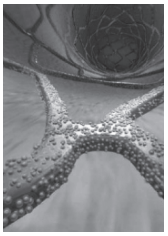

CHAPTER 4 :

LESION CHARACTERISTICS

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LESION CHARACTERISTICS

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Summary

1. Both in stent restenosis (ISR) and stent thrombosis were uncommon; ISR constituted 4.7% of all lesions treated. The incidence of stent thrombosis was only 0.4%.

2. Complex lesions (Type B2 and Type C) constituted a total of 62.7% among all lesions. 31.4% of the lesions had high risk characteristics (ostial, bifurcation, totally occluded and thrombus).

3. There was a trend of increasing use of drug eluting stents (DES). In this registry, DES comprised 64.0% of all stents.

4. A high procedural success rate was observed (96.1%).

5. Among all patients with ISR, 44.9% of the lesions were noted in DES, followed by 35.8% in BMS. Majority of ISR (41.5%) were treated with balloon angioplasty (including cutting balloon), followed by DES and DEB in 37.9% and 29.9% respectively.

6. Usage of DEB for ISR was becoming more popular over the last couple of years.

7. An increase in number of LMS interventions (749 lesions) were noted, majority were successful and no reflow was noted in 1.5% of cases, usage of IVUS and IABP were less common.

8. There was an increasing trend of graft PCI in the recent years and majority were on SVG.

9. Large majority of CTO lesions were de-novo lesions, and they were treated more often with femoral approach and 6 French size sheath. DES usage was higher in CTO lesions. Overall success rate was 80.2%.

Anatomical location of the lesion

From year 2007 to 2012, a total of 34873 lesions were treated with PCI. Among these lesions, the commonest vessel treated was left anterior descending artery (LAD; 47.7%), followed by right coronary artery (RCA; 30.0%) and left circumflex artery (LCx; 18.3%). Left main stem (2.2%) and bypass grafts (1.3%) constituted a small number. [Table 4.2.1]

The commonest lesion location treated was proximal LAD (33.3%), followed by proximal RCA (13.3%) and mid LAD (10.4%). Among lesions of bypass graft treated (total of 481 lesions), majority were in saphenous venous graft (423 lesions), followed by left internal mammary artery (51 lesions). Throughout the years of this registry, both the target vessel and target lesion location distribution remained consistent. [Table 4.2.1]

Table 4.2.1 Summary of location of lesions treated with Percutaneous Coronary Intervention, NCVD-PCI Registry, 2007-2012

Location of lesion	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
None	1	0.0	0	0	1	0.1	1	0.0	2	0.1	3	0.0
Left main stem	287	1.8	152	2.5	147	2.5	163	2.4	462	2.5	749	2.2
Left anterior descending artery (LAD)	7592	47.9	2880	47.4	2874	48.0	3285	47.2	9039	47.4	16631	47.7
LAD proximal	5374	33.9	1966	32.3	2067	34.6	2197	31.6	6230	32.7	11604	33.3
LAD mid	1649	10.4	631	10.4	575	9.6	771	11.1	1977	10.4	3626	10.4
LAD distal	190	1.2	83	1.4	89	1.5	158	2.3	330	1.7	520	1.5
D1	343	2.2	188	3.1	127	2.1	140	2.0	455	2.4	798	2.3
D2	30	0.2	11	0.2	14	0.2	17	0.2	42	0.2	72	0.2
D3	6	0.0	1	0.0	2	0.0	2	0.0	5	0.0	11	0.0
Right coronary artery (RCA)	4688	29.6	1805	29.6	1804	30.2	2175	31.2	5784	30.4	10472	30.0
RCA proximal	2042	12.9	758	12.5	944	15.8	911	13.1	2613	13.7	4655	13.3
RCA mid	1566	9.9	593	9.7	509	8.5	683	9.8	1785	9.4	3351	9.6
RCA distal	798	5.0	336	5.5	261	4.4	453	6.5	1050	5.5	1848	5.3
PDA	145	0.9	49	0.8	31	0.5	72	1.0	152	0.8	297	0.9
PLV	137	0.9	69	1.1	59	1.0	56	0.8	184	1.0	321	0.9
Left circumflex artery (LCx)	2908	18.3	1147	18.9	1071	17.9	1244	17.9	3462	18.2	6370	18.3
LCX proximal	1186	7.5	518	8.5	559	9.4	619	8.9	1696	8.9	2882	8.3
LCX distal	1148	7.2	363	6.0	288	4.8	336	4.8	987	5.2	2135	6.1
OM1	442	2.8	195	3.2	194	3.2	229	3.3	618	3.2	1060	3.0
OM2	103	0.6	54	0.9	24	0.4	48	0.7	126	0.7	229	0.7
OM3	29	0.2	17	0.3	6	0.1	12	0.2	35	0.2	64	0.2
Graft	205	1.3	104	1.6	80	1.3	92	1.3	276	1.4	481	1.3
Saphenous vein graft	177	1.1	93	1.5	71	1.2	82	1.2	246	1.3	423	1.2
Left internal mammary artery graft	24	0.2	9	0.1	8	0.1	10	0.1	27	0.1	51	0.1
Right internal mammary artery graft	1	0.0	2	0.0	0	0	0	0	2	0.0	3	0.0
Radial artery graft	3	0.0	0	0	1	0.0	0	0	1	0.0	4	0.0
Missing	167	1.1	0	0	0	0	0	0	0	0	167	0.5

