ANGIOGRAPHY AND QCA

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TCT-278

Radiation Safety: Every Little Bit Helps

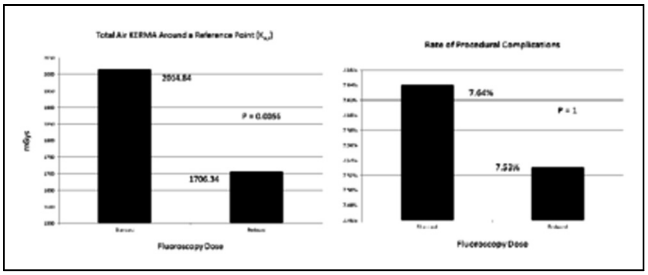
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BACKGROUND Ionizing radiation makes invasive diagnostic imaging and therapeutic procedures possible but is also associated with deterministic and stochastic effects. Strategies to reduce radiation in the cardiac catheterization lab are well established and include appropriate collimation, reducing fluoroscopy pulse (frame) rate and reducing on cine acquisition, i.e. use of fluoroscopy store. There remains concern about the fidelity of image quality with lower pulse rates as well as the risk/benefit for further fluoroscopy rate reduction. To our knowledge, no studies to date have examined reduction of fluoroscopy pulse rate on all-comers undergoing percutaneous intervention.

METHODS As a quality improvement project, the default pulse/second rate was reduced from 10 to 7.5 in all fluoroscopy machines in the cardiac catheterization laboratory at Penn State Hershey Medical Center. The option to change fluoroscopy pulse rate was left to operator discretion. Six months of data, including radiation dose (Ka,r in mGys), number of stents, age, height, weight (and therefore BSA), risk factors for coronary artery disease, indication for catheterization and intraprocedural complication rates for patients undergoing PCI were reviewed and compared with nine months of baseline data that preceded the pulse rate reduction.

RESULTS Demographics and number of stents placed were balanced across all groups. There was a significantly higher rate of STEMI in the standard fluoroscopy dose group, but this did not alter the overall radiation dose across the population. Radiation dose was lower in the reduced pulse rate group (2014.84 ± 1131.68 mGys versus 1706.34 ± 1047.41, 95% CI 90.84 - 526.16, p = 0.0056) without increased rate of procedural complications.

	Standard	n	Standard Deviation	Reduced	n	Standard Deviation	P Value	Confidence Interval	
Demographics (Total)		314			146				
Male (%)	77.07	242		74.66	109		0.6376		
Age at cath (years)	63.89		11.69	64.84		11.93	0.4207	-3.2662	1.3662
Height (cm)	171.99		10.1	171.68		10.37	0.7616	-1.6971	2.3171
Weight (kg)	92.26		18.42	91.24		20.85	0.5966	-2.764	4.804
Body Surface Area (BSA in m2)	2.05		0.22	2.03		0.26	0.3928	-0.0259	0.0659
Indication									
NSTE - ACS	41.08%	129		47.26%	69		0.2258		
STEMI or Equivalent	31.85%	100		22.60%	33		0.0468		
Stable Angina or Equivalent	24.84%	78		28.08%	41		0.4931		
Evaluation of Cardiomyopathy	0.64%	2		0.68%	1		1		
Valvular Heart Disease/Other	1.59%	5		1.37%	2		1		
Outcomes									
Air KERMA around a Reference Point (Ka,r in mGys)	2014.84		1131.68	1706.34		1047.41	0.0056	90.8441	526.16
Procedure Complications	7.64%	24		7.53%	11		1		



CONCLUSIONS In all patients undergoing PCI, a reduction in fluoroscopy rate, from 10 to 7.5 pulses per second, was associated with a statistically significant reduction in radiation dose without a difference in procedural complications.

