

COR Analyzer – A Fully Automatic Analysis of Coronary CT Angiography

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ICI meeting 2009
Innovations in Cardiovascular Interventions

Disclosures

I have the following financial relationships to disclose:

Type of relation: Medical Advisor to Rcadia Medical Imaging

(moderate level of remuneration)

**Type of relation: Consultancy, employment, honoraria, other compensation*

**Level of remuneration: high (over \$50,000 yearly), moderate (10-50,000), modest (under 10,000)*

Coronary CTA - Pros

- Numerous studies confirming high correlation to invasive angiography (especially for excluding obstructive CAD)
- Significantly reduced radiation dose - new CTs
- Reimbursement – Category I CPT codes in 2010
- Proven time and money saver for chest pain triage in the ED
- Becoming a diagnostic standard for low to mid pre-test probability for obstructive CAD

Coronary CTA - Cons

- Interpretation
 - Complex and time consuming, requires training
- Cardiologists
 - Relatively new modality – insufficient number of experienced readers
 - Busy, occasionally do not have time to manipulate complex workstations with post-processing and visualization software tools (sometimes >1/2 hour per case)
 - Are not available during off hours to read ED cases

COR Analyzer

- Fully automatic CCTA analysis software system
- Automatically detects significant coronary lesions

Studies

	Last Name	First Name	Patient ID	Study ID	Study Date	Process Date	# Images
1	Philips-MultiPhase	1	3	3	Oct 28, 07, 3:10 PM	Nov 26, 09, 4:03 AM	615
2	Siemens	4	8	8	May 16, 08, 8:14 AM	-	124
3	Philips-MultiPhase	2	7	7	Apr 01, 07, 3:36 PM	Nov 26, 09, 4:14 AM	700
4	Siemens	PCA_prox	94	2	Oct 11, 05, 5:30 PM	Nov 25, 09, 2:17 PM	361
5	Siemens	Marginal	105	CT20050...	Sep 18, 05, 9:59 AM	Nov 25, 09, 12:43 PM	301
6	GE	Diag	213	-	May 14, 07, 3:17 PM	Nov 25, 09, 12:29 PM	204
7	GE	LAD	234	-	Oct 10, 05, 12:39 PM	Nov 25, 09, 11:46 AM	201
8	Philips	5	364	3679	Aug 17, 06, 12:59 ...	-	365
9	Philips	S70	453	6530	Nov 16, 06, 12:37 ...	Nov 25, 09, 11:54 AM	380
10	Toshiba	SE00001	508	590	Jan 01, 06, 2:07 PM	Nov 25, 09, 12:15 PM	407
11	Siemens	LAD_CA_R...	60	CT20060...	Aug 27, 06, 10:47 ...	Nov 25, 09, 2:01 PM	356
12	GE	4	5	5	Jan 02, 08, 2:08 PM	Jun 22, 09, 6:58 AM	217

Coronaries

Segment	Percentage	Action
LM	75%	[?]
LAD	75%	[?]
Prox:	Significant ...	
Mid:	-	
Dist:	-	
LCX	75%	[?]
Prox:	-	
Mid:	-	
Dist:	-	

