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Beneficial Effects Of Manual- Versus Pump Contrast Injection On Image Quality And ContRast Demand During Optical Coherence Tomography: The BIRD Study

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Background: Optimal blood clearance with contrast medium is the prerequisite to high image quality for optical coherence tomography (OCT). We investigated whether manual contrast injection (MCI) enables comparable image quality at significantly lower contrast volume, as compared with automated pump contrast injection (APCI).
Methods: We enrolled 26 patients consecutively, who underwent OCT imaging for any reason. Pullbacks were performed with both, MCI and APCI in a random order in each investigated segment. Amount of used contrast per pullback was recorded. Images were analyzed offline by a dedicated OCT-technician, blinded for the used method. Frames were categorized into three groups by the image quality, namely (1) perfect, if no residual blood present, (2) acceptable, if residual blood did not compromise the imaging of the entire endothelial surface, or (3) failed, if residual blood caused any shadowing on the vessel wall.
Results: 84 pullbacks were analyzed, distributed equally between the MCI and the APCI groups. There was no significant difference in image quality, defined as the number of perfect or acceptable frames per pullback (246 [178-262] vs 230 [192-269], respectively; p=0.989). Comparing the two methods on millimeter level, and defined the quality as the worst frame of the given one millimeter, we found no difference at any section of the total length of the pullback in the rate of perfect clearance (57.8±15.1% vs 59.3±17.1%, respectively; p=0.206) or in the rate of perfect and acceptable clearance (84.9±6.8% vs 84.1±6.6%, respectively; p=0.250). Amount of used contrast was significantly lower with MCI compared to APCI (12 [11-13] vs 20 [17-25], respectively; p<0.001).
Conclusions: Using MCI for optimal blood clearance during OCT imaging allows the operator to use less contrast media compared to the conventional APCI, without jeopardizing the quality of the images.

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Calibration of Intravascular Optical Coherence Tomography As Presented In Peer Reviewed Publications

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Background: Intravascular Optical Coherence Tomography (OCT) provides high-resolution intracoronary images with a broad range of utility. Marketed OCT systems have been validated and measurements are found to be accurate and precise in carefully performed bench tests. However, precision of quantitative measurements in-vivo is sensitive to various factors including correct calibration. Calibration as depicted in OCT images in peer reviewed publications may be considered proven standard by OCT users.
Methods: Using a fixed search of MESH-terms in the PubMed database, we identified more than 600 articles since 1. January 2011, of which 224 were included in the analysis giving a total of 1163 OCT images with the information needed for evaluating the calibration. Calibration errors were divided into 8 groups, ranging from slightly incorrect through errors with substantial impact on measurements. Errors that may likely affect stent sizing were termed serious calibration errors.
Results: We found 757 images produced by time domain OCT systems. Of these were 15% in-assessable. More than slightly incorrect calibration was found in 30 % of assessable cases. Serious calibration incorrectness was seen in 14 % of images. A total of 417 images had been obtained by marketed frequency domain systems, (375 by C7 system and 42 images by Illumien, both St. Jude Medical, USA). In images acquired by C7, serious calibration issues were detected in 20 % of cases. In images acquired by Illumien only a single acquisition with 3 images were severely incorrect calibrated due to the calibration artifact.
Conclusions: A high incidence of incorrect calibrated images were found in systematic analysis of peer reviewed publications. Improved calibration facilities by newer generation OCT systems seems to reduce errors though not alleviating the risk associated with not identifying the calibration artifact.

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Relationship between the severity of left main coronary artery (LMCA) disease and overall coronary atherosclerotic burden: The PROSPECT study

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Background: Whether the severity of left main coronary artery (LMCA) stenosis reflects the overall patient-level atherosclerotic burden is not known.
Methods: In PROSPECT, following successful stenting of culprit lesions in 697 acute coronary syndrome pts, 3-vessel grayscale and virtual histology (VH) intravascular ultrasound (IVUS) was performed and untreated non-culprit lesions (NCLs) were evaluated. The most powerful predictors of future unanticipated non-culprit lesion (NCL) MACE were a minimal luminal area (MLA) ≤4mm2, plaque burden (PB) ≥70%, and VH thin-cap fibroatheroma (TCFA).
Results: Overall, 552 pts comprised the present analysis and were divided into tertiles according to LMCA MLA. The tertile with the smallest MLA was significantly associated with largest plaque burden and the greatest necrotic core (NC) volume in the LMCA. Furthermore, the tertile with the smallest MLA was also significantly associated with largest plaque burden within the 3 major epicardial arteries. Of the 3 predictors of future NCL MACE, the tertile with the smallest LMCA MLA was significantly related to the largest number of pts with at least 1 lesion with an MLA ≤ 4mm2 and with at least 1 of 3 PROSPECT predictors of future unanticipated NCL MACE (Table).
Conclusions: A smaller LMCA MLA was associated with a higher plaque and NC burden both in LMCA and within the 3 epicardial coronary arteries. These findings may explain in part why pts with LMCA disease exhibit a higher incidence of future cardiac events unrelated to the LMCA.

	Q1 (n=184)	Q2 (n=185)	Q3 (n=185)	p
LMCA				
Total plaque volume (%)	44.2 (35.7-50.2)	34.6 (28.2-42.0)	29.1 (23.6-34.5)	<0.001
MLA (mm2)	10.1 (8.9-11.1)	13.8 (13.1-15.0)	18.8 (17.3-21.1)	<0.001
Plaque burden at MLA (%)	51.1 (46.2-59.5)	41.8 (35.1-47.0)	32.0 (26.1-39.6)	<0.001
Total NC volume (%)	9.4 (3.8-15.2)	5.5 (2.3-10.1)	2.8 (1.0-7.8)	<0.001
Sum of all NCL (pt level analysis)				
Total plaque volume of all NCLs (mm2)	50.2 (47.7-53.1)	49.4 (46.8-52.5)	48.8 (46.4-51.4)	0.005
Smallest MLA among NCLs (mm2)	3.6 (3.0-4.2)	3.8 (3.1-4.9)	4.1 (3.2-4.8)	<0.001
Total NC volume of all NCLs (%)	13.9 (8.9-18.1)	11.7 (7.8-17.8)	11.2 (6.9-16.6)	0.06
High-risk findings				
Pts with ≥ 1 lesions with MLA ≤4mm^2 (%)	66.8	59.0	48.6	0.002
Pts with ≥ 1 lesions with PB ≥70% (%)	33.2	35.5	32.8	0.84
Pts with ≥ 1 lesions with TCFAs (%)	52.9	61.5	55.8	0.26
Pts with ≥ 1 lesions with ≥ 1 predictors (%)	87.0	84.2	76.8	0.03

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