Lesion characteristics

The majority of the lesions treated in this registry were de novo type of lesion (93.3%). In-stent restenosis (ISR) constituted a total of 1618 lesions (4.7%). Acute stent thrombosis was rare (0.4%). The distribution of the type of lesions remained consistent throughout the years. [Table 4.2.2]

Most of the lesions treated were of Type C (36.9%), followed by Type B1 (25.8%), Type B2 (24.3%) and Type A (11.2%). Complex lesions (Type B2 and Type C) constituted a total of 62.7% among all lesions. [Table 4.2.3]

Among the lesions treated with PCI, about 31.4% were of high risk characteristics, such as ostial, bifurcation, totally occluded and thrombus. [Table 4.2.4] The distribution of lesion complexity had remained similar in the years of this registry. The cardiac centres involved have been treating high risk lesions with complex PCI.

Most of the lesions treated with PCI achieved TIMI-3 flow (at least 89.0%) after the procedure; compared to about 53.8% lesions only had TIMI-3 flow pre-procedure. [Table 4.2.5]

Types of Stents and Devices used

A total of 43839 stents were used in 34873 lesions treated with PCI. An average of 1.26 stent was used per lesion treated. Majority of the stents used were drug eluting stents (DES; 64.0%), and bare metal stents (BMS) constituted 15.7% of stents used. There were a marked increasing trend of DES usage and a decreasing trend of BMS usage, from year 2007 to 2012. After being commercially available, a small number of bio-absorbable stents (37 stents, 0.1%) were being used in the recent years. [Table 4.2.6]

Direct stenting was being performed in 11.9% of lesions treated. There was a marked decreasing trend of this technique. More lesions were treated with pre-dilatation instead in the recent years. The mean stent length was 29.4mm (SD 16.7mm), and the mean stent diameter was 3.0mm (SD 0.4mm). [Table 4.2.7]

Balloon angioplasty (POBA) was performed in 7.1% of lesions treated. There was a decreasing trend of this technique as well throughout the years. On the other hand, drug eluting balloon was getting more popular over the years, which had doubled from 3.0% in 2007-2009 to 6.3% in 2010-2012 among all lesions treated. [Table 4.2.8]

Adjunctive angioplasty devices were not commonly used during PCI, which include intravascular ultrasound (IVUS; 3.6%), cutting balloon (1.8%) and rotablator (0.9%). [Table 4.2.8]

There was a high success rate of PCI in this registry, which achieved 96.1% of all lesions. [Table 4.2.7]

Lesion complication during PCI

The commonest complication during PCI was vessel dissection, which constituted 3.2% of all lesions. No reflow occurred in 1.1% of all lesions, and majority of them were transient (78.2%). Acute closure and perforation were not common, which constituted 0.3% each. The number remained similar throughout the years. [Table 4.2.9]

Table 4.2.2 Characteristics of lesions treated by PCI, NCVD-PCI Registry, 2007-2012

Types of lesions	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
De novo	14749	93.1	5631	92.5	5595	93.6	6568	94.4	17794	93.5	32543	93.3
Restenosis (no prior stent)	34	0.2	15	0.2	14	0.2	2	0.0	31	0.2	65	0.2
Stent thrombosis	80	0.5	22	0.4	27	0.5	18	0.3	67	0.4	147	0.4
In-stent restenosis	743	4.7	353	5.8	227	3.8	295	4.2	875	4.6	1618	4.7
Not available	26	0.2	67	1.1	114	1.9	77	1.1	258	1.3	284	0.8
Missing	216	1.3	0	0	0	0	0	0	0	0	216	0.6
Total	**15848**	**100.0**	**6088**	**100.0**	**5977**	**100.0**	**6960**	**100.0**	**19025**	**100.0**	**34873**	**100.0**

Table 4.2.3 Prevalence of lesions according to American College of Cardiology (ACC) classifications, NCVD-PCI Registry, 2007-2012

Types of lesions	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
A	2011	12.7	648	10.6	615	10.3	652	9.4	1915	10.1	3926	11.2
B1	4198	26.5	1704	28.0	1568	26.2	1632	23.4	4904	25.8	9102	26.1
B2	3570	22.5	1570	25.8	1717	28.7	1342	19.3	4629	24.3	8199	23.5
C	5751	36.3	2114	34.7	1737	29.1	3253	46.7	7104	37.3	12855	36.9
Not available	118	0.7	52	0.9	340	5.7	81	1.2	473	2.5	591	1.7
Missing	200	1.3	0	0	0	0	0	0	0	0	200	0.6
Total	**15848**	**100.0**	**6088**	**100.0**	**5977**	**100.0**	**6960**	**100.0**	**19025**	**100.0**	**34873**	**100.0**

Table 4.2.4 Prevalence of high risk lesion type, NCVD-PCI Registry, 2007-2012

#Types of lesions	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ostial	1084	6.8	483	7.9	413	6.9	381	5.5	1277	6.7	2361	6.8
Bifurcation	1313	8.3	1046	17.2	434	7.3	492	7.1	1972	10.4	3285	9.4
Total occlusion	452	2.9	351	5.8	394	6.6	420	6.0	1165	6.1	1617	4.6
CTO>3mo	1138	7.2	510	8.4	534	8.9	444	6.4	1488	7.8	2626	7.5
Thrombus	532	3.4	197	3.2	156	2.6	195	2.8	548	2.9	1080	3.1

