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PRONTO

Open Source Webapp for Management of Imaging Protocols and Protocol Updates

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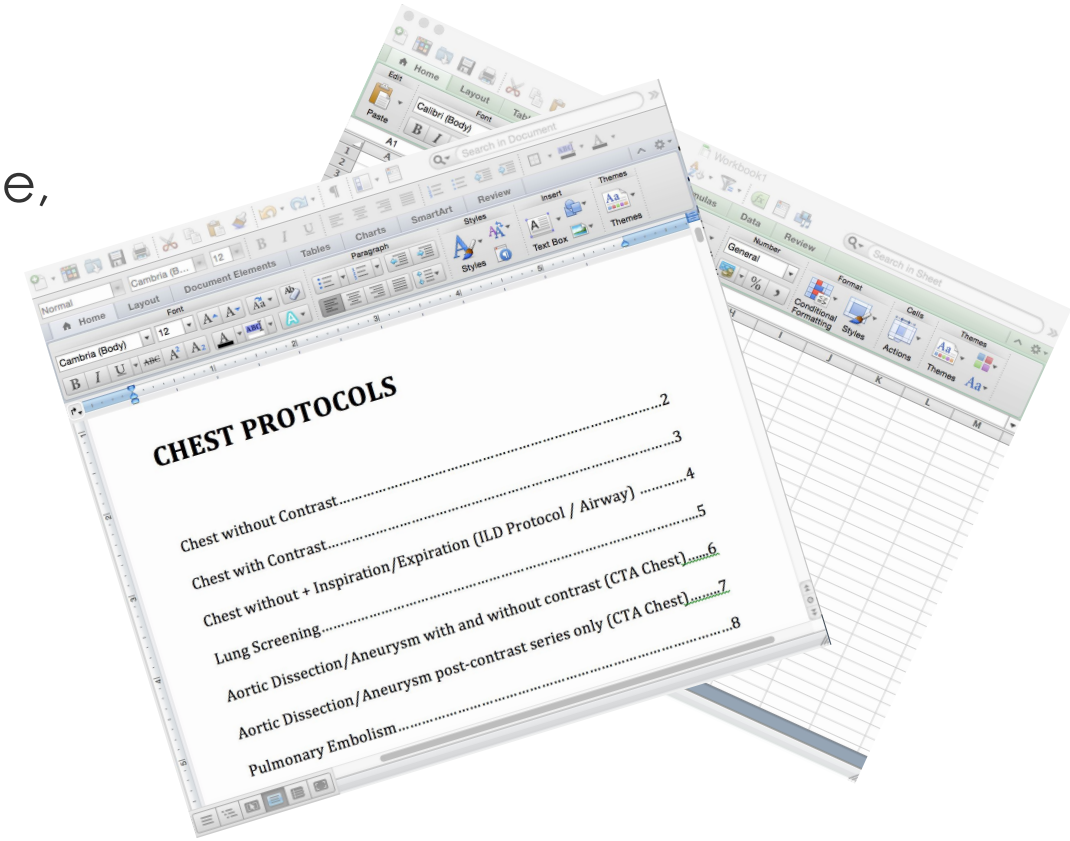
Protocol management and standardization are crucial in radiology practices of all sizes.

Goals:

- Ensure patient safety
- Minimize radiation dose (CT)
- Sustain highest quality imaging parameters
- Maintain throughput
- Promote timely and universal updates
- Enable routine quality assurance

Implementing revised and/or new protocols can be cumbersome.

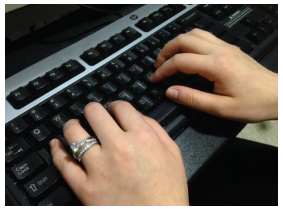
- While some 3rd party vendor tools are available, many practices use standard documents or spreadsheets for management



Every step relies on a chain of communication that is hard to track and can break down.

