Aquilion ONE Clinical Evidence: Cardiac

320-row CT transcatheter aortic valve replacement planning with a single reduced contrast media bolus injection

Mata-Mbemba D, Labani A, El Ghannudi S, Jeung M-Y, Ohlmann P, Roy C, Ohana M

PLoS ONE, 2018, 13(9): e0204145

- The use of a 320-row CT scanner with single contrast media bolus injection acquisition protocol can halve the iodine load in TAVR planning, while maintaining excellent aorto-ilio-femoral arterial enhancement and significantly lowering the radiation dose. This new approach could be useful whenever a complete aorta CTA with excellent depiction of the ascending aorta is required.

The impact of dose reduction on the quantification of coronary artery calcifications and risk categorization: A systematic review

Vonder M, van der Werf N, Leiner T, Greuter M, Fleischmann D, Vliegenthart R, Oudkerk M, Willemink M

JCCT, 2018, DOI:10.1016/j.jcct.2018.06.001

- The impact of AIDR 3D and tube current reduction was examined in five studies, including two phantoms and 441 patients.
- Radiation doses of the full dose protocols ranged from 4.1 to 16.1 mGy and reduced to radiation doses ranging from 0.7 to 5.7 mGy with a reclassification of 5%–11% when AIDR 3D was used.

Low Radiation Dose Calcium Scoring: Evidence and Techniques

Kaitlin B. Baron, Andrew D. Choi, Marcus Y. Chen

Curr Cardiovasc Imaging Rep (2016) 9: 12

- This review article shows that we have an increasing body of evidence on multiple platforms that CAC scoring at sub-mSv radiation doses can be performed reliably, particularly through the use of iterative reconstruction.
- Thus, the present literature supports coronary calcium scoring at radiation doses that allow for cardiac risk categorization lower than for screening in other diseases.

Tradeoff between noise reduction and inartificial visualization in a model-based iterative reconstruction algorithm on coronary computed tomography angiography

Kenichiro Hirata, Daisuke Utsunomiya, Masafumi Kidoh, Yoshinori Funama, Seitaro Oda, Hideaki Yuki, Yasunori Nagayama, Yuji Iyama, Takeshi Nakaura, Daisuke Sakabe, Kenichi Tsujita, Yasuyuki Yamashita

Medicine (2018) 97:20(e10810)

- FIRST provides significant improvements in objective and subjective image quality compared with FBP and AIDR3D. FIRST reduced image noise and structure visibility of coronary vessels and plaque is superior.

Accuracy of coronary artery calcium scoring with tube- current reduction by 75%, using an adaptive iterative reconstruction algorithm

Luhur R, Schuijf JD, Mews J, Blobel J, Hamm B, Lembcke A

Br J Radiol. 2018 Apr;91(1084):20170678

- The use of AIDR3D in Calcium scoring can reduce the dose while maintaining accurate coronary artery calcium scoring. The total dose in the reduced dose protocol was 0.44 mSv compared to 1.77 mSv showing a dose reduction of 75% when using AIDR3D

Impact of heart rate on diagnostic accuracy of second generation 320-detector computed tomography coronary angiography

Nerlekar Nitesh; Ko Brian S; Nasis Arthur; Cameron James D; Leung Michael; Brown Adam J; Wong Dennis T L; Ngu Philip J; Troupis John M; Seneviratne Sujith K

Cardiovasc Diagn Ther 2017;7(3):296-304

- The diagnostic accuracy, IQ and radiation dose were similar between <60bpm and >60bpm with almost no uninterpretable segments. Patients with HR up to 80bpm can be scanned with a 1 beat protocol and a wider window with no loss of diagnostic accuracy.

Noninvasive CT-Derived FFR Based on Structural and Fluid Analysis

Ko B, Cameron J, Munnur R, Wong D, Fujisawa Y, Sakaguchi T, Hirohata K, Hislop-Jambrich J, Fujimoto S, Takamura K, Crossett M, Leung M, Kuganesan A, Malaiapan Y, Nasis A, Troupis J, Meredith I, Seneviratne S

JACC Cardiovasc Imaging. 2017 Jun;10(6):663-673

- The first clinical validation of the CT FFR application. It shows that the application is feasible and can provide accurate detection of functionally significant coronary stenosis. Importantly, the success rate was high, even in this challenging population with high calcium scores. CT FFR can be done on-site, within 30 minutes processing time

Use of Coronary Computed Tomographic Angiography to Guide Management of Patients With Coronary Disease

Williams Michelle C.; Hunter Amanda; Shah Anoop S.V.; Assi Valentina; Lewis Stephanie; Smith Joel; Berry Colin; Boon Nicholas A.; Clark Elizabeth; Flather Marcus; Forbes John; McLean Scott; Roditi Giles; van Beek Edwin J.R.; Timmis Adam D.; Newby David E.

