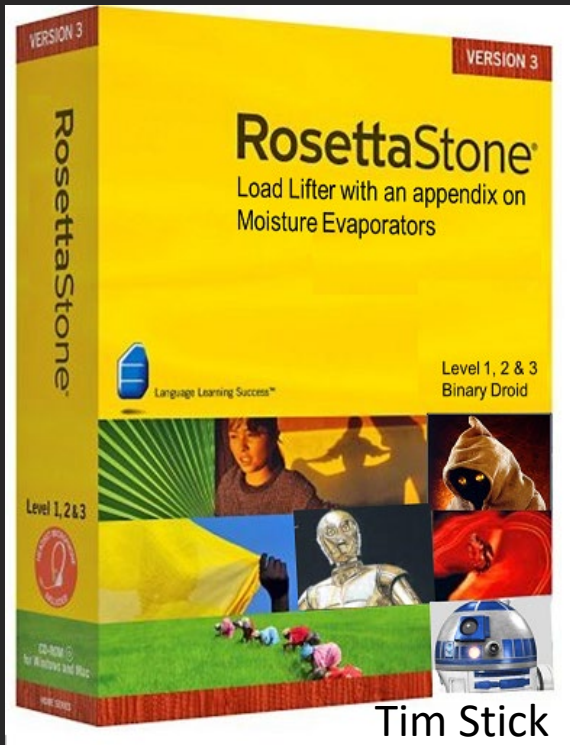
- Hospital guideline on Foley catheter
- Injector loading instructions

All of this information
needs to get
documented
somewhere

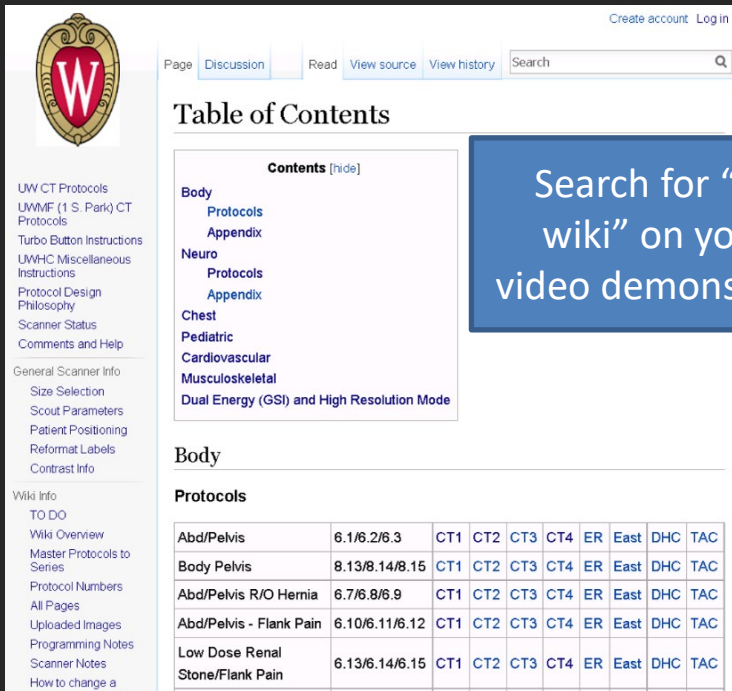
But not in every
protocol...

ESSENTIAL ELEMENTS OF A PROTOCOL: RESOURCES

- AAPM lexicon
 - “Rosetta stone” Of CT scanners
 - Best resource for sites using multiple vendors
 - Great resource for sites desiring to come up with their own standard layout for CT protocol information
 - May point your team to consider facets of your protocols you currently do not document



ESSENTIAL ELEMENTS OF A PROTOCOL: RESOURCES



UW CT Protocols
UWMF (1 S. Park) CT Protocols
Turbo Button Instructions
UWHC Miscellaneous Instructions
Protocol Design Philosophy
Scanner Status
Comments and Help

General Scanner Info
Size Selection
Scout Parameters
Patient Positioning
Reformat Labels
Contrast Info