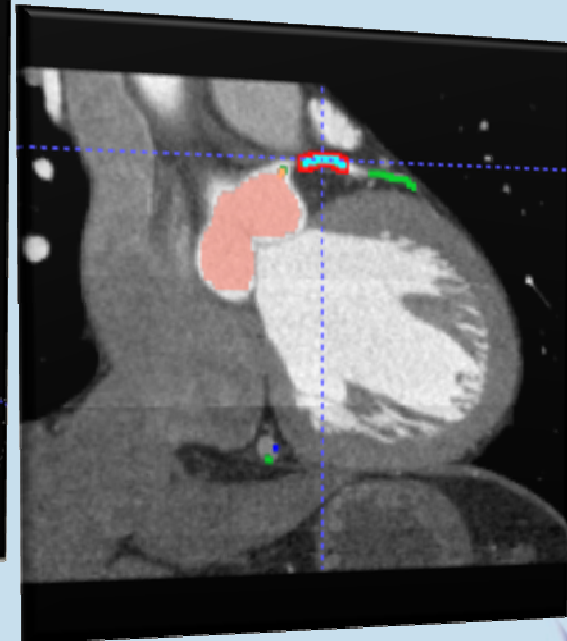
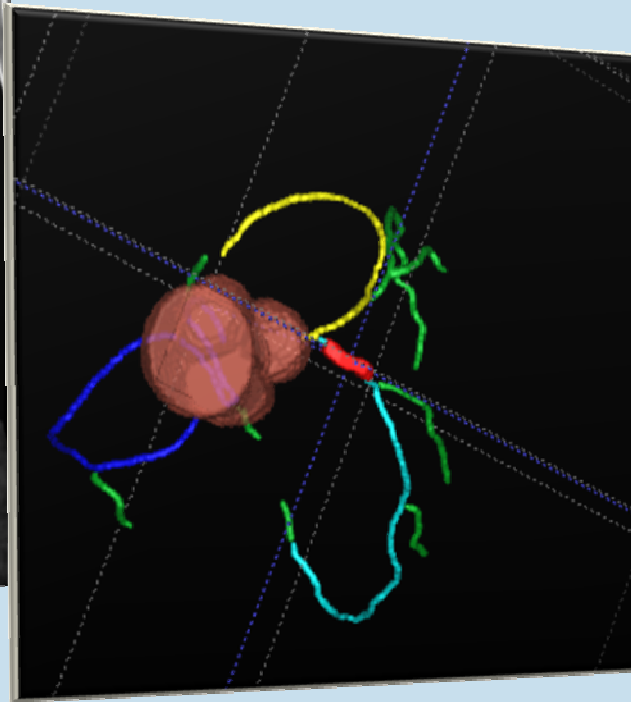
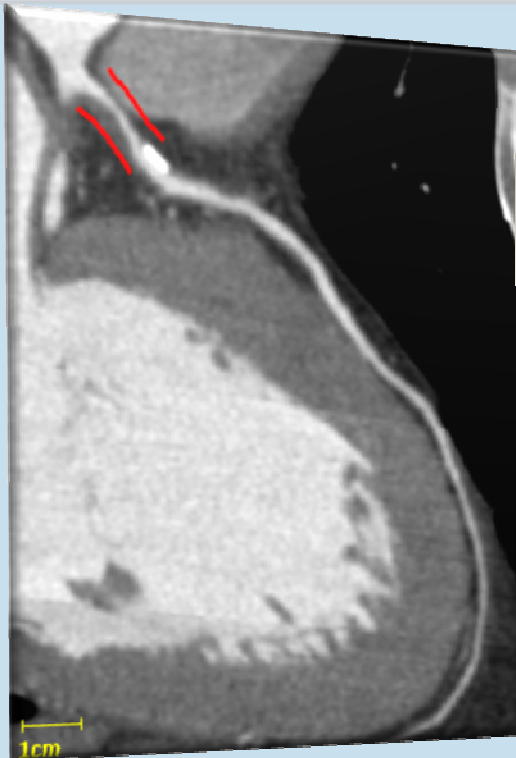
Study Details (Row 7)

Last Name	First Name	Patient ID	Study ID	Phase	Series Description	Process Date	# Images	Voxel Size
GE	LAD	234	-	75%	SS Segment ...	Nov 25, 09, 11:46	201	0.49 x 0.49 x 0.63