JACC, 2016, 67(15):1759-1768

- Analysis from the SCOT-HEART trial shows that CCTA leads to more appropriate use of invasive angiography and alterations in preventive therapies that were associated with a halving of fatal and non-fatal myocardial infarction. This is an important paper for the acceptance of coronary CTA in clinical practice.

Radiation dose reduction for coronary artery calcium scoring at 320-detector CT with adaptive iterative dose reduction 3D

Tatsugami Fuminari; Higaki Toru; Fukumoto Wataru; Kaichi Yoko; Fujioka Chikako; Kiguchi Masao; Yamamoto Hideya; Kihara Yasuki; Awai Kazuo

The International Journal of Cardiovascular Imaging, 2015, epub ahead of print

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- The mean effective radiation dose for routine- and low-dose CT was 2.2 and 0.7 mSv, respectively. The use of AIDR 3D made it possible to reduce the radiation dose by 67 % for CAC scoring without impairing the quantification of coronary calcification

Observer variability in the assessment of CT coronary angiography and coronary artery calcium score: substudy of the Scottish COmputed Tomography of the HEART (SCOT-HEART) trial

Williams M. C.; Golay S. K.; Hunter A.; Weir-McCall J. R.; Mlynska L.; Dweck M. R.; Uren N. G.; Reid J. H.; Lewis S. C.; Berry C.; van Beek E. J. R.; Roditi G.; Newby D. E.; Mirsadraee S.

Open Heart, 2015, 2(1): e000234-e000234

- Excellent observer agreement for the assessment of coronary artery calcium score, CT coronary angiography assessment of stenosis severity and the post CT diagnosis of angina pectoris due to coronary heart disease. This supports the use of CT coronary angiography in the assessment of patients with suspected angina due to coronary heart disease.

Superior CT coronary angiography image quality at lower radiation exposure with second generation 320-detector row CT in patients with elevated heart rate: a comparison with first generation 320-detector row CT.

Denni sT. L. Wong, Siang Y. Soh, Brian S. H. Ko, James D. Cameron, Marcus Crossett, Arthur Nasis, John Troupis, Ian T. Meredith, Sujith K. Seneviratne

Cardiovasc Diagn Ther 2014;4(4):299-306

- The second generation CT scanner provides better image quality at lower radiation dose in patients with elevated heart rate (≥65 bpm) compared to first generation CT scanner

A combined local and global motion estimation and compensation method for cardiac CT

Tang Qiulin, Chiang Beshan, Akinyemi Akinola, Zamyatin Alexander, Shi Bibo, Nakanishi Satoru

SPIE 2015

- Technical description of the Adaptive Motion Correction algorithm. Clinical examples are included. Useful technical validation of Toshiba technology

Superior CT coronary angiography image quality at lower radiation exposure with second generation 320-detector row CT in patients with elevated heart rate: a comparison with first generation 320-detector row CT

Dennis T. L. Wong, Siang Y. Soh, Brian S. H. Ko, James D. Cameron, Marcus Crossett, Arthur Nasis, John Troupis, Ian T. Meredith, Sujith K. Seneviratne

Cardiovasc Diagn Ther 2014;4(4):299-306

- The CTCA images performed using the second generation 320-CT scanner were superior in quality and required a lower radiation dose in patients with elevated heart rate (≥65 bpm) when compared with the first generation 320-CT scanner.

Minimizing the acquisition phase in coronary CT angiography using the second generation 320-row CT

Nobuo Tomizawa, Shigeaki Kanno, Eriko Maeda, Masaaki Akahane, Rumiko Torigoe, Kuni Ohtomo

Japanese Journal of Radiology, 2014, ePub ahead of print

- This paper shows that smaller exposure windows with low stable heart rates can produce lower radiation dose

Submillisievert Median Radiation Dose for coronary angiography with a second-generation 320–Detector Row CT Scanner in 107 Consecutive Patients

Chen, Marcus Y and Shanbhag, Sujata and Arai, Andrew E

Radiology, 2013, 267, 1:76-85

- Excellent paper describing the advantages of the Aquilion ONE Vision over the Aquilion ONE. Analysis of 107 patients. Describes improved temporal resolution allowing one heartbeat scans up to 75bpm HR. Mean radiation dose for CTA was 0.93mSv. Describes the use of SUREExposure, AIDR 3D and 100kV for cardiac CTA. The supplementary online data includes an excellent description of why 'padding' is necessary to get the best motion free phase and this is free with Aquilion ONE.