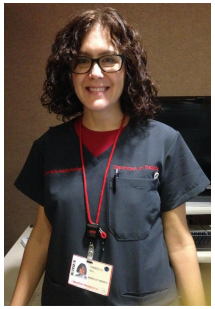
1. Problem Identified

2. Conference Held & Decision made



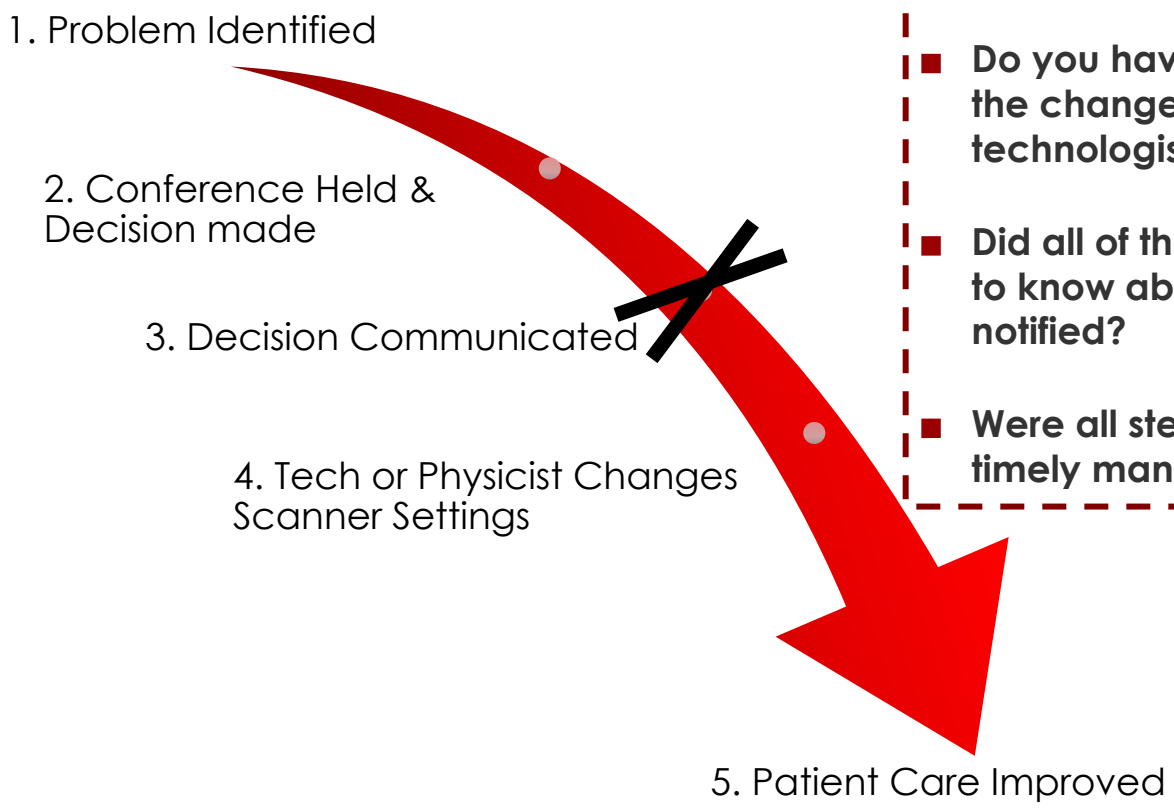
3. Decision Communicated

4. Tech or Physicist Changes Scanner Settings



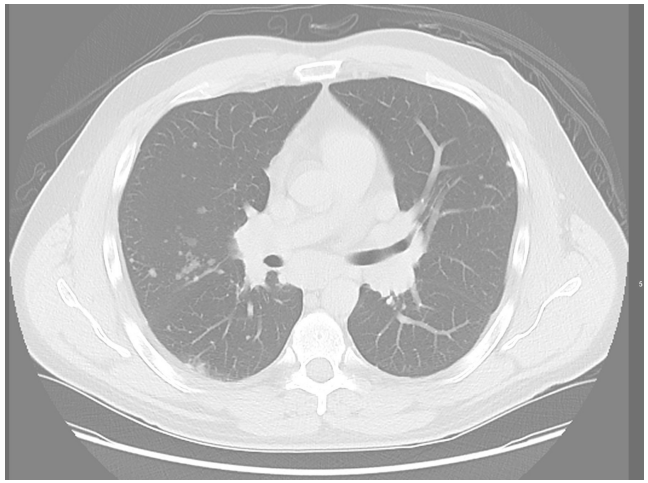
5. Patient Care Improved

Decision to change a protocol may be made, but implementation may fail or is not confirmed.



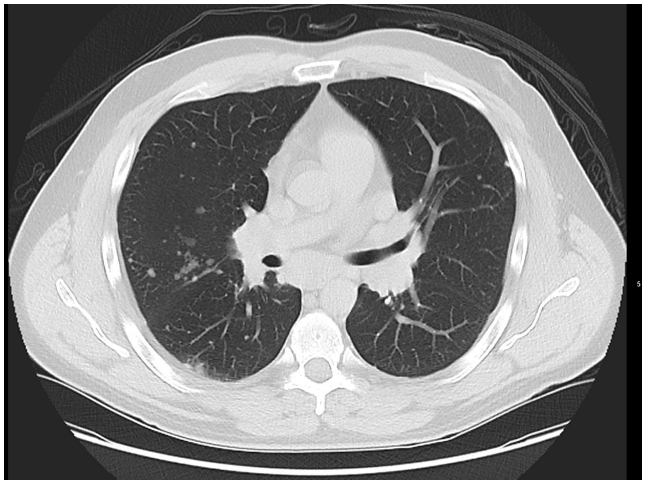
- **How do you know the change was made?**
- **Do you have a way to confirm the change with the lead technologist or modality chief?**
- **Did all of the people who need to know about the change get notified?**
- **Were all steps achieved in a timely manner?**

Without a way to confirm a protocol change, the problem will only be noticed when you see a suboptimal study.