Wiki Info
TO DO
Wiki Overview
Master Protocols to Series
Protocol Numbers
All Pages
Uploaded Images
Programming Notes
Scanner Notes
How to change a

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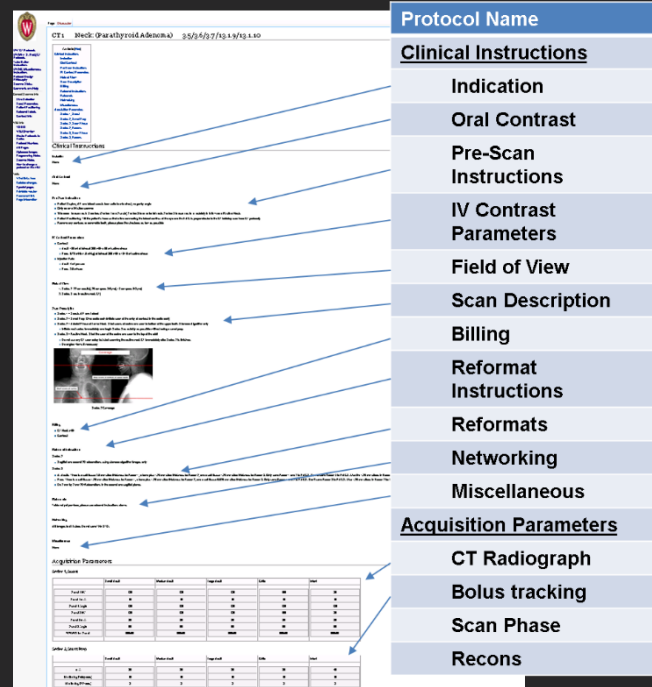
Body
Protocols
Appendix
Neuro
Protocols
Appendix
Chest
Pediatric
Cardiovascular
Musculoskeletal
Dual Energy (GS) and High Resolution Mode

Body

Protocols

Protocol	Protocol Number	CT1	CT2	CT3	CT4	ER	East	DHC	TAC
Abd/Pelvis	6.1/6.2/6.3	CT1	CT2	CT3	CT4	ER	East	DHC	TAC
Body Pelvis	8.13/8.14/8.15	CT1	CT2	CT3	CT4	ER	East	DHC	TAC
Abd/Pelvis R/O Hernia	6.7/6.8/6.9	CT1	CT2	CT3	CT4	ER	East	DHC	TAC
Abd/Pelvis - Flank Pain	6.10/6.11/6.12	CT1	CT2	CT3	CT4	ER	East	DHC	TAC
Low Dose Renal Stone/Flank Pain	6.13/6.14/6.15	CT1	CT2	CT3	CT4	ER	East	DHC	TAC

Search for “CT protocol wiki” on youtube for a video demonstration of this



Protocol Name

Clinical Instructions

Indication

Oral Contrast

Pre-Scan Instructions

IV Contrast Parameters

Field of View

Scan Description

Billing

Reformat Instructions

Reformats

Networking

Miscellaneous

Acquisition Parameters

CT Radiograph

Bolus tracking

Scan Phase

Recons

Szczykutowicz *et al.* “A wiki based CT protocol management solution” Radiology Management November 2015

Szczykutowicz *et al.* “A wiki based solution to managing your institution’s Imaging Protocols” JACR 2016

COMPLIANCE/REGULATORY DETAILS

Contributors

Who wrote the protocol and what qualifications do they have?

See TJC Provision of Care, Treatment, and Services PC.01.03.01 A26

Design Philosophy

Why are the timing delays/dose levels/slice thicknesses/etc. set at the values they are?

See TJC Provision of Care, Treatment, and Services PC.01.03.01 A26

Clinical Indication/s

Most protocol can be used for many indications, what are they?

See TJC Provision of Care, Treatment, and Services PC.01.03.01 A25

Dose Data

Document expected dose index ranges (ideally size/age based)

See TJC Performance Improvement PC.02.01.01 A6

COMPLIANCE/REGULATORY DETAILS

Protocol Name

Easily a source of confusion, so you need to document well and develop a systematic approach for this. Be aware different roles think of protocol names in unique ways.