Coronary CT angiography using the second-generation 320-detector row CT: assessment of image quality and radiation dose in various heart rates compared with the first-generation scanner.

Tomizawa, Nobuo and Maeda, Eriko and Akahane, Masaaki and Torigoe, Rumiko and Kiryu, Shigeru and Ohtomo, Kuni

The international journal of cardiovascular imaging, 2013 Oct; 29(7):1613-8

- The radiation dose of 48 patients scanned on the ViSION were compared with 48 patients scanned on the ONE. This comparison only looked at the difference in radiation dose caused by the faster rotation speed and larger generator. The dose reduction was 24%. Overall an excellent paper showing a 24% dose reduction between the ViSION and ONE.

Associations between routine coronary computed tomographic angiography and reduced unnecessary hospital admissions, length of stay, recidivism rates, and invasive coronary angiogr**aphy in** the emergency department triage of chest pain.

Poon Michael; Cortegiano Michael; Abramowicz Alexander J; Hines Margaret; Singer Adam J; Henry Mark C; Viccellio Peter; Hellinger Jeffrey C; Ferraro Summer; Poon Annie; Raff Gilbert L; Voros Szilard; Farkouh Michael E; Noack Pamela

Journal of the American College of Cardiology, 2013, 62, 6:542-52.

- Cardiac CTA is cost effective in triaging patients who present to the Emergency Department with acute chest pain.

Radiation Dose in 320-Slice Multidetector Cardiac CT: - A Single Center Experience of Evolving Dose Minimization

Tung, M.K. and Cameron, J.D. and Casan, J.M.L. and Crossett, M. and Troupis, J.M. and Meredith, I.T. and Seneviratne, S.K.

Journal of Cardiovascular Computed Tomography, May 2013

- This is an excellent paper describing the dose reduction achieved with the introduction of different software versions on the Aquilion ONE. The radiation dose for prospective gated scans dropped from 420.5 to 149.3 mGy.cm. This shows real world results in a large cohort. Image quality is maintained while the radiation dose is reduced due to improvements in arrhythmia detection software, narrow phase width, reduced scan length, SUREExposure and AIDR3D.

Comparison of coronary plaque subtypes in male and female patients using 320-row MDCTA

Khosa F, Khan, Atif N, Nasir K, Bedayat A, Malik Z, Jon A, Cheema A, Clouse M, Welty F

Atherosclerosis 226 (2013) 428e432

- Validation of SURE Plaque software on Vitrea. In patients with non-obstructive CAD, males were found to have significantly higher total coronary plaque volume with predominance of fibrous and fatty subtypes compared to females of the same age and BMI

Diagnostic accuracy of 320-row computed tomography as compared with invasive coronary angiography in unselected, consecutive patients with suspected coronary artery disease.

Pelliccia F, Pasceri V, Evangelista A, Pergolini A, Barillà F, Viceconte N, Tanzilli G, Schiariti M, Greco C, Gaudio C.

International Journal of Cardiovascular Imaging, November 2012

- Diagnostic Accuracy of cardiac CTA compared to catheter angiography. Sensitivity 98%, Specificity 91%, PPV 93%, NPV 98%. No patients were excluded because of atrial fibrillation or high calcium score. All coronary segments were evaluable.

Triple rule-out acute chest pain evaluation using a 320-row-detector volume CT: a comparison of the wide-volume and helical modes.

Kang EJ, Lee KN, Kim DW, Kim BS, Choi S, Park BH, Oh JY.

International Journal of Cardiovascular Imaging, Aug 2012.

- This paper compares the two scan techniques of Wide Volume vs. Ultra Helical very well. Many customers ask which is better for Chest Pain examinations and this paper really helps explain the benefits of both. While highlighting the dose reduction benefits of using Wide Volume, it also adds that the image quality of Ultra Helical was slightly better overall. There is no significant difference between the two in terms of "diagnostic" exams

Diagnostic accuracy of 320-slice computed-tomography for detection of significant coronary artery stenosis in patients with various heart rates and heart rhythms compared with conventional coronary-angiography.

Uehara M, Takaoka H, Kobayashi Y, Funabashi N.

Int J Cardiol. 2012 Mar 17. [Epub ahead of print]

- Results showed that diagnostic accuracy is excellent and there is no significant difference between <65 bpm patients and >65 bpm patient including arrhythmia patients. High quality images might be able be obtained using 320-slice CT, even in patients with high HR or heart rhythm irregularities and the diagnostic accuracy of the results was equivalent to those obtained for patients with low HR with normal heart rhythmn.

The effect of adaptive iterative dose reduction on image quality in 320-detector row ct coronary angiography.