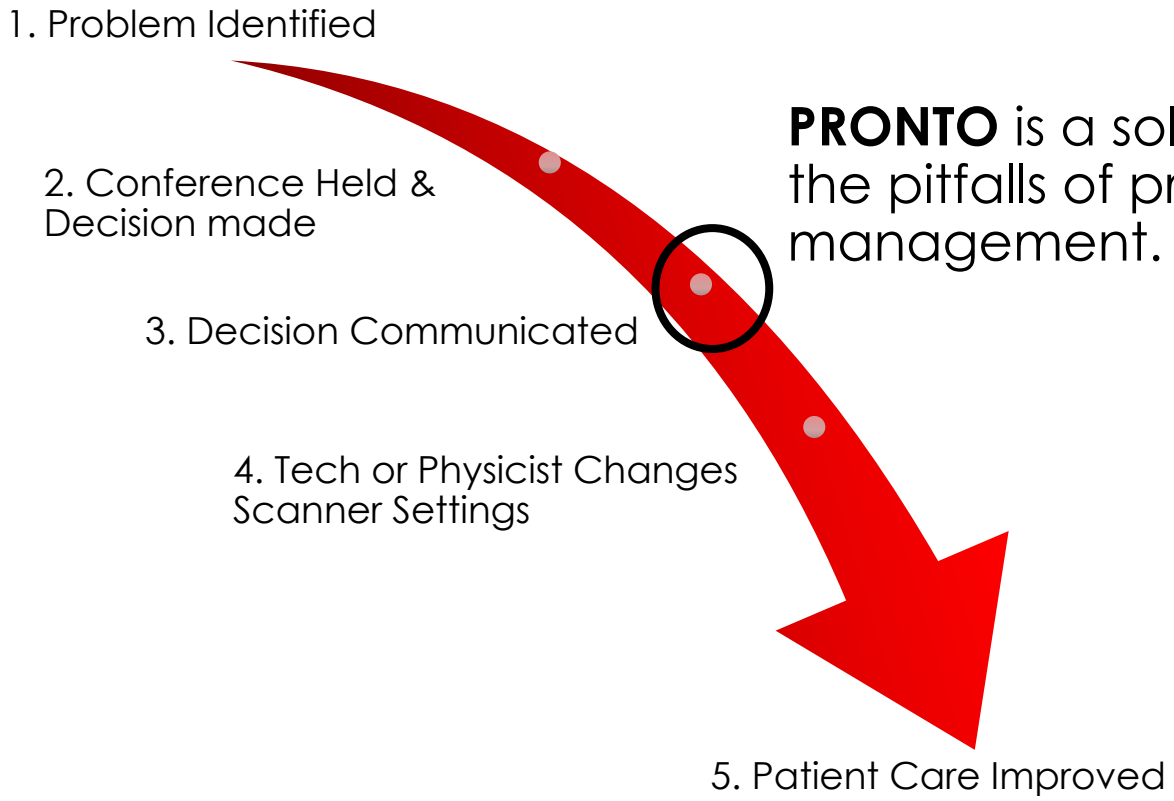
This doesn't look right!

Problem is **re-assessed** and changes are finally made



That's better!

By introducing an automated system like **PRONTO** for tracking protocol changes, we can improve this process.



PRONTO is a solution to the pitfalls of protocol management.

What is PRONTO?

- PRONTO is an **open-source** Protocol management web-app via which a Radiology Department can collect, modify and view protocols
- It provides a free convenient web-based way to distribute protocols to physicians and technologists
- **It manages the process of protocol updates with email notifications to the appropriate individuals**
- It uses the LAMP stack (Linux, Apache, MySQL, PHP)

How does PRONTO work?

- A **decision** is made to change a protocol parameter

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- The division head or other radiologist assigned to managing that protocol downloads the protocol from PRONTO (in the form of an **Excel spreadsheet**), updates the spreadsheet and re-uploads it to PRONTO (CSV upload)

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- This spreadsheet replaces the prior spreadsheet and differences are registered by PRONTO

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- PRONTO sends **email notifications** to all assigned parties

