Electronic Records with Alerts for CT Technologist QC across Multiple Locations



WEXNER MEDICAL CENTER

Kevin J Little, PhD, Amy Leighty, BS, Xia Jiang, PhD, Xiangyu Yang, PhD, David E Hintenlang, PhD Department of Radiology, Ohio State University Wexner Medical Center, Columbus, OH 43210

Introduction

 Daily, weekly, and monthly technologists' quality control (QC) tests have the potential to identify technical issues with a CT scanner before they affect clinical image quality or safety.

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Results

 Email alerts allow missed QC tests to be corrected the same day instead of being discovered after their due date by a technologist or by a physicist's periodic QC review.

- Values outside their expected range are not always immediately recognized by the person performing the test.
- QC testing can be missed due to miscommunication or deviation from routines.
- If missed QC is not identified and reported according to site policy, this can lead to a citation by state regulators or accreditation agencies.
- Paper QC records are usually kept at the scanner, which can be inconvenient for a physicist or administrator to access in a multi-site system.
- While there is commercially available QC-related software and some groups have built fully automated in-house QC tools^{1,2}, our goal was to use readilyavailable software at our institution to streamline the recording and review of QC data as acquired by technologists.

Methods	
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References:

A screenshot of the QC website. The site is customizable for each user to show only applicable sites.

Technologist's Daily Quality Control											
OSUWMC CP Lewis Center Siemens Definition AS CTAP# 50804											
Siemens Daily QC Head Mode: Axial; 120 kV; 350 mA; 1 s rot; 12 x 1.2 mm coll; 4.8 mm recon; Homogeneity/Water HU Kernel: S80s; Noise Kernel: H30s											
Siemens Daily QC Body Mode: Axial; 120 kV; 420 mA; 0.5 s rot; 64 x 0.6 mm coll; 5 mm recon; Homogeneity/Water HU Kernel: S80f; Noise Kernel: B30f											
OSU Abdomen Helical: Hel; 120 kV; 210 eff mAs; 0.5 s rot; 1.0 pitch; 128 x 0.6 mm coll; 3 mm recon; 210 mm FOV; Kernel: I40f											
		Ciaman	OSU Daily Artifa	cts: Axial; 120 KV; 2	Axial; 120 kV; 210 mA; 1 s rot; 128		6 mm recon; 210 r	nm FOV; Kernel: B30f			
		Siemen	IS NOISE	Siemens H	omogeneity	Daily US		Artifacts			
		Head: Water SD	Body: Water SD	Head: Water HU	Body: Water HU	Center 400 mm ²	Center 400 mm ²				
Data	Initiale	Slice 2	Slice 2	Slice 2	Slice 2	Water HU	Water SD	Artifacts (Y = yes, N = no;	Notoc		
2/1/2018		(3.22 (0 3.94 HO) 3 50	(3.78 t0 4.02 HU)	(-4 (0 4 HO) 0 1/	(-4 (0 4 HO) 1 71	(-4 10 4 HU) 2	(Gainening data)	N	notes		
3/2/2018	NE	3.62	4.00	0.14	-0.31	-03	6	N			
3/3/2018	141	0.02	4.07	0.00	-0.01	-0.0	0	N			
3/4/2018											
3/5/2018	TR	3.57	3.99	0.29	-1.44	-0.7	6.1	N			
3/6/2018	TR	3.5	4.05	0.19	-1.72	0.2	6.5	N			
3/7/2018	TR	3.55	4.16	-0.69	-1.72	-0.3	6.6	Ν			
3/8/2018	WW	3.54	4.15	-1.6	-0.11	-0.1	6.8	Ν			
3/9/2018	WW	3.56	4.05	-1.23	-0.09	0.1	6.5	N			
3/10/2018											
3/11/2018											
3/12/2018	NF	3.56	4.15	-0.32	-0.93	-0.7	6.4	N			
3/13/2018	KL	3.45	4.8								
3/14/2018											

- QC tests that are out of range are easily identified, and appropriate action can be taken.
- QC review by the QMP can be done remotely and more frequently in less time.
- Preparation for regulatory inspections of QC logs has been simplified.
- In two cases in the first six months of use, failing QC values (MTF) gave an early indication of tube failure.

Daily QC Status - Yel @ 12A	AM, Red @ 9AM	Weekly QC Status - Yel on Wed, Red on Fri				
Show Only Problems		Show Only Problems				
Indicator	Status	Indicator	Status			
UH Doan AS+		UH Doan AS+				
UH Doan Emotion 16	•	UH Doan Emotion 16	\bigcirc			
UH Doan Brightspeed		UH Doan Brightspeed	\bigcirc			
UH ED Edge	\diamond	UH ED Edge				
UH ED Force	\diamond	UH ED Force	\bigtriangleup			
James 10th AS		James 10th AS				
Ross 750HD		Ross 750HD				
Gahanna AS		Gahanna AS				
James 4th AS		James 4th AS				
James Flash	•	James Flash				
Morehouse Flash	•	Morehouse Flash				
Lewis Center AS		Lewis Center AS	\triangle			
SSCBC AS+		SSCBC AS+				
Stoneridge Brightspeed		Stoneridge Brightspeed	\bigcirc			
CPE AS		CPE AS				