Tatsugami F, Matsuki M, Nakai G, Inada Y, Kanazawa S, Takeda Y, Morita H, Takada H, Yoshikawa S, Fukumura K, Narumi Y.

Br J Radiol. 2012 Jan 17. Epub ahead of print

- This paper used data from 50 patients reconstructed with FBP and AIDR+. Results show highly significant differences in image quality and improved segment image quality with AIDR+. Image noise was reduced by 42% while CNR improved 70% when comparing FBP to AIDR+. The authors clearly articulate the limitations of the study as well as explaining the positive impact of their work on reducing patient dose using the 320-row unit.

Acute Chest Pain Investigation: Utility of Cardiac CT Angiography in Guiding Troponin Measurement

Nasis A, Meredith IT, Nerlekar N, Cameron JD, Antonis PR, Mottram PM, Leung MC, Troupis JM, Crossett M, Kambourakis AG, Braitberg G, Hoffmann U, Seneviratne SK.

Radiology, 2011, 260(2):381-9

- This paper demonstrates the use of cardiac CTA in guiding ED strategy. The length of stay in the hospital was lower with a CTA guided strategy than the current standard of care.

Low dose 320-row CT for left atrium and pulmonary veins imaging-the feasibility study

Yang L, Xu L, Yan Z, Yu W, Fan Z, Lv B, Zhang Z,

European Journal of Radiology, 2011,

- This paper describes the safe and effective use of CT for EP Planning in patients with A Fib on the Aquilion ONE. The scan protocol very easy to understand in a step by step approach.

Reduced exposure using asymmetric cone beam processing for wide area detector cardiac CT.

Bedayat A, Rybicki FJ, Kumamaru K, Powers SL, Signorelli J, Steigner ML, Steveson C, Soga S, Adams K, Mitsouras D, Clouse M, Mather RT.

Int J Cardiovasc Imaging. 2011,

- 24% dose reduction with Asymmetrical Cone Beam Reconstruction (V4.51 software)

Presence of accessory left atrial appendage/diverticula in a population with atrial fibrillation compared with those in sinus rhythm: a retrospective review

Troupis J, Crossett M, Scneider-Kolsky M, Nandurkar D.

Int J Cardiovasc Imaging. 2011 Feb 18

- Patients with cardiac arrhythmias can be successfully scanned on Aquilion ONE.

320-row CT coronary angiography: effect of 100-kV tube voltages on image quality, contrast volume, and radiation dose

Zhang C, Zhang Z, Yan Z, Xu L, Yu W, Wang R

Int J Cardiovasc Imaging. 2011, 27(7):1059-68

- 100kV protocols can be used for all patients with BMI less than 25 with significant reduction in contrast medium volume and radiation dose while maintaining adequate image quality.

Diagnostic Accuracy of Noninvasive Coronary Angiography With 320-Detector Row Computed Tomography

Nasis A, Leung M, Antonis P, Cameron J, Lehman S, Hope S, Crossett M, Troupis J, Meredith I, Seneviratne S

Am J Cardiol. 2010 Nov 15;106(10):1429-35.

- Diagnostic Accuracy of cardiac CTA compared to catheter angiography. Sensitivity 94%, Specificity 87%, PPV 88%, NPV 93%. No patients were excluded because of atrial fibrillation or high calcium score.

Feasibility of contrast material volume reduction in coronary artery imaging using 320-slice volume CT.

Hein P, May J, Rogalla P, Butler C, Hamm B, Lembcke A

European Radiology, 2010, 20(6):1337-43

- This is a simple study that compares the clinical quality difference when using 40, 50, 60, and 70 ml of contrast in similar groups of patients all injected at 5 ml/sec with 50 ml of saline flush. They concluded that diagnostic image quality can be achieved using only 40 ml of iodinated contrast material.

Quality of coronary arterial 320-slice computed tomography images in subjects with chronic atrial fibrillation compared with normal sinus rhythm.

Uehara M, Funabashi N, Ueda M, Murayama T, Takaoka H, Sawada K, Kasahara T, Yanagawa N, Komuro I.

Int J Cardiol. 2011, 150(1):65-70.

- Image quality in patients with atrial fibrillation is similar to that of patients in sinus rhythm.

Diagnostic Accuracy of 320-row multidetector computed tomography coronary angiography in the non-invasive evaluation of significant coronary artery disease

de Graaf F, Schuijf J, van Velzen J, Kroft L, de Roos A, Reiber J, Boersma E, Schalij M, Spano F, Jukema W, van der Wall E, Bax B

European Heart Journal 2010, 31(15):1908-15

- Diagnostic Accuracy of cardiac CTA compared to catheter angiography. Sensitivity 100%, Specificity 81%, PPV 88%, NPV 100%.