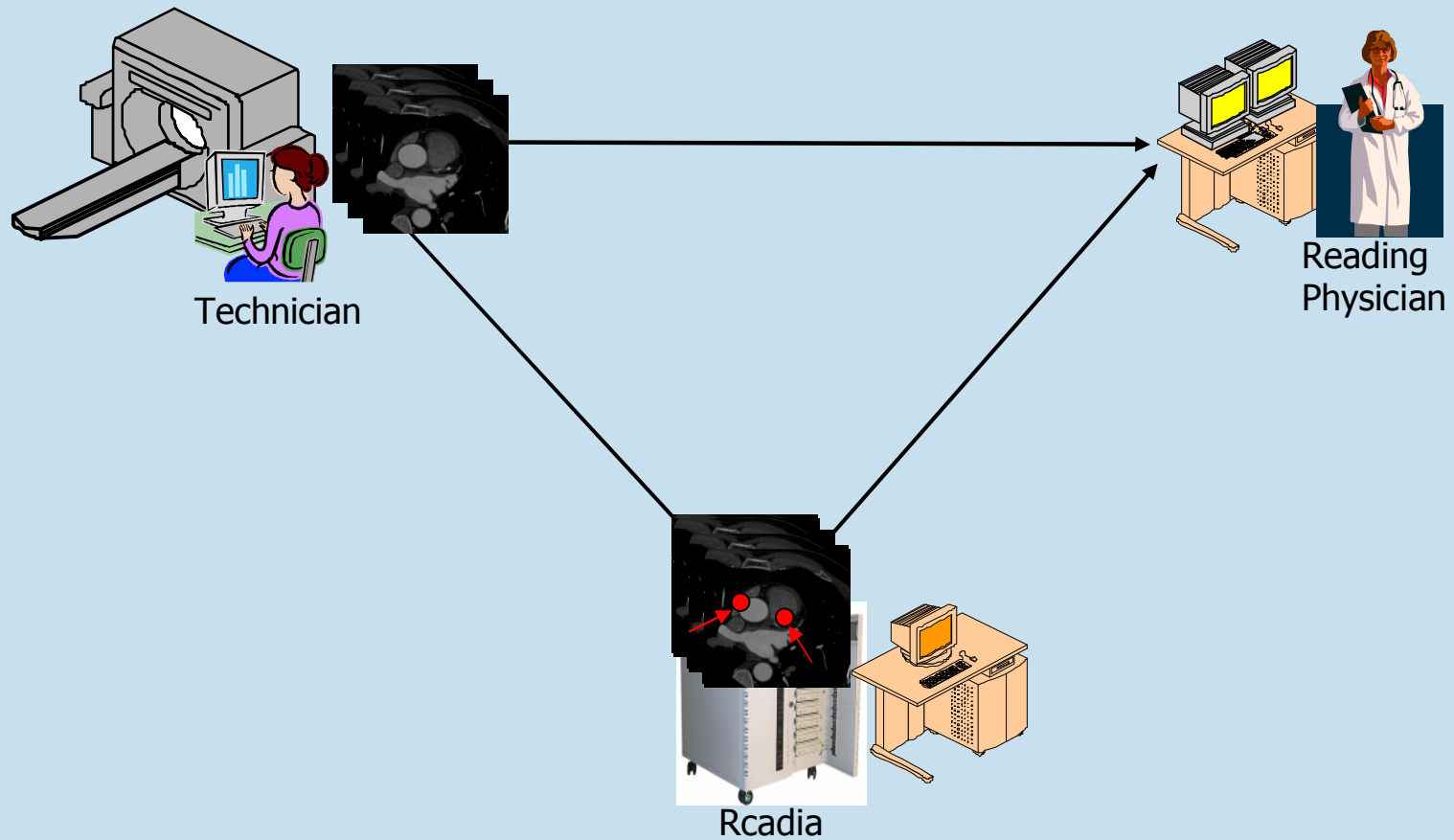
Anonymize
 Auto Import and Process

Free disks space: Drive F: 42.2% (196.6 GB)

Visual Validation



Workflow



Clinical Studies

Site	# cases	Patients	Prevalence	Sensitivity	Specificity	NPV	PPV	Reference standard
Cardiac CT Institute, Philadelphia, PA	138	Outpatient Cardiology	45.65%	95.20%	68.00%	94.40%	71.40%	CCTA consensus reading
Washington Hospital Center	88	Outpatient Cardiology	24.00%	89.70%	56.50%	92.90%	56.50%	CCTA consensus reading
Thomas Jefferson Univ.	100	Outpatient	13.00%	77.00%	74.00%	95.00%	33.00%	CCTA consensus reading
Stony Brook Univ. MC	96	ED, chest pain Cardiology	8.33%	100.00%	64.20%	100.00%	21.62%	CCTA consensus reading
Dr. Poon Cardiac Center, New York	49	Outpatient Cardiology	26.53%	100.00%	38.24%	100.00%	38.24%	CCTA consensus reading
Cardiac Study Center, Tacoma, WA	196	Outpatient	13.27%	100.00%	41.10%	100.00%	21.31%	CCTA consensus reading
Beth Israel Deaconess MC	100	ED, chest pain Cardiology	6.00%	83.00%	82.00%	98.00%	23.00%	CCTA consensus reading
Medical Univ. South Carolina	59	Outpatient	32.20%	100.00%	65.00%	100.00%	58.00%	Cath Lab, QCA

Use Case Scenarios

- “Wet read” when no experienced reader available
 - ED – chest pain triaging
 - Rural hospitals
- Prioritization for high volume practices
- Alarm system for CT technician
- Second opinion / safety net
- Does not replace standard of care: clinical judgment, ECG and Cardiac biomarkers

Publications

- E. Arnoldi et al, “**Automated computer-aided stenosis detection at coronary CT angiography: initial experience**”, European Radiology, Nov 2009
- G.Tyagi et al, “**Segmental Accuracy of an Automated Analyzer of Coronary CT Angiography (CCTA) in ED Patients: (Initial experience)**”, RSNA’09, Chicago, Dec 2009
- G.Tyagi, “**Accuracy of an Automated Coronary CTA Analyzer in ED Patients**”, ASER’09, Orlando, Oct 2009
- M. Poon, “**The Role of Computed Aided Diagnosis in the Management of Acute Chest Pain**”, SCCT’09, Orlando, Jul 2009
- V. Malhotra, “**COR Analyzer Diagnostic Performance Analysis**”, SCCT’09, Orlando, Jul 2009
- S. Zhang et al, “**Automated Diagnosis of Stenosis on Coronary CT Angiography**”, ARRS’09, Boston, Apr 2009
- C. Lopez et al, “**Automatic computerized evaluation of 64 multislice coronary CTA. A comparison between COR Analyzer II software and visual evaluation**”, SCCT’08, Orlando, Jul 2008
- J. S. Weisman, M.Yuz, “**Fully Automated Coronary CTA Analysis**”, SCCT’08, Orlando, Jul 2008