Scanner specific

Tech “6.23 ABD-LIVER BIPHASIC MEDIUM ADULT”

Site specific

Radiologist “Biphasic liver”

Institution specific

Billing department “CT Abdomen Angio”

Country specific

Dose Repository “RPID5”

Protocol Compliance

What programs/studies/trial does the protocol comply with?

e.g. ACR LCS, ACR CTC, Research trial, Device manufacturer (robotic surgery), OPTN/UNOS, etc.

COMPLIANCE/REGULATORY DETAILS

Billing Code

Mistakes made by techs here will cause downstream issues. Each protocol should explicitly state what billing code (usually techs just choose text description, billing department will assign code) to use and any modifications due to scan time changes to the protocol.

RSNA reporting template

Whether your site uses RSNA or in house templates, what template to use should be documented somewhere linked to the protocol used to realize that study.

CLINICAL DETAILS

Patient Preparation

Jewelry removal, practice breathing, IV access, etc.

Oral Contrast Instructions

How to mix, how much to give, when to give, frequency of drinking.

IVC Contrast Instructions

Volume, rate, chaser volume, timing, IV access details, etc.

Patient Coaching Instructions

Breath hold, Valsalva maneuver, etc.

A 25. The [critical access] hospital establishes or adopts diagnostic computed tomography (CT) imaging protocols based on current standards of practice, which address key criteria including clinical indication, contrast administration, age (to indicate whether the patient is pediatric or an adult), patient size and body habitus, and the expected radiation dose index range. 

CLINICAL DETAILS

Patient Preparation

Pre-Scan Instructions [\[edit\]](#)

Clamp Foley catheter prior to scanning. Make sure to place Foley below the level of the bladder.

Oral Contrast Instructions

Oral Contrast [\[edit\]](#)

Give a total 400 mL of water prior to scan (A 200mL dose every 15 minutes over 30 minutes).

Give an additional 200mL dose of water on the CT scan table.

IVC Contrast Instructions

IV Contrast Parameters [\[edit\]](#)

Medrad™ P3T PA protocol

To set up P3T= choose P3T, Thorax, PA then click on ok. Confirm contrast and load fluids. Enter scan duration and click ok.

Iopamidol (Isovue 370) 76% injection

For sites without the Medrad™ P3T or P3T PA option, refer to the weight based contrast tables we provide in the protocol booklet. [Click here to access these tables](#)

Pre-Scan Instructions [\[edit\]](#)

Practice the 3 breaths for scouts, smart prep, and the actual helical scan, we do not want to induce a transient interruption of contrast (TIC) which would can mimic a PE and or produce an indeterminate exam. Please give the patient these instructions: **When you take your last breath before the exam, please do not bear down, take a deep breath, tense up or strenuously hold your breath. This exam will be over in about 4 seconds from when we tell you hold your breath to when you may breath again.**

We would like to visualize contrast in the pulmonary arteries and aorta because this is a double rule out protocol. If you see the contrast in the pulmonary arteries at a much lower intensity than the SVC and aorta, the patient likely had a TIC which kept the PA from enhancing correctly. This is not a scan timing issue, but an issue with un-opacified blood entering the heart faster from the IVC than opacified blood from the SVC caused by a pressure imbalance between the thorax and abdomen. This is why the breathing instructions we provide above are critical for this exam.

Patient Coaching Instructions

CLINICAL DETAILS

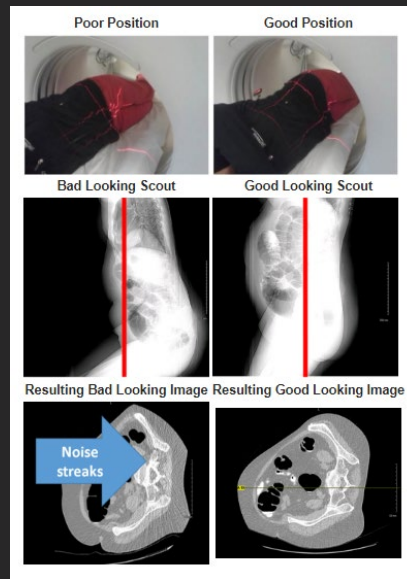
See TJC Provision of
Care, Treatment, and
Services PC.01.03.01 A25

Radiologist/
Physician/Nurse
Monitoring Instructions

Documentation of what physicians should be looking for to guide the diagnostic exam. For example in coronary CTA, if after the non con a patient's coronaries are full of Calcium, the CCTA may be skipped.