- Daily, weekly, and monthly QC forms for the diagnostic CT scanners in our system were implemented with Microsoft Excel and hosted using our institution's existing Microsoft SharePoint website.
- The QC site could be remotely accessed by technologists, administrators, and physicists across our multiple sites.
- Versioning with timestamps was used to track changes.
- Conditional formatting was used to identify QC values that were outside their expected range.
- A Python script was utilized to trigger timely email alerts for missing QC to a qualified medical physicist (QMP) and the respective system's lead technologist for follow-up.
- A dashboard was created using Excel-based indicators in SharePoint to give an overview of the QC status of the enterprise.
- QC Technologists' feedback was used to refine the system and to implement improvements, such as

An example online form for daily QC. Values out of range appear in red, and required values that have not yet been entered appear in yellow.

echnologist's Weekly Quality Control	
SUWMC Ross H1154 GE Discovery CT750HD CTAP 53475	

													<u>+</u>
							GE C	ontr., Res., LCD, Noise, Uniform. QC Protocol					Axia
		Helical; 120 kV; 335 mA; 0.4 s rot; 0.516 pitch; 64 x 0.625 mm (40 mm) coll; 5 mm recon; Small Body SFOV; 25 cm DFOV; Kernel: Standard if not indicated											
		Contras	st Scale (Se	r 1 lm 1)	High Contr	Spatial Res	(Ser 1 lm 1)	Low Contrast Detectability (Ser 7 Im 1)	Noise and Uniformity (Ser 1 lm 13)				SI
		Water	Acrylic	Difference	1.6 mm bars SD	# groups visible std	# groups visible bone	Contrast (HU) @ 95% CL for 3 mm hole (<5.3 HU) (Service Desktop > Image Quality > Highlight Image > Image Analysis > Manual > I CD >	Center HU Mean	Water SD	12:00 HU Mean	3:00 HU Mean	(Sr10 lr coll; 5
Date	Initials	Mean HU	Mean HU	HU)	(33 to 41 HU)	kernel (≥4)	kernel (≥5)	Accept > 3 mm > OK)	(-3 to 3 HU)	(4 to 5.7 HU)	(Center ±3 HU)	(Center ±3 HU)) W/
9/6/2017	ag	4.62	120.91	116.29	39.05	4	5	5.071	0.58	4.92	-0.09	-0.8	
9/13/2017	ag	4.7	120.55	115.85	37.82	4	5	5.003	0.82	5	-0.08	-0.34	
9/20/2017	ag	4.87	120.5	116.37	37.19	4	5	5.25	0.74	5.21	-0.12	-0.73	
9/27/2017	ag	4.59	120.8	116.21	38.05	4	5	5.151	0.46	4.67	-0.39	-0.51	
Position box cursor over largest. Bar pattern, and size it until it fits over the pattern. 1.6 mm 1.3, 1.0, 0.8 mm 0.6, 0.5 mm Description 1.3, 1.0, 0.8 mm 0.6, 0.5 mm Description Descriptio										cm (400 mm²) OI @ 12 'clock m (400 n²) ROI @ 3 lock			

A visual dashboard is available on the main page showing QC completion across the health system. Yellow indicates that a system is due for testing, and red indicates that a system is overdue.

Mon 3/5/2018 9:01 AM □ CT Technologists' QC <mossadmin@osumc.edu> Daily Missing - UH ED Edge - 2018-03-05 To ■ Little, Kevin Cc ♀ Retention Policy 3 Month Mailbox Policy (90 days) Expires 6/3/2018 ● If there are problems with how this message is displayed, click here to view it in a web browser Click above to connect to this document library.

> CT Technologists' QC - Daily Missing SharePoint Document Library https://securecollaborate.osumc.edu/sites/radiology/medicalphysics/CTQC/Daily%20Missir

CT Technologists' OC UH ED Edge - 2018-03-05 has been added

Modify my alert settings | View UH ED Edge - 2018-03-05 | View Daily Missing | Mobile View

Last Modified 3/5/2018 9:00 AM by Little, Kevin

Email alerts are sent to the imaging physics team and the appropriate lead technologist or manager when QC is missed or not fully completed.

system and to implement improvements, such as including guidance for performing QC directly on the form.

¹J. Grimes, S. Leng, and C. McCollough, "A software tool for automated

analysis of CT quality assurance phantoms," Med. Phys. 41, 558 (2014).

²P. Nowik, R. Bujila, G. Poludniowski, and A. Fransson, "Quality control of

year study," J. Appl. Clin. Med. Phys. 16, 5469:254–265 (2015).

CT systems by automated monitoring of key performance indicators: A two-



An example online form for weekly QC. Instructions for evaluating each QC test are provided for quick reference.



Using software available at our institution, we implemented a QC system that improves efficiency for technologists, lead technologists, and the QMP by giving timely on-screen and email-based feedback remotely across multiple sites.