

Patient Radiation Exposure During Primary Percutaneous Coronary Intervention in Acute ST-elevation Myocardial Infarction at the Philippine Heart Center

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Keywords

STEMI, radiation dose, diagnostic reference level

Citation: *Interventional Cardiology Review* 2021;16:e21. DOI: <https://doi.org/10.15420/icr.2021.16.P010>

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Background: Emergency procedures, such as primary percutaneous coronary intervention (PCI) in the setting of acute ST-elevation MI (STEMI), may entail longer procedural times which translate to higher radiation exposure. In an effort to further improve radiation safety practices, the determination of the diagnostic reference level (DRL) for these procedures may allow the identification of practices which may predispose patients and operators to the undesirable effects of radiation.

Aim: This study aims to determine the radiation doses of the patients who underwent primary PCI in the setting of STEMI and to set the DRL for this procedure in our cardiac catheterisation laboratory.

Methods: This was a retrospective cohort study conducted at the Philippine Heart Center (PHC) on all patients with STEMI who underwent primary PCI from 1 May 2019 to 29 February 2020. The DRL was established based on the third quartile values of the median dose area products.

Results: There were 663 consecutive STEMI patients who underwent primary PCI, with a mean age of 55.75 ± 11.45 years. There were significantly more patients who underwent primary PCI using the transradial approach (395, 59.58%) compared to the transfemoral approach (268, 40.42%; $p < 0.001$). For both approaches, the median fluoroscopy time was 11.05 minutes (7.23–16.38). The median cumulative air kerma was 496.46 mGy (330.95–842.8). The median total DAP was 4.22 mGy.m^2 (interquartile ratio 2.78–6.55) and the DRL was 6.55 mGy.m^2 . A significantly higher DRL was seen when the femoral access was used (6.74 versus 6.50, $p < 0.001$).

Conclusion: Higher radiation exposure can occur during emergency procedures compared to elective cases. Compared to the established DRL for elective ad hoc PCI in other countries, we report a higher local DRL, highlighting the need to reduce radiation exposure to as low as reasonably achievable for the operators. □

Table 1: Clinical and Procedural Characteristics of Patients

	Total (n=663)	Radial (n=395) Frequency (%), mean \pm SD	Femoral (n=268)	p-value
Age	55.75 \pm 11.45	55.04 \pm 10.48	56.78 \pm 12.69	0.055
Sex				
Male	530 (79.94)	314 (79.49)	216 (80.60)	0.728
Female	133 (20.06)	81 (20.51)	52 (19.40)	
Hypertension	345 (52.04)	202 (51.14)	143 (53.36)	0.575
Diabetes	102 (15.38)	60 (15.19)	42 (15.67)	0.866
Prior stroke	21 (3.17)	10 (2.53)	11 (4.10)	0.256
Onset of chest pain (hours)	6.85 \pm 4.36	7.02 \pm 3.75	6.60 \pm 5.12	0.2281
Inter-hospital transfer	447 (67.42)	249 (63.04)	198 (73.88)	
Primary ER	216 (32.58)	146 (36.96)	70 (26.12)	0.003
Door-to-wiring time (mins)	25 (20–34)	25 (20–32)	27 (21–36)	0.049
Door-to-balloon (mins)	29 (23–38)	28 (23–36)	30 (24–40)	0.007
Infarct-related artery				
LAD	455 (68.63)	290 (73.42)	165 (61.57)	
LCX	40 (6.03)	25 (6.33)	15 (5.60)	0.001
RCA	168 (25.34)	80 (20.25)	88 (32.84)	
Left main involvement	27 (4.07)	8 (2.03)	19 (7.09)	0.001
PCI of the infarct-related artery only	411 (61.99)	271 (68.761)	140 (52.24)	<0.001
POBA of the infarct-related artery	30 (4.52)	17 (4.30)	13 (4.85)	0.740
Complete revascularization	112 (45.34)	53 (44.17)	59 (46.46)	
Staged PCI	135 (54.66)	67 (55.83)	68 (53.54)	0.718
DES				
1 stent	436 (65.76)	284 (71.90)	152 (56.72)	
2 stents	111 (16.74)	63 (15.95)	48 (17.91)	0.065
3 or more stents	61 (9.2)	32 (8.1)	29 (10.82)	
Volume of contrast (ml)	90 (80–110)	80 (75–100)	100 (80–120)	<0.001
Alive	618 (93.21%)	362 (91.65%)	256 (95.52%)	0.051
Expired	45 (6.79%)	33 (8.35%)	12 (4.48%)	

Table 2: Radiation Doses During Primary Percutaneous Coronary Intervention

	Total (n=663)	Radial (n=395) Median (IQR)	Femoral (n=268)	p-value
Fluoroscopy time (mins)	11.05 (7.23–16.38)	10.43 (7.02–16.03)	11.215 (7.75–16.9)	0.158
DAP fluoroscopy (Gy.cm ²)	2.4 (1.53–4.21)	2.39 (1.42–4.03)	2.49 (1.64–4.27)	0.194
DAP exposure (Gy.cm ²)	1.77 (1.20–2.5)	1.77 (1.21–2.46)	1.75 (1.19–2.57)	0.929
Total DAP (Gy.cm ²)	4.22 (2.78–6.55)	4.195 (2.7–6.5)	4.3 (2.89–6.74)	0.162
Estimated effective dose (mSV)	7.81 (5.14 to 12.12)	7.76 (5 to 12.03)	7.96 (5.35 to 12.47)	0.161
Air Kerma (mGy)	496.46 (330.95–842.8)	495.89 (323.15–842.8)	500.275 (331.58–823.48)	0.6403
Estimated peak skin dose (mGy)	461.18 (376.11–639.2)	460.89 (372.1–639.2)	463.14 (376.43–629.27)	0.640
Diagnostic reference level (Gy.cm ²)	6.55	6.5	6.74	<0.001

DAP = dose area product, which is also known as the kerma area product.