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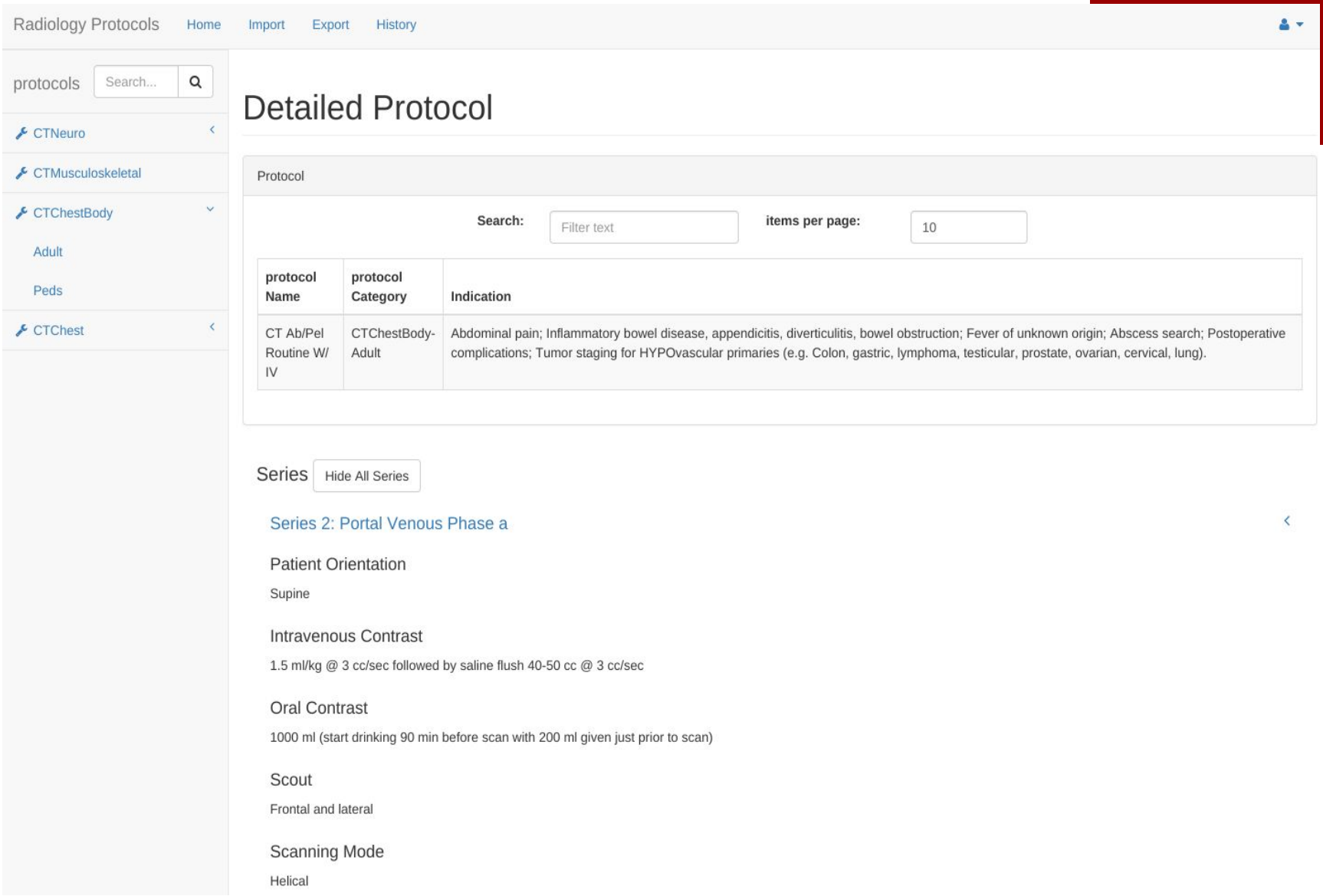
- Technologists and/or physicists reply with **confirmation** when scanner settings are changed

Step 1: Review Protocol & Decide on Change



Example Protocol:
Pediatric CT Abdomen Pelvis with Contrast

Detailed Protocol

Protocol

protocol Name	protocol Category	Indication	Permalink
Ped CT Ab/Pel W/ IV (WITH PO; by weight)	CTBody-Peds	Age 0-17 with Abdominal Pain and/or Mass	127.0.0.1/pronto/mylist?protocolID=CTPed202&Category=CTBody-Peds

Series

Series Name
WITH IV

Series | Hide All Series | << Go Back

WITH IV

Scanner
All

Orientation
Supine

Intravenous Contrast
1.5mL/kg Omnipaque300 at 1-2mL/sec followed by 10mL saline flush at 1-2mL/sec

Oral Contrast
AGE-BASED ORAL CONTRAST DOSING:
0 - 5 months = 4mL Gastrografin in 116mL water for total 120mL
6 - 11.9 months = 6mL Gastrografin in 174mL water for total 180mL
1 - 1.9 years = 8mL Gastrografin in 232mL water for total 240mL
2 - 3.9 years = 12mL Gastrografin in 348mL water for total 360mL
4 - 5.9 years = 14mL Gastrografin in 406mL water for total 420mL
6 - 8.9 years = 16mL Gastrografin in 464mL water for total 480mL
9 - 10.9 years = 20mL Gastrografin in 580mL water for total 600mL
11 - 13.9 years = 25mL Gastrografin in 725mL water for total 750mL
14 years and older = 30mL Gastrografin in 870mL water for total 900mL

Scout
WEIGHT-BASED (Groups 1 through 12):
(1-3) 0-25 lb: GE = 0 + 90 degrees, S0-I150, 80kVp, 10mA; Siemens=#
(4) 26-31 lb: GE = 0 + 90 degrees, S0-I180, 100 kVp, 10mA; Siemens=#
(5-7) 32-65 lb: GE = 0 + 90 degrees, S0-I200, 100 kVp, 10mA; Siemens=#
(8) 66-80 lb: GE = 0 + 90 degrees, S0-I250, 100 kVp, 10mA; Siemens=#
(9-12) 81+ lb: GE = 0 + 90 degrees, S0-I300, 120 kVp, 10mA; Siemens=#