#*Patients are allowed to have more than one type of category*

Table 4.2.5 Comparison of TIMI flow grade by pre and post procedure, NCVD-PCI Registry, 2007-2012

TIMI Flow Grade	2007-2009 Total no. of lesions = 15848				2010-2012 Total no. of lesions = 19025				2007-2012 Total no. of lesions = 34873			
	Pre - Procedure		Post - Procedure		Pre - Procedure		Post - Procedure		Pre - Procedure		Post - Procedure	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
TIMI-0	1817	11.5	270	1.7	2479	13.0	386	2.0	4296	12.3	656	1.9
TIMI-1	1164	7.3	80	0.5	1329	7.0	49	0.3	2493	7.2	129	0.4
TIMI-2	3111	19.6	175	1.1	3546	18.7	176	0.9	6657	19.1	351	1.0
TIMI-3	9199	58.1	14743	93.0	9571	50.3	16307	85.7	18770	53.8	31050	89.0
Not available	37	0.2	41	0.3	346	1.8	313	1.7	383	1.1	354	1.0
Missing	520	3.3	539	3.4	1754	9.2	1794	9.4	2274	6.5	2333	6.7
Total	**15848**	**100.0**	**15848**	**100.0**	**19025**	**100.0**	**19025**	**100.0**	**34873**	**100.0**	**34873**	**100.0**

Table 4.2.6 Types of stents used, NCVD-PCI Registry, 2007-2012

Types of stents	2007-2009 Total no. of stents used = 20180		2010 Total no. of stents used = 7661		2011 Total no. of stents used = 7558		2012 Total no. of stents used = 8440		2010-2012 Total no. of stents used = 23659		2007-2012 Total no. of stents used = 43839	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Drug eluting stent	10652	52.8	5036	65.8	4636	61.3	5462	64.7	15134	64.0	25786	58.8
Bare metal stent	6640	32.9	1381	18.0	1219	16.1	1114	13.2	3714	15.7	10354	23.6
Bio-absorbable stent	8	0.1	1	0.0	4	0.1	24	0.3	29	0.1	37	0.1
Antibody coated	371	1.8	124	1.6	94	1.2	40	0.5	258	1.1	629	1.5
Others	583	2.9	334	4.4	843	11.2	1052	12.4	2229	9.4	2812	6.4
Drug eluting balloon stent	0	0	0	0	0	0	0	0	0	0	0	0
Bifurcated stent	0	0	0	0	0	0	0	0	0	0	0	0
Covered stent	9	0.0	3	0.0	1	0.0	0	0	4	0.0	13	0.0
Combo stent	0	0	0	0	0	0	0	0	0	0	0	0
No stent	1917	9.5	782	10.2	761	10.1	748	8.9	2291	9.7	4208	9.6
Total	**20180**	**100.0**	**7661**	**100.0**	**7558**	**100.0**	**8440**	**100.0**	**23659**	**100.0**	**43839**	**100.0**

Table 4.2.7 Lesion characteristics for patients who undergone PCI, NCVD-PCI Registry, 2007-2012

	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pre-procedure stenosis												
N	14588		6026		5765		6574		18365		32953	
Mean(SD)	84.1 (12.4)		84.3 (12.1)		85.6 (12.2)		86.0 (11.7)		85.3 (12.0)		84.8 (12.2)	
Median(min,max)	90.0 (0.0, 100.0)		85.0 (0.0, 100.0)		90.0 (0.0, 100.0)		90.0 (0.0, 100.0)		90.0 (0.0, 100.0)		90.0 (0.0, 100.0)	
Missing, No. (%)	1260	8.0	62	1.0	212	3.5	386	5.5	660	3.5	1920	5.5
Post-procedure stenosis												
N	14567		6001		5359		5639		16999		31566	
Mean (SD)	3.9 (16.8)		4.5 (19.0)		5.1 (20.4)		4.7 (19.5)		4.8 (19.6)		4.3 (18.4)	
Median (min,max)	0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)	
Missing, No. (%)	1281	8.1	87	1.4	618	10.3	1321	19.0	2026	10.6	3307	9.5
Estimated lesion length, mm												
N	13704		5819		5641		6569		18029		31733	
Mean (SD)	23.5 (14.1)		24.1 (14.7)		24.0 (14.3)		23.2 (13.9)		23.7 (14.3)		23.6 (14.2)	
Median (min,max)	20.0 (1.0, 99.0)		20.0 (4.0, 140.0)		20.0 (1.0, 115.0)		20.0 (1.0, 142.0)		20.0 (1.0, 142.0)		20.0 (1.0, 142.0)	
Missing, No. (%)	2144	13.5	269	4.4	336	5.6	391	5.6	996	5.2	3140	9.0