CATEGORIES **OTHER:** Quality, Guidelines and Appropriateness Criteria

KEYWORDS PCI - Percutaneous Coronary Intervention, Radiation dose

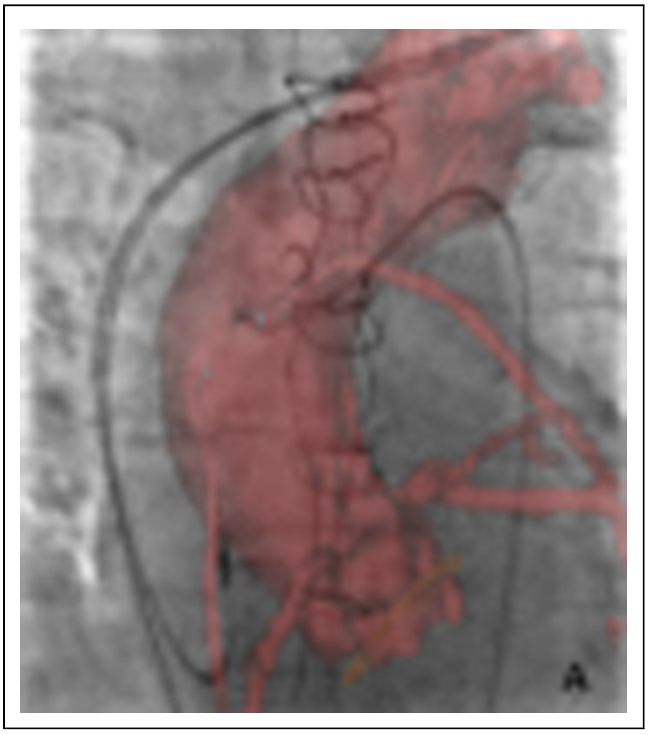
TCT-279

The value of image fusion in coronary angiography for the detection of coronary artery bypass grafts

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BACKGROUND Coronary angiography are more complex in patients with coronary artery bypass grafts (CABG). These procedures are longer leading to more X-ray exposure, compared to conventional coronary angiography. Image fusion is a new technology allowing a fusion in real-time of a 3D model obtained by reconstruction of Computed Tomography (CT) with fluoroscopic images. Purpose: To evaluate the impact of image fusion in coronary angiography for detection of CABG.

METHODS This single-center prospective study included all patients admitted for angiographic control of CABG, over a period of 12 months. Image fusion coronary angiographies were compared to conventional coronary angiographies. Fusion image group was defined by patients with previous (for another indication) chest CT with contrast injection. Patients without prior injected chest CT constituted the control group. For patients in the fusion group, aorta, CABG, sternotomy sutures, bronchi and a vertebra were reconstructed in 3D from CT acquisitions and merged in real-time on fluoroscopic images. The following parameters were compared: length of time necessary to find CABG, procedure time, X-Ray exposure and amount of contrast product needed.



RESULTS Sixty-six patients were included, 20 in the fusion image group, 46 in the control group. There were no significant differences between the 2 groups in general data and procedures characteristics. There are more women on the fusion group. The search time of CABG was significantly shorter in the fusion group (respectively 7.3 min ± 4.5 min vs 16.04 min ± 13.2 min, p = 0.002), as well as the procedure duration (20.1 min ± 7.2 min vs 31.5 min ± 15.2 min, p = 0.002), fluoroscopy time (9.2 min ± 3.7 min vs 16.4 min ± 7.8 min , p = 0.01), total radiation time (11.1 min ± 4.4 min vs 14.76 min ± 8.3 min, p = 0.006), Air KERMA (546 mGy ± 227 mGy vs 823 mGy ± 475 mGy, p = 0.02), Dose Area Product (4467.8 cGy.cm^2 ± 2030.5 cGy.cm^2 vs 6542.1 cGy.cm^2 ± 3769 mGy, p = 0.02) and volume of iodinated contrast product (87 cc ± 26 cc vs 121 cc ± 43.5 cc, p = 0.002).

CONCLUSIONS 3D reconstruction of CABG from CT with real-time fusion on coronary angiography images reduce the length of time necessary to find CABG, procedure time duration, X-Ray exposure and quantity of iodinated contrast compared to standard coronary angiography for diagnostic purposes in patients with CABG.

CATEGORIES IMAGING: Cath Lab of the Future

KEYWORDS Coronary angiography, Imaging technology, Three-dimensional

TCT-280

Impact of Diabetes Mellitus on Graft Patency following Coronary Artery Bypass Graft Surgery: a Propensity Score Analysis

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BACKGROUND There is limited data on impact of diabetes mellitus (DM) on graft occlusion rates after coronary artery bypass graft surgery (CABG). We sought to evaluate the association of DM on graft patency following CABG.

METHODS Patients who underwent CABG between January 1995 through September 2014 and had at least one follow up coronary angiogram were included for analysis. Outcomes assessed were graft (venous and arterial) stenosis and graft occlusion. Graft stenosis was defined as 70% occlusion on visual assessment on follow-up coronary angiogram while graft occlusion referred to total (100%) occlusion of the graft. Baseline demographic, clinical, echocardiographic and surgical data were extracted. We used a propensity score model to match the baseline characteristics between DM and non-DM groups. Propensity scores of both groups were matched 1:1 using nearest neighborhood method. Only scores in the common support range were used to find matched pairs. The incidence of graft occlusion in matched pairs was compared separately for arterial and venous grafts using McNemar's test.