Scanning Mode
GE=Helical; Siemens=Spiral

Range/Direction
Dome of diaphragm to symphysis pubis

Gantry Angle
0

Algorithm
Standard

Beam Collimation / Detector Configuration
WEIGHT-BASED (Groups 1 through 12):
(1-5) 0-40 lb: 20 mm
(6-12) 41+ lb: 40 mm

Additional included parameters (most of which are weight-based):
- Slice Thickness
- Interval
- Pitch
- kVp
- mA
- Noise Index
- Noise Reduction
- Rotation Time
- Scan FOV
- Display FOV
- Scan Delay
- Post Processing
- Transfer Images
- CTDI maximums

Example Protocol:
Adult Chest CT - Pulmonary Embolism

WITH IV

Scanner

All

Orientation

Supine

Intravenous Contrast

1.5mL/kg (max 150mL) Omnipaque300 at 4mL/sec then 50mL saline at 4mL/sec

Oral Contrast

None

Scout

0 + 90 degrees

Scanning Mode

Helical

Range/Direction

Inferior neck to left mid-kidney

Gantry Angle

0

Algorithm

Standard

Beam Collimation / Detector Configuration

40 mm

Slice Thickness

1.25 mm

Interval

1.25 mm

Table Speed (mm/rotation)

39.375

Pitch

0.984:1

kVp

SIZE-BASED (DIAMETER):
Small (0-30 cm): 80;
Medium (31-40 cm): 100;
Large (41-50 cm): 100;
XL (51+ cm): 120

mA

SIZE-BASED (DIAMETER):
Small (0-30 cm): Auto 75-200;
Medium (31-40 cm): Auto 75-300;
Large (41-50 cm): Auto 75-400;
XL (51+ cm): Auto 75-400

Noise Index

SIZE-BASED (DIAMETER):
Small (0-30 cm): 55.0;
Medium (31-40 cm): 50.0;
Large (41-50 cm): 60.0;
XL (51+ cm): 60.0

Noise Reduction

ASiR 0%

Rotation Time

0.5 sec

Scan FOV

Large Body

Display FOV

36 cm

Scan Delay

Smart-Prep @150HU

Post Processing

Create:
(A) 2.5 x 2.5 mm STANDARD algorithm,
(B) 2.5 x 2.5 mm LUNG algorithm,
(C-D) Use 0.625 x 0.625 mm STANDARD algorithm (do not send to PACS) to make 2 x 2 mm CORONAL (C) and SAGITTAL (D) reformats,
(E) Use 0.625 x 0.625 mm LUNG algorithm (do not send to PACS) to make 5 x 2.5 mm AXIAL MIP

Transfer Images

Send to PACS:
(S) 1.25 x 1.25 mm AXIAL STANDARD algorithm,
(A) 2.5 x 2.5 mm AXIAL STANDARD algorithm,
(B) 2.5 x 2.5 mm AXIAL LUNG algorithm,
(C) 2 x 2 mm CORONAL STANDARD reformats,
(D) 2 x 2 mm SAGITTAL STANDARD reformats,
(E) 5 x 2.5 mm AXIAL MIP

Notes

Image during respiratory INSPIRATION

CTDI

Max 21 mGy (ACR DRL)

