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Letter to the Editor

Comparison of fluoro and cine angiographic modes in coronary stenting procedure: A preliminary feasibility study

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X-ray exposure of patient during coronary angiography (CA) and percutaneous coronary intervention (PCI) may have some deleterious effects. The radiation dose per frame for digital acquisitions can be 15 times greater than that for fluoroscopy. The number and length of digital acquisition or cine "runs" may be the greatest source of patient radiation dose in interventional cardiology procedures. Last fluoroscopy hold (LFH) is a new advanced feature that dynamically stores only the last current sequence of fluoroscopy images for instant replay, editing and storage in radiography and fluoroscopy systems without the need for operator pre-setting. LFH could reduce the fluoroscopy time to half compared to when it is not used and enables the operator to examine the image as long as necessary for decision making without the use of radiation [1–7].

We compared cumulative DAP, cumulative air kerma, fluoroscopy time, contrast use and image quality between LFH and conventional cine stenting techniques. 10 patients were enrolled into LFH stenting group and 26 patients were prospectively enrolled into cine stenting group according to operator's decision. LFH cases were performed by 1 operator experienced in IVUS and FFR and cine cases were performed by 5 operators having >100 PCI case and FFR experience. Images were acquired by Phillips Allura FD 10 angiography system.

Informed consent was obtained from each patient and the study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institution's human research committee. Results were compared by Student t and chi-square tests. There was no difference between age, sex, diabetes mellitus presence, creatinine, acute coronary syndrome presentation, history of CABG, and PCI between two groups (Table 1).

There was no difference in number of the stents per patient in LFH and cine group (1.3 ± 0.48 vs 1.27 ± 0.45, p = 0.86). Mean cumulative air kerma was higher in cine stenting group than LFH stenting group (1699.5 ± 1008.8 vs 561.4 ± 478 mGy, p < 0.0024). Mean cumulative DAP was higher in cine stenting group than LFH stenting group (123,252.8 ± 77,496.2 mGy cm^2 vs 45,569.9 ± 34,477.4 mGy cm^2, p < 0.0047). Mean fluoroscopy times were higher in cine stenting group than LFH stenting group (13.77 ± 7.66 min vs 5.41 ± 6.43 min, p = 0.0044). Mean contrast use was higher in cine stenting group than LFH stenting group (179.81 ± 60.11 ml vs 103 ± 24.52 ml, p = 0.0004). Body mass indices were not different between cine and LFH groups (29.44 ± 5.03 kg/m^2 vs 29.7 ± 3.76 kg/m^2, p = 0.86). Cardiologists assessed LFH images sufficient for decision making and in only 3 of the LFH cases additional limited cine images were taken for better images. 2 of the LFH cases were primary PCI. There was no mortality or complication in both groups (Table 2).

Interventional cardiologists are competitive and perfectionistic people but a recent publication about brain and neck tumors in interventional cardiologists should warn and encourage them to reduce radiation doses and perfection during procedures [8]. Clearly, the types of examination where this strategy is acceptable are limited to those where the requirement is only to adequately distinguish high contrast features. Procedures which could be considered to be in this category are cardiac pacing and electrophysiology in which electrophysiology

Table 1
Comparison of patients' demographic data.

	LFH stent group, n = 10	Cine stent group, n = 26	p
Age, years	56 ± 10.91	66 ± 11.02	0.95
Sex, female, n	1 (10%)	7 (26%)	0.4
Diabetes mellitus, n	6 (%60%)	16 (61.53%)	1
Creatinine, mg/dl	0.89 ± 0.1449	0.8952 ± 0.2603	0.25
Acute coronary syndrome, n	4 (40%)	13 (50%)	0.0759
History of PCI, n	1 (10%)	5 (19.2%)	0.654
History of CABG, n	0	4 (15.38%)	0.558

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Table 2
Radiation doses, fluoroscopy times, contrast use and BMI.

	Last fluoro hold stent group (LFH), n = 10	Cine stent group, n = 26	p
Cumulative dose-area product values (mGy cm^2)	45,569.9 ± 34,477.4	123,252.8 ± 77,496.2	<0.0047
Cumulative air kerma product (mGy)	561.4 ± 478	1699.5 ± 1008.8	<0.0024
Fluoroscopy times (min)	5.41 ± 6.43	13.77 ± 7.66	0.0044
Number of implanted stents per patient	1.3 ± 0.48	1.27 ± 0.45	0.86
Amount of contrast use, ml	103 ± 24.52	179.81 ± 60.11	0.0004
Body mass index, BMI, kg/m^2	29.7 ± 3.76	29.44 ± 5.03	0.86

wires are inserted via an artery or vein and guided into the heart using fluoroscopy and electrocardiographic monitoring [9,10].

In our study radiation doses, contrast use and fluoroscopy times were prominently lower in LFH stenting than cine stenting technique. This preliminary study shows that a senior operator experienced in IVUS and FFR uses much lower radiation, contrast and fluoroscopy times with LFH stenting technique than conventional cine stenting technique. Larger studies are needed to show whether senior operators can perform PCI safely by LFH technique despite fluoroscopic LFH images' conventional inferior diagnostic quality when compared to cine coronary stenting with new angiographic systems with improved LFH image quality. We propose that these techniques be initially used especially by experienced operators in PCI and primary PCI and when in doubt additional cine images be taken. Once in larger studies a significant reduction in DAP, air kerma and fluoroscopy time readings are shown, the low dose LFH technique should universally be accepted by the clinicians in interventional cardiology and new industry standards in imaging established.

Conflict of interest

The authors report no relationships that could be construed as a conflict of interest.

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