Patient Positioning

Most important for MSK where joint angles are important. Details (ideally with pictures) should be given to guide patient set-up.



- Position patient supine, feet first with foot secured in an upright position with a rolled towel or the foot to secure the ankle as shown.
- Elevate the knee of the patient slightly with a rolled towel or blanket.
- Wrap the velcro strap one complete revolution around the rod as shown in the image. Do this position and one at the ankle position as shown.
- Set the Motion Rod on the patient to pass From just proximal of Hip Center to distal of Ankle.
- Adjust the femoral and tibial straps to secure the rod.
- Verify the rod is in both anterior/posterior and medial/lateral field of views for all scan regions.
- The Velcro strap must be wrapped around the rod in one complete revolution, before wrapping snug, but not excessively tight.



Figure 1

velcro being wrapped around rod



Figure 2

rod placement

WORKFLOW DETAILS

Exam Logistics by
series

High level description of what the tech will be doing for each part of the exam.

Reformat
Instructions

What planes and what source data to use to make them.

Networking
Instructions

What to send where. Not trivial since you may send to PACS, 3D lab, perfusion processing, etc. which will likely differ at different sites.

WORKFLOW DETAILS

Exam Logistics by series

Scan Description [\[edit\]](#)

- Series 1- PA and Lateral Scout
- Coverage: Lower Neck to Below lung Base
- Series 2- Non - Contrast – Calcium Score
 - Coverage: Carina to below heart
- Series 3 – Timing Bolus = on the ascending aorta (use your without series to find the level)
 - Use 10 ml of Iodixanol and 50 ml of saline
 - Take 16 + Bolus time = Prep delay
 - If the timing for the prep delay is less that 20 seconds, please change the prep group to 20 seconds. We do not want to use anything less than 20 seconds for a delay.
- Series 4 – CTA
 - Use Timing Bolus
 - Coverage: Same as non - contrast scan
 - Number 13 breathing instructions on the scanner (10 s breath in and out + 4 s pause)

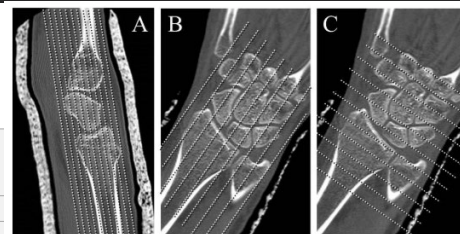
Reformat Instructions

Reformat Instructions [\[edit\]](#)

Use DMPR on THIN ST.

Reformats [\[edit\]](#)

Name	Source Recon	DMPR or Manual	Type (MIP, Average, etc.)	WW/WL	Slice Thickness (mm)	Interval (mm)	Orientation
SA BODY	THIN ST	DMPR	Average	450/50	5	2.5	sagittal
CO BODY	THIN ST	DMPR	Average	450/50	5	2.5	coronal



↑ (A) & (B) are parallel to long axis of radius ↑

↑ (C) is perpendicular to (B)

Reformats A,B and C

TECHNICAL DETAILS

Scanner Platform

Acquisition Details

Recon Options

In the interest of time, I am not going to go into the details of technical acquisition parameters. This should be the wheel house of the physicist. For good references, see the parameters listed within the AAPM CT protocols.

This is not trivial, you should worry about all the recons the techs/docs need, not “just recon 1” or the acquisition parameters.