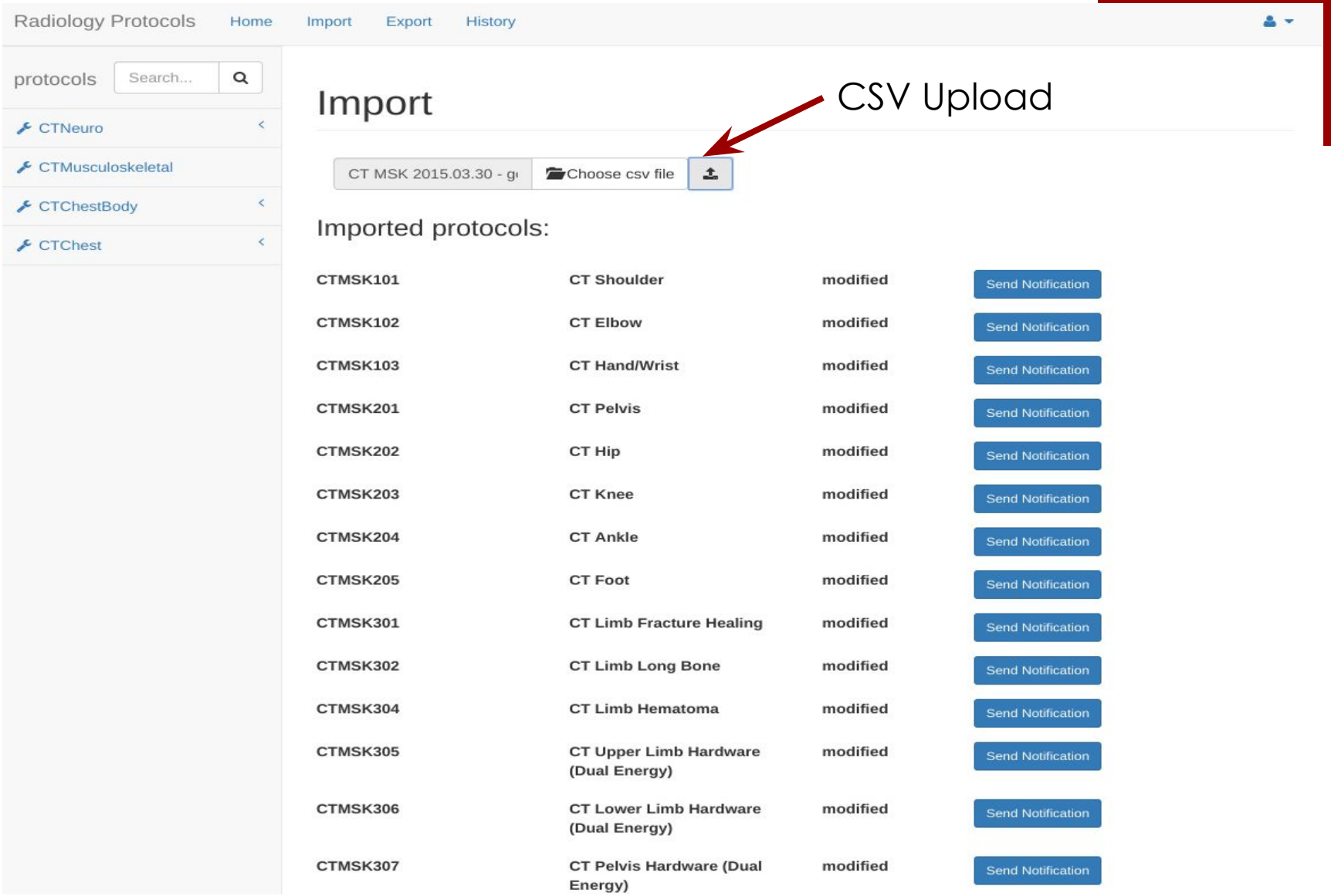
Step 2: Download Excel and Update

	A	B	C	D	E	F	G	H	I	J
1	**Protocol ID**	**Protocol Name**	**Indications**	**Orientation**	**Scout (Series 1)**	**Series**	**Intravenous Contrast**	**Oral Contrast**	**Scanning Mode**	**Range/Direction**
2	CTChestAdult01	CT Chest Adult 1: Chest Without Contrast		Supine	AP and Lateral	Series 2: Without Contrast	None	None	Helical	Inferior neck to left mid-kidney
3	CTChestAdult02	CT Chest Adult 2: Chest With Contrast		Supine	AP and Lateral	Series 2: With Contrast	75 cc Omni 300 + 30 cc saline flush at 3 cc/sec	None	Helical	Inferior neck to left mid-kidney
4	CTChestAdult03	CT Chest Adult 3: Chest Without + Inspiration/Expiration (ILD Protocol / Airway)		Supine	AP and Lateral	Series 2: Without Contrast	None	None	Helical	Inferior neck to left mid-kidney
5	CTChestAdult03	CT Chest Adult 3: Chest Without + Inspiration/Expiration (ILD Protocol / Airway)		Supine	Already obtained in Series 1	Series 3: Supine Expiration	None	None	Helical	Inferior neck to left mid-kidney
6	CTChestAdult03	CT Chest Adult 3: Chest Without + Inspiration/Expiration (ILD Protocol / Airway)		Prone	Series 4 Scout: Prone PA and Lateral	Series 5: Prone Inspiration	None	None	Helical	Inferior neck to left mid-kidney