RESULTS We found 294 matched pairs who had at least one venous graft and 293 matched pairs who had at least one arterial graft. In both venous and arterial graft matched cohorts the age [venous(mean age in years: DM 61.6, non-DM 63.3), arterial(mean age in years: DM 60.7, non-DM 61.9)] and gender [venous(males: DM 71%, non-DM 72.4%), arterial(males: 70.9% DM, non-DM 73%)] distribution were similar among DM and non-DM groups. Mean follow up period was 10.7 years. DM was associated with higher venous graft stenosis (50% Vs 41.8% McNemar chi-square 3.6, p = 0.05) and occlusion (40.8% Vs 32.9% McNemar chi-square 3.9, p = 0.04) compared to non-DM. On the other hand, arterial graft stenosis (12.9% Vs 15% McNemar chi-square 0.49, p = 0.48) and occlusion (8.8% Vs 11.6% McNemar chi-square 1.1, p = 0.29) rates were similar between DM and non-DM.

CONCLUSIONS Diabetes is associated with lower vein graft patency but similar arterial graft patency in comparison to non-diabetics.

CATEGORIES CORONARY: Diabetes

TCT-281

Real-Time Radiation Monitoring Reduces Patient Peak Skin Dose During Coronary Angiography

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BACKGROUND Exposure to ionizing radiation during coronary angiography can have dose related effects including skin damage. Angiography systems providing a real-time pictorial display of patient skin dose are now available. Hypothesis: The use of a real-time radiation skin dose monitor displaying a color pictorial reduces patient peak skin dose (PSD) during coronary angiography or intervention.

METHODS Consecutive patients undergoing coronary angiography or percutaneous coronary intervention (PCI) at a single center were prospectively enrolled. Total and PSD were collected using the Dose Tracking System (DTS) (Toshiba Medical Systems, Japan). The DTS displays cumulative dose values in real-time using a color map on a 3D graphic of the patient adjacent to the fluoroscopy image. Two patient groups were collected sequentially for comparison; i) control group representing standard clinical practice with the DTS recording procedural variables without the pictorial feedback displayed for the operator and ii) "DTS" group subsequently collected with the DTS displayed for operator visualization. High-risk dose thresholds for skin injury were defined as: fluoroscopy time (FT) > 30 mins, reference air kerma (Kar) > 3 Gy and PSD > 2 Gy.

RESULTS Over an 11-month period a total of 1077 consecutive patients were enrolled by 16 proceduralists. Coronary angiography alone was performed in 617 with angiography and PCI in 460. Comparison between control (n = 488) and the DTS group (n = 589) revealed no difference in BMI, age, prior CABG, contrast volume or progression to PCI. Radial access was more common in the DTS group (p = 0.001). Institution of the DTS resulted in a significant 15.5% reduction in PSD compared with control (290 vs 343mGy, p < 0.001). Similar reductions in Dose Area Product (DAP)(13.9%, p < 0.001) and Kar (19.5%, p < 0.001) were seen with no change in fluoroscopy time (p = 0.379) or number of cine acquisitions (p = 0.753). The most profound reductions were in those undergoing PCI; in the DTS group the PSD was reduced by 46.3% (p < 0.001), DAP by 35% (p < 0.001) and Kar by 41.4% (p < 0.001). Less patients in the DTS group were placed at risk of skin damage by exceeding the PSD high-risk threshold (control 2.7% vs DTS 0.7%, p = 0.012). There was no change in the frequency of FT (p = 1) or Kar (p = 1) high-risk exposure. The benefit of the DTS was seen irrespective of access site (radial or femoral). In the radial group, the PSD (248 vs 298mGy, p =0.004) DAP (5740 vs 6510mGy.cm2, p = 0.014) and Kar (497 vs 574mGy.cm2, p = 0.002) were all reduced by the DTS compared with control. Additional subgroups that derived reduction in PSD with the DTS compared with control included those with prior CABG (257 vs 314mGy, p = 0.004, n = 100) and obese patients undergoing PCI (815 vs 1231mGy p < 0.001, n =148).

CONCLUSIONS Real-time PSD radiation monitoring using a color pictorial on a 3D graphic of the patient results in substantial reductions in radiation dose during coronary angiography and PCI.

CATEGORIES IMAGING: Cath Lab of the Future

KEYWORDS PCI - Percutaneous Coronary Intervention, Radiation dose, Skin dose

TCT-282

The combination of high Syntax Score and moderate to severe Coronary Artery Calcification is a strong predictor of thrombotic events after an Acute Coronary Syndrome

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BACKGROUND The Syntax Score (SS) and Coronary Artery Calcification (CAC) are two variables related with the extent and severity of the coronary artery disease (CAD). Our purpose was to investigate the relationship of complexity and extent of CAD assessed by the SS and the CAC, with acute atherothrombotic events (AAE) during follow up.

METHODS We studied 270 patients with ACS admission who underwent coronary angiography (CA). Clinical variables were recorded and CA were reviewed by two experienced operators, calculating SS and CAC grade (measured with a semiquantitative scale, ranging from 0 (none) to 3 (severe)). AAE were defined as: ACS or stroke/TIA. Patients were divided into three groups, depending on SS and CAC: Group 0 (SS below the median of