TECHNICAL DETAILS: RESOURCES

This is online as well.
<https://www.radiology.wisc.edu/uw-ge-ct-protocol-project/resources/>
 We made this because
 we were sick of
 “making these names
 up” which lead to
 complete non
 uniformity across our
 thousands of CT
 protocols. Hopefully
 you can find value in it
 as well! 😊

UW-Madison CT Protocol Series Naming Scheme

Each series description is composed of 6 possible modifiers:

Thickness	+	Recon Type	+	Time	+	Contrast**	+	Energy***	+	Special Options****
THIN (default is to leave empty which denotes a thick recon)		ST (soft tissue) BONE LUNG		LATE (i.e. for differentiating early and late arterial phases) DELAY XX MINUTES (i.e., XX is the number of minutes the phase is delayed and varies by protocol) TIMING BOLUS* (default is empty)		W/C W/O CTA CTV (CT venogram) ARTERIAL LATE ARTERIAL (default is empty)		50 keV 67 keV 140 keV QC VNC (virtual non contrast) VUE (virtual unenhanced) Water (Iodine) Iodine (Water) (default is empty, only used for DECT)		MAR (metal artifact reduction) SSF (snap shot freeze) XX-XX% (i.e., cardiac phase range) XX% (i.e., centered cardiac phase) EXP (expiration) INSP (inspiration) EXP HI-RES (high resolution) INSP HI-RES ABER (abduction and external rotation) TAVI PRO (prospective) RETRO (retrospective) LT (left side) RT (right side) (default is empty, use sparingly)
Slice Thickness Modifiers by Section		THIN		THICK						
Abdominal/Pediatric/Thoracic/Neuro/CV		<2.5 mm		>=2.5 mm						
MSK		<1 mm		>=1 mm						

*A timing bolus series normally only has 1 reconstruction; therefore, no modifiers are needed for naming a timing bolus series other than the label “TIMING BOLUS”.

**If the series is single phase and non contrast, this modifier is empty. If a protocol has multiple series, the non contrast series has the “W/O” modifier. In general, it is preferred to use time to specify specific contrast phases (i.e., use “DELAY 10 MINUTES” instead of “UROGRAPHIC” to denote a delayed CT urography phase).

***This is where DECT names are detailed. Energy here refers to monochromatic energy level. Only 50, 67, and 140 are shown; your practice will likely use different energy levels. These levels do not refer to the beam energy used in SECT (i.e., 120 kV). SECT energy levels should not be specified. Basis material images should be denoted using <material name> (<partner basis material name>).

****We do not have orthopedic device modifiers in the list as they vary site to site. The “Special Options” modifier should capture vendor/device/practice-specific naming conventions.

Examples:

- “5 mm soft tissue recon from a non contrast single energy scan” → “ST”
- “0.5 mm bone recon at 140 keV from a non contrast DECT scan” → “THIN BONE 140 keV”
- “1.25 mm soft tissue recon from an angio phase single energy scan” → “THIN ST CTA”
- “0.6 mm soft tissue recon from the CTA phase centered at 75% R-R of a gated single energy cardiac scan” → “THIN ST CTA 75%”

Medical Physics Group

CT experts

Radiology Group

Sub specialty section experts

Scanners	Neuro	Thoracic	Cardio-Vascular	Abdomen Pelvis	MSK	Pediatric
Vendor 1						
• Model 1	*	*	*	*	*	*
• Model 2	*	*	*	*	*	*
• Model 3	*	*	*	*	*	*
Vendor 2						
• Model 1	*	*	*	*	*	*
• Model 2	*	*	*	*	*	*
Vendor 3						
• Model 1	*	*	*	*	*	*

Uniformity in Workflow

Uniformity in Protocols

Adapted from a slide
given by Professor Mika
Koresniemi at the
Prague 2018 CT
workshop hosted by

EFOMP

Technologist Pool

CT experts



Group activity time

1. Break into pairs
2. Discuss facets of a protocol using the provided handout (does not need to be exhaustive) (~15 minutes)
3. Complete the size and patient presentation questions at the end of the handout

Clinical Protocol to document is “Active Bleeder”