	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Lesion result, No. (%)												
Successful	15110	95.3	5912	97.1	5768	96.5	6725	96.6	18405	96.8	33515	96.1
Unsuccessful	499	3.2	169	2.8	203	3.4	223	3.2	595	3.1	1094	3.1
Not available	12	0.1	7	0.1	6	0.1	12	0.2	25	0.1	37	0.1
Missing	227	1.4	0	0	0	0	0	0	0	0	227	0.7
*Stent length, mm												
N	13839		5265		5176		6165		16606		30445	
Mean (SD)	29.5 (17.0)		30.0 (17.0)		29.7 (16.9)		28.3 (15.5)		29.3 (16.4)		29.4 (16.7)	
Median (min,max)	24.0 (8.0, 149.0)		24.0 (8.0, 141.0)		24.0 (8.0, 138.0)		24.0 (8.0, 166.0)		24.0 (8.0, 166.0)		24.0 (8.0, 166.0)	
Not available, No. (%)	2009	12.7	823	13.5	801	13.4	795	11.4	2419	12.7	4428	12.7
**Stent diameter, mm												
N	13807		5250		5135		6137		16522		30329	
Mean (SD)	3.0 (0.4)		3.0 (0.4)		3.0 (0.4)		3.0 (0.4)		3.0 (0.4)		3.0 (0.4)	
Median (min,max)	3.0 (2.0, 7.0)		3.0 (2.0, 5.0)		3.0 (2.0, 5.0)		3.0 (2.0, 5.0)		3.0 (2.0, 5.0)		3.0 (2.0, 7.0)	
Not available, No. (%)	2041	12.9	838	13.8	842	14.1	823	11.8	2503	13.2	4544	13.0

** Summation of stent length was used for lesions which were treated with more than one stent*
*** Average of stent diameter was used for lesions which were treated with more than one stent*

	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Maximum balloon size used, mm												
N	14144		5714		5352		6453		17519		31663	
Mean (SD)	3.1 (0.6)		3.1 (0.6)		3.1 (0.6)		3.1 (0.5)		3.1 (0.6)		3.1 (0.6)	
Median (min,max)	3.0 (1.0, 5.5)		3.0 (1.0, 6.0)		3.0 (1.0, 5.8)		3.0 (1.0, 6.0)		3.0 (1.0, 6.0)		3.0 (1.0, 6.0)	
Missing, No. (%)	1704	10.8	374	6.1	625	10.5	507	7.3	1506	7.9	3210	9.2
Maximum stent/balloon deploy pressure, atm												
N	14315		5683		5299		6255		17237		31552	
Mean (SD)	15.7 (3.9)		15.7 (4.0)		15.9 (4.2)		15.7 (4.1)		15.8 (4.1)		15.7 (4.0)	
Median (min,max)	16.0 (1.0, 30.0)		16.0 (2.0, 30.0)		16.0 (1.0, 30.0)		16.0 (3.0, 30.0)		16.0 (1.0, 30.0)		16.0 (1.0, 30.0)	
Missing, No. (%)	1533	9.7	405	6.7	678	11.3	705	10.1	1788	9.4	3321	9.5
Direct stenting, No. (%)												
Yes	2791	17.6	543	8.9	352	5.9	461	6.6	1356	7.1	4147	11.9
No	12196	77.0	5284	86.8	5409	90.5	6260	90.0	16953	89.1	29149	83.6
Not applicable	659	4.1	261	4.3	216	3.6	239	3.4	716	3.8	1375	3.9
Missing	202	1.3	0	0	0	0	0	0	0	0	202	0.6

Table 4.2.8 Types of devices used during Percutaneous Coronary Intervention, NCVD-PCI Registry, 2007-2012

#Intracoronary devices	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Aspiration	0	0	123	2.0	174	2.9	226	3.2	523	2.7	523	1.5
Balloon only	1281	8.1	473	7.8	365	6.1	371	5.3	1209	6.4	2490	7.1
Drug eluting balloon	482	3.0	355	5.8	351	5.9	486	7.0	1192	6.3	1674	4.8
Drug eluting stent	7773	49.0	3934	64.6	3800	63.6	4863	69.9	12597	66.2	20370	58.4
Cutting balloon	334	2.1	123	2.0	100	1.7	88	1.3	311	1.6	645	1.8
IVUS	603	3.8	239	3.9	191	3.2	215	3.1	645	3.4	1248	3.6
Flowire	3	0.0	20	0.3	25	0.4	30	0.4	75	0.4	78	0.2
Rotablator	134	0.8	66	1.1	55	0.9	54	0.8	175	0.9	309	0.9
Bare metal stent	5913	37.3	1273	20.9	1304	21.8	1226	17.6	3803	20.0	9716	27.9
Distal embolic protection	64	0.4	15	0.2	22	0.4	39	0.6	76	0.4	140	0.4
Others	926	5.8	303	5.0	272	4.6	294	4.2	869	4.6	1795	5.1

 # Patients are allowed to have more than one type of category

Table 4.2.9 Types of post-procedure complications, NCVD-PCI Registry, 2007-2012

*Types of post-procedure complications	2007-2009 Total no. of lesions = 15848		2010 Total no. of lesions = 6088		2011 Total no. of lesions = 5977		2012 Total no. of lesions = 6960		2010-2012 Total no. of lesions = 19025		2007-2012 Total no. of lesions = 34873	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Dissection	687	4.3	240	3.9	91	1.5	84	1.2	415	2.2	1102	3.2
No reflow	197	1.2	60	1.0	46	0.8	65	0.9	171	0.9	368	1.1
Transient	131	75.3	46	82.1	35	79.5	53	81.5	134	81.2	265	78.2
Persistent	43	24.7	10	17.9	9	20.5	12	18.5	31	18.8	74	21.8
Not available/ Missing	23		4		2		0		6		29	
Acute closure	57	0.4	17	0.3	12	0.2	9	0.1	38	0.2	95	0.3
Perforation	49	0.3	23	0.4	12	0.2	10	0.1	45	0.2	94	0.3