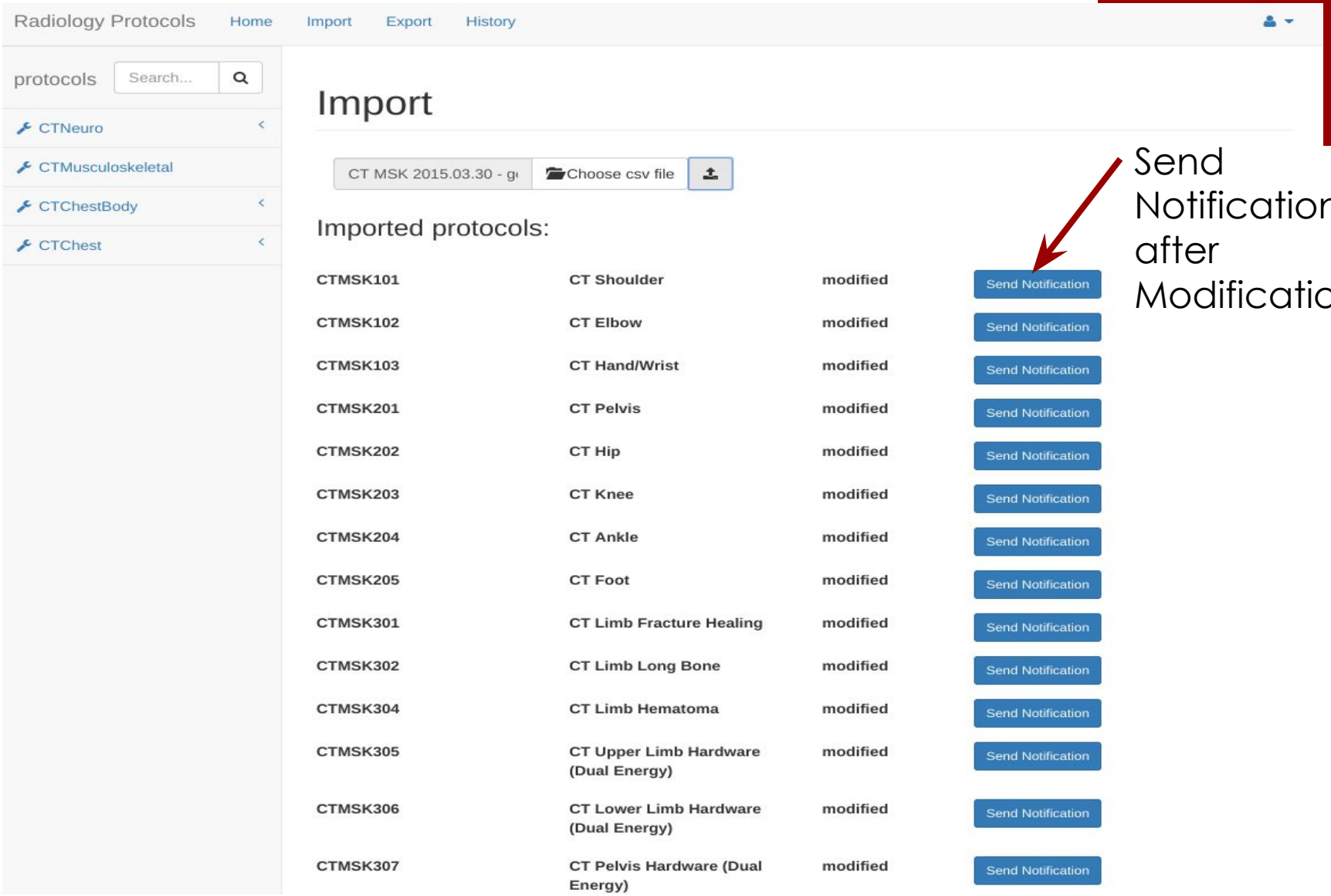
	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
	Gantry Angle	**Algorithm**	**Beam Collimation**	**Slice Thickness**	**Interval**	**Table Speed (mm/rotation)**	**Pitch**	**kVp**	**mA**	**Noise Reduction**	**Rotation Time**	**Scan FOV**	**Display FOV**	**Detector Configuration**	**Scan Delay**
	0	Standard	n/a	2.5 mm	2.5 mm	39.37	0.984:1	120	80 (pt < 200 lbs), 160 (pt > 200 lbs)	ASiR 70%	0.5 sec	Chest	n/a	n/a	n/a
	0	Standard	n/a	2.5 mm	2.5 mm	39.37	0.984:1	120	80 (pt < 200 lbs), 160 (pt > 200 lbs)	ASiR 70%	0.5 sec	Chest	n/a	n/a	30 sec
	0	Standard	n/a	2.5 mm	2.5 mm	39.37	0.984:1	120	80 (pt < 200 lbs), 160 (pt > 200 lbs)	ASiR 70%	0.5 sec	Chest	n/a	n/a	n/a
	0	Lung	n/a	1.25 mm	10 mm	39.37	0.984:1	120	80 (pt < 200 lbs), 160 (pt > 200 lbs)	ASiR 70%	0.5 sec	Chest	n/a	n/a	n/a
	0	Lung	n/a	1.25 mm	10 mm	39.37	0.984:1	120	80 (pt < 200 lbs), 160 (pt > 200 lbs)	ASiR 70%	0.5 sec	Chest	n/a	n/a	n/a

- Each row is a series
- Each column is a protocol parameter

Step 3: Re-upload Excel as a CSV file



Step 4: Notify Others of Change



Send Notification after Modification

Step 5: Notification Emailed & Recipients Confirm Change

Radiqal: [New] Ticket 26232 - George Shih

https://outlook.office365.com/owa/#viewmodel=ReadMessageItem&ItemID=AAMkAGIyNDQ2ZjBjLTc3NzY

Radiqal: [New] Ticket 26232

donotreply@radiqal.nyp.org

Wed 9/9/2015 9:19 AM

To: George Shih <ges9006@med.cornell.edu>; Kurt Teichman <kut2002@med.cornell.edu>; pronto@radiqal.nyp.org <pronto@radiqal.nyp.org>;

To: set([u'ges9006@med.cornell.edu', u'kut2002@med.cornell.edu', u'pronto@radiqal.nyp.org'])
ID: 26232
Issuer: pronto pronto
Email: pronto@radiqal.nyp.org
Accession:
MRN:
Location:
Modality:
Issue: CT protocol added or modified
Comments:

1. New or Modified: modified
2. Protocol ID, Name: CTBody115, CT Enterography W/WO IV
3. Series ID: Series 2: Without Contrast
4. PRONTO user that uploaded and date / time stamp: george, 1441804774