** Results only showed for number of patients who were reported to have the complications*

In stent restenosis (ISR)

From 2007-2012, a total of 1618 (4.7% of all lesions treated) in-stent restenosis (ISR) were noted in this registry. Majority of the reported ISR occurred in the native coronary artery (97.3%). ISR within the grafts occurred in 43 (2.7%) cases, out of which 3 cases were internal mammary artery grafts (LIMA-2, RIMA-1), nearly half of ISR (726 lesions, 44.9%) occurred in the previously implanted DES, followed by (579 lesions, 35.8%) ISR in BMS implantation. [Table 4.2.10]

The mean estimated length of the lesion was 22.7mm(SD 14.7). Among all the ISR, 14.3% of the cases was of TIMI 0 flow. TIMI 3 flow was seen only in 48.3% of cases prior to intervention. Nearly 90.8% achieved TIMI 3 flow after intervention, 2.1% were failed procedures.

About one third of patients (33.1%) with ISR presented as ACS. Majority of ISR (41.5%) were treated with balloon angioplasty (including cutting balloon), followed by DES and DEB in 43.2% and 29.9% respectively. Very few newer generation stents like antibody coated stents and others were used, however the usage of drug eluting balloons have become more popular over last five years (14.1% in 2007-2009 vs. 43.2% in 2010-2012). BMS were used in only 6.9% of cases. IVUS guidance was only used in 19.5%. [Table 4.2.11 and Table 4.2.12] The mean stent diameter was 3.0mm (SD 0.5) and the mean length was 29.5mm(SD 18.0).

Most of the lesions were successfully treated; however no reflow was noted in 0.7% of cases, and dissection in 2.2% of cases. [Table 4.2.13]

Table 4.2.10 Types of prior stents used in in-stent restenosis, NCVD-PCI Registry, 2007-2012

Types of prior stents used in ISR	2007-2009 Total no. of lesions = 743		2010 Total no. of lesions = 353		2011 Total no. of lesions = 227		2012 Total no. of lesions = 295		2010-2012 Total no. of lesions = 875		2007-2012 Total no. of lesions = 1618	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Drug eluting stent	287	38.6	168	47.6	112	49.3	159	53.9	439	50.2	726	44.9
Bare metal stent	338	45.5	124	35.1	51	22.5	66	22.4	241	27.5	579	35.8
Others	15	2.0	10	2.8	20	8.8	8	2.7	38	4.4	53	3.2
Not available	64	8.6	45	12.8	36	15.9	54	18.3	135	15.4	199	12.3
Missing	39	5.3	6	1.7	8	3.5	8	2.7	22	2.5	61	3.8
Total	743	100.0	353	100.0	227	100.0	295	100.0	875	100.0	1618	100.0

Table 4.2.11 Types of stents used in the in-stent restenosis, NCVD-PCI Registry, 2007-2012

Types of stents used in the ISR	2007-2009 Total no. of stents used = 855		2010 Total no. of stents used = 411		2011 Total no. of stents used = 267		2012 Total no. of stents used = 326		2010-2012 Total no. of stents used = 1004		2007-2012 Total no. of stents used = 1859	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Drug eluting stent	367	42.9	178	43.3	120	44.9	139	42.6	437	43.5	804	43.2
Bare metal stent	84	9.8	24	5.9	11	4.1	9	2.8	44	4.4	128	6.9
Bio-absorbable stent	1	0.1	0	0	0	0	0	0	0	0	1	0.1
Antibody coated	3	0.4	1	0.2	0	0	1	0.3	2	0.2	5	0.3
Others	24	2.8	7	1.7	21	7.9	32	9.8	60	6	84	4.5
Covered stent	1	0.1	1	0.2	0	0	0	0	1	0.1	2	0.1

Table 4.2.12 Types of devices used in the in-stent restenosis, NCVD-PCI Registry, 2007-2012

#Intracoronary devices used in ISR	2007-2009 Total no. of lesions = 743		2010 Total no. of lesions = 353		2011 Total no. of lesions = 227		2012 Total no. of lesions = 295		2010-2012 Total no. of lesions = 875		2007-2012 Total no. of lesions = 1618	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Drug eluting balloon	105	14.1	131	37.1	92	40.5	155	52.5	378	43.2	483	29.9
Balloon only	251	33.8	71	20.1	31	13.7	29	9.8	131	15.0	382	23.6
IVUS	130	17.5	84	23.8	48	21.1	53	18.0	185	21.1	315	19.5
Cutting balloon	146	19.7	75	21.2	32	14.1	37	12.5	144	16.5	290	17.9
Aspiration	0	0	1	0.3	9	4.0	7	2.4	17	1.9	17	1.1
Flowire	0	0	2	0.6	0	0	2	0.7	4	0.5	4	0.2
Rotablator	4	0.5	3	0.8	3	1.3	0	0	6	0.7	10	0.6
Distal embolic protection	2	0.3	2	0.6	0	0	3	1.0	5	0.6	7	0.4
Others	33	4.4	8	2.3	9	4.0	18	6.1	35	4.0	68	4.2

#Patients are allowed to have more than one type of category

Table 4.2.13 Types of complications in post in-stent restenosis, NCVD-PCI Registry, 2007-2012

*Types of complications in ISR	2007-2009 Total no. of lesions = 743		2010 Total no. of lesions = 353		2011 Total no. of lesions = 227		2012 Total no. of lesions = 295		2010-2012 Total no. of lesions = 875		2007-2012 Total no. of lesions = 1618	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Dissection	17	2.3	11	3.1	3	1.3	5	1.7	19	2.2	36	2.2
No reflow	4	0.5	6	1.7	0	0	1	0.3	7	0.8	11	0.7
Transient	4	100.0	5	83.3	0	0	1	100.0	6	85.7	10	90.9
Persistent	0	0	1	16.7	0	0	0	0	1	14.3	1	9.1
Acute closure	1	0.1	1	0.3	0	0	0	0	1	0.1	2	0.1
Perforation	3	0.4	4	1.1	2	0.9	0	0	6	0.7	9	0.6

** Results only showed for patients with the complications*

PCI of Left Main Stem (LMS)

From 2007 to 2012, a total of 749 LMS interventions were performed. Most were denovo lesions and 6.4% were in stent restenosis. [Table 4.2.14] Majority of interventions were performed on unprotected LMS, only 94 cases (12.6%) were performed in patients with previous coronary artery bypass graft (CABG). [Table 4.2.15] The most common access was femoral artery (72.0%); however radial artery access was not uncommon (24.6%).

Majority of LMS interventions were elective cases (88.9%). About 11.0% of LMS cases presented with ACS, among them, 48.5% had STEMI and 39.8% had NSTEMI. Over the years we see an increasing trend of LMS interventions in ACS patients. [Table 4.2.16]

Mean pre-procedure stenosis was 80.9% (SD 14.6) with TIMI III flow in only 57.8% of cases, however post procedure 89.7% of cases achieved TIMI III flow and less than 1.0% achieved TIMI 0 to TIMI II flow. [Table 4.2.17]

The mean lesion length was 27.1mm (SD 17.5). Majority of the lesions were stented with DES (81.8%) [Table 4.2.18] and direct stenting technique was used in 8.0% of cases. The mean stent length was 33.6mm (SD 20.1), the use of longer stents might be due to stenting across the LAD or LCx.

Use of IVUS and IABP guided LMS intervention was uncommon; they were used in only 27.1% and 12.8% respectively. [Table 4.2.19] Despite intervention in unprotected LMS disease, majority of the LMS PCI were successful (98.4%). Complications such as dissection were noted in 7.5% of cases, followed by 1.5% of cases with no reflow.

About 85.0% of patients with LMS stenting received DAPT for 12 months or longer. DAPT were prescribed for 12 months in 59.0% of patients, and 25.2% of patients received DAPT for more than 12 months. [Table 4.2.20]

PCI to the grafts

From 2007 to 2012, a total of 481 bypass graft PCI were performed, 88.0% of interventions were on SVG and the rest 10.6% were on LIMA. Majority of the lesions were de novo (89.0%) followed by 9.0% of ISR in grafts. [Table 4.2.21] There was an increasing trend in the number of interventions on bypass grafts.

The mean lesion length was 19.8mm(SD 12.0), distal embolic devices were used only in 96 (20.0%) lesions, majority were stented with DES (60.0%), followed by BMS (24.7%). The mean stent length was 25.5mm(SD 15.3) and diameter of 3.1mm(SD 0.6). TIMI III flow was achieved in 88.4% of patients without any major complications; however 2.1% of grafts PCI were unsuccessful.

Long term DAPT was prescribed to most of the patients, about 62.6% received DAPT for 12 months.

Table 4.2.14 Types of lesions in left main stem procedure, NCVD-PCI Registry, 2007-2012

Types of lesion in left main stem procedure	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
De novo	262	91.3	137	90.1	140	95.2	154	94.5	431	93.3	693	92.5
Restenosis (no prior stent)	0	0	1	0.7	2	1.4	0	0	3	0.7	3	0.4
Stent thrombosis	1	0.3	0	0	1	0.7	0	0	1	0.2	2	0.3
In-stent restenosis	22	7.7	14	9.2	4	2.7	8	4.9	26	5.6	48	6.4
Previous DES	14	77.8	9	69.2	3	75.0	5	83.3	17	73.9	31	75.6
Previous BMS	4	22.2	4	30.8	1	25.0	1	16.7	6	26.1	10	24.4
Not available/Missing	4		1		0		2		3		7	
Not available	0	0	0	0	0	0	1	0.6	1	0.2	1	0.1
Missing	2	0.7	0	0	0	0	0	0	0	0	2	0.3

Table 4.2.15 Characteristics of left main stem procedure, NCVD-PCI Registry, 2007-2012

	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Intra-aortic balloon pump (IABP), No. (%)												
Yes	38	13.2	17	11.2	27	18.4	14	8.6	58	12.6	96	12.8
No	249	86.8	135	88.8	117	79.6	148	90.8	400	86.6	649	86.6
Missing	0	0	0	0	3	2.0	1	0.6	4	0.8	4	0.6

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	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Previous PCI, No. (%)												
Yes	80	27.9	49	32.2	37	25.2	44	27.0	130	28.1	210	28.0
No	207	72.1	103	67.8	110	74.8	119	73.0	332	71.9	539	72.0
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Previous CABG, No. (%)												
Yes	44	15.3	18	11.8	14	9.5	18	11.0	50	10.8	94	12.6
No	243	84.7	134	88.2	133	90.5	145	89.0	412	89.2	655	87.4
Missing	0	0	0	0	0	0	0	0	0	0	0	0