Link to ticket: http://radiqal.nyp.org/2.0/app/#/ticket/edit/26232

Email indicates which protocol was changed, which series, and who made the change

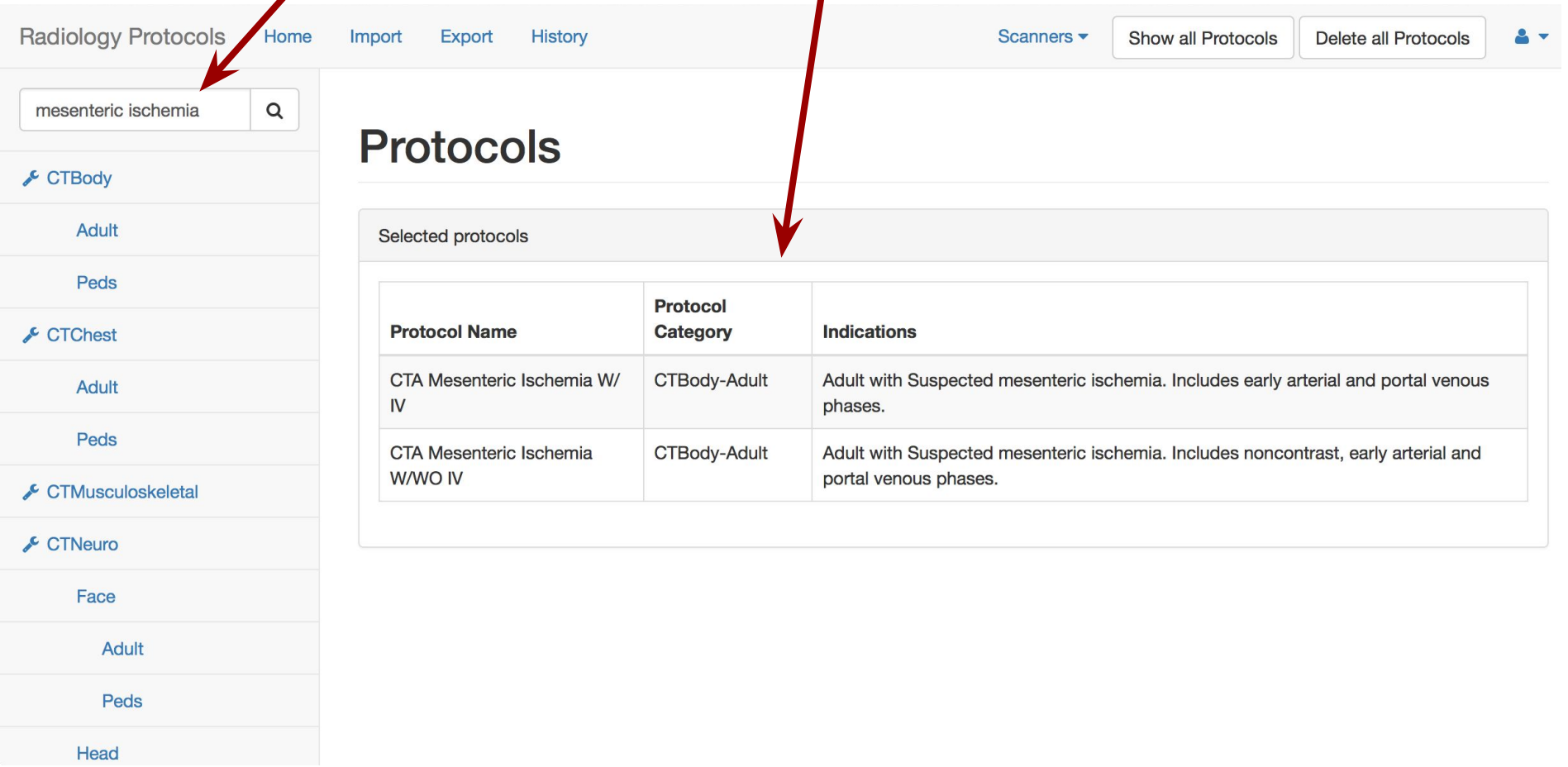
Other Advantages of PRONTO

- ✔ A **search box** allows protocols to be located by name and/or indication, which may be helpful for residents and technologists during the protocoling process
- ✔ Each protocol also has a unique URL that can be **easily shared**
- ✔ Protocols can be easily exported and **backed up** with a single click

Example Search: "Mesenteric Ischemia"

Type term in search box

Relevant protocols are shown



Our Experience So Far & Future Plans

- We have already uploaded our CT protocols for all subspecialties (total of **162 protocols**)
- We are in the process of uploading our MR protocols
- PRONTO lists all protocol parameters, which will allow us to better perform more comprehensive **quality assurance**
  - By crosschecking the protocol parameters with DICOM information and data from our ordering system, we can ensure that the correct study was performed with the correct protocol

Conclusion

- **PRONTO** is a free **open source** web-based protocol management system
- It provides a practical way to manage, update, and search imaging protocols, allowing a radiology practice to efficiently ensure high quality imaging
- Source Code: **http://src.pronto.trove.nyc**