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Table 4.2.16 Clinical presentation of left main stem, NCVD-PCI Registry, 2007-2012

Clinical presentation in left main stem procedure	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
PCI status												
Elective	262	91.3	133	87.5	129	87.8	142	87.1	404	87.4	666	88.9
NSTEMI/UA	12	4.2	12	7.9	8	5.4	8	4.9	28	6.1	40	5.4
AMI	12	4.2	7	4.6	10	6.8	13	8	30	6.5	42	5.6
Not available	1	0.3	0	0	0	0	0	0	0	0	1	0.1

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Clinical presentation in left main stem procedure	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Acute coronary syndrome												
Total	98	100.0	49	100.0	49	100.0	45	100.0	143	100.0	241	100.0
STEMI	46	46.9	19	38.8	29	59.2	22	48.9	70	49	116	48.1
NSTEMI	38	38.8	26	53.1	12	24.5	19	42.2	57	39.9	95	39.4
UA	13	13.3	4	8.1	8	16.3	3	6.7	15	10.5	28	11.6
Not available	1	1.0	0	0	0	0	1	2.2	1	0.6	2	0.9

Table 4.2.17 TIMI flow prior to intervention in left main stem procedure, NCVD-PCI Registry, 2007-2012

TIMI flow prior to intervention in left main stem procedure	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
TIMI-0	24	8.4	18	11.8	10	6.8	15	9.2	43	9.3	67	8.9
TIMI-1	19	6.6	15	9.9	4	2.7	6	3.7	25	5.4	44	5.9
TIMI-2	61	21.3	36	23.7	25	17.0	27	16.6	88	19.0	149	19.9
TIMI-3	178	62.0	80	52.6	81	55.1	94	57.7	255	55.2	433	57.8
Not available	0	0	0	0	0	0	4	2.4	4	0.9	4	0.5
Missing	5	1.7	3	2.0	27	18.4	17	10.4	47	10.2	52	7.0

Table 4.2.18 Types of stents used in left main stem procedure, NCVD-PCI Registry, 2007-2012

Types of stent used in left main stem procedure	2007-2009 Total no. of stents used = 450		2010 Total no. of stents used = 219		2011 Total no. of stents used = 199		2012 Total no. of stents used = 227		2010-2012 Total no. of stents used = 645		2007-2012 Total no. of stents used = 1095	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Drug eluting stent	382	84.9	186	84.9	144	72.4	170	74.9	500	77.5	882	80.5
Bare metal stent	40	8.9	15	6.9	19	9.5	19	8.4	53	8.2	93	8.5
Bio-absorbable stent	0	0	0	0	0	0	0	0	0	0	0	0
Antibody coated	6	1.3	3	1.4	3	1.5	3	1.3	9	1.4	15	1.4
*Others	4	0.9	4	1.8	19	9.6	19	8.4	42	6.5	46	4.2
Covered stent	4	0.9	0	0	0	0	0	0	0	0	4	0.4

** Stents which are not listed in the NCVD-PCI Stent List*

Table 4.2.19 Types of devices used in left main stem procedure, NCVD-PCI Registry, 2007-2012

#Intracoronary devices used in left main stem procedure	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Aspiration	0	0	1	0.7	3	2.0	1	0.6	5	1.1	5	0.7
Balloon only	11	3.8	3	2.0	10	6.8	5	3.1	18	3.9	29	3.9
Drug eluting balloon	11	3.8	19	12.5	6	4.1	13	8.0	38	8.2	49	6.5
Cutting balloon	18	6.3	3	2.0	1	0.7	1	0.6	5	1.1	23	3.1
IVUS	98	34.1	42	27.6	28	19.0	35	21.5	105	22.7	203	27.1
Flowire	0	0	0	0	0	0	1	0.6	1	0.2	1	0.1
Rotablator	13	4.5	7	4.6	7	4.8	9	5.5	23	5.0	36	4.8
Distal embolic protection	2	0.7	0	0	0	0	1	0.6	1	0.2	3	0.4
Others	13	4.5	5	3.3	4	2.7	8	4.9	17	3.7	30	4.0

#Patients are allowed to have more than one type of category

Table 4.2.20 Planned duration of dual antiplatelet therapy in left main stem procedure, NCVD-PCI Registry, 2007-2012

Planned duration of dual antiplatelet therapy in left main stem procedure (months)	2007-2009 Total no. of lesions = 287		2010 Total no. of lesions = 152		2011 Total no. of lesions = 147		2012 Total no. of lesions = 163		2010-2012 Total no. of lesions = 462		2007-2012 Total no. of lesions = 749	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	11	3.8	8	5.3	3	2.0	7	4.3	18	3.9	29	3.9
3	6	2.1	1	0.7	6	4.1	10	6.1	17	3.7	23	3.1
6	17	5.9	1	0.7	1	0.7	4	2.5	6	1.3	23	3.1
12	117	40.8	85	55.9	117	79.6	123	75.5	325	70.3	442	59
>12	118	41.1	52	34.2	13	8.9	6	3.7	71	15.4	189	25.2
Not available	18	6.3	4	2.6	4	2.7	5	3.0	13	2.8	31	4.1
Missing	0	0	1	0.6	3	2.0	8	4.9	12	2.6	12	1.6

Table 4.2.21 Lesion types in graft PCI, NCVD-PCI Registry, 2007-2012

Lesion type in graft PCI	2007-2009 Total no. of lesions = 205		2010 Total no. of lesions = 104		2011 Total no. of lesions = 80		2012 Total no. of lesions = 92		2010-2012 Total no. of lesions = 276		2007-2012 Total no. of lesions = 481	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
De novo	180	87.8	94	90.4	70	87.5	84	91.3	248	89.9	428	89.0
Restenosis (no prior stent)	4	1.9	0	0	0	0	0	0	0	0	4	0.8
Stent thrombosis	0	0	0	0	0	0	0	0	0	0	0	0
In-stent restenosis	17	8.3	10	9.6	8	10.0	8	8.7	26	9.4	43	9.0
Not available	1	0.5	0	0	2	2.5	0	0	2	0.7	3	0.6
Missing	3	1.5	0	0	0	0	0	0	0	0	3	0.6

PCI of Chronic total occlusion (> 3 months)

A total of 2626 (7.5% of all lesions) chronic total occlusion > 3 months were noted in 2007-2012. Majority of CTO lesions involved left anterior descending artery (46.0%), followed by right coronary artery (39.0%) and left circumflex artery (12.9%). [Table 4.2.22] Large majority of CTO lesions were de-novo lesions which constituted 92.9%, and in-stent restenosis constituted 5.8%.

Entry site and sheath
For CTO PCI the femoral approach was preferred to radial approach (61.2% vs. 34.2%). Regarding the sheath used, majority of the procedures were performed using a 6 French sheath (70.9%), followed by 7 French (23.8%) and 8 French sheaths (1.1%). [Table 4.2.23]

Types of Stents and Devices used
Drug eluting stents were used more frequently in CTO lesions (68.9%), compared to bare metal stents (11.8%). [Table 4.2.24] Comparing with overall lesions treated in this registry, the percentage of DES used was also higher in CTO lesions (68.9% vs. 64.0%).

Adjunctive devices usage (intravascular ultrasound (4.3%), cutting balloon (1.0%) and rotablator (0.9%) were low and similar to those in overall lesions. [Table 4.2.25]

Results and complications
About 4/5 (80.2%) of all CTO lesions were successfully treated with PCI. Mean stent length was 45.1mm (SD 24.2), and mean stent diameter was 2.8mm (SD 0.4). [Table 4.2.23] Complication for CTO PCI was uncommon with dissection (6.1%), followed by no reflow (2.1%) and perforation (0.8%). [Table 4.2.26]

Duration of dual anti-platelet therapy (DAPT)
Duration of DAPT varied depending on the intra-coronary devices used. For lesions treated with DES, 94.0% of patients were given at least 6 months of DAPT and 78.3% of patients were given for 12 months. For lesions treated with BMS, 53.2% of patients were given at least 6 months of DAPT, which was similar to those patients treated with balloon only (46.7%). [Table 4.2.28]

Table 4.2.22 Summary of location of lesions treated with percutaneous coronary intervention and for lesion with description of CTO >3months only, NCVD-PCI Registry, 2007-2012

Location of lesion with CTO >3months	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Left main stem	**14**	**1.1**	**9**	**1.6**	**4**	**0.8**	**5**	**1.1**	**18**	**1.2**	**32**	**1.2**
Left anterior descending artery (LAD)	**542**	**47.7**	**230**	**45.1**	**248**	**46.3**	**187**	**42.0**	**665**	**44.8**	**1207**	**46.0**
LAD proximal	421	37.0	180	35.3	203	38.0	136	30.6	519	34.9	940	35.8
LAD mid	110	9.7	47	9.2	37	6.9	45	10.1	129	8.7	239	9.1
LAD distal	3	0.3	1	0.2	4	0.7	5	1.1	10	0.7	13	0.5
D1	8	0.7	2	0.4	4	0.7	1	0.2	7	0.5	15	0.6
Right coronary artery (RCA)	**431**	**37.9**	**200**	**39.3**	**208**	**39.0**	**185**	**41.8**	**593**	**39.8**	**1024**	**39.0**
RCA proximal	232	20.4	105	20.6	136	25.5	118	26.6	359	24.1	591	22.5
RCA mid	134	11.8	60	11.8	52	9.7	42	9.5	154	10.3	288	11.0
RCA distal	54	4.7	24	4.7	16	3.0	19	4.3	59	4.0	113	4.3
PDA	7	0.6	4	0.8	2	0.4	2	0.5	8	0.5	15	0.6
PLV	4	0.4	7	1.4	2	0.4	4	0.9	13	0.9	17	0.6
Left circumflex artery (LCx)	**143**	**12.6**	**64**	**12.6**	**71**	**13.3**	**62**	**14.0**	**197**	**13.3**	**340**	**12.9**
LCX proximal	66	5.8	35	6.9	46	8.6	36	8.1	117	7.9	183	7.0
LCX distal	54	4.7	18	3.5	14	2.6	16	3.6	48	3.2	102	3.9
OM1	18	1.6	7	1.4	11	2.1	7	1.6	25	1.7	43	1.6
OM2	3	0.3	3	0.6	0	0	3	0.7	6	0.4	9	0.3
OM3	2	0.2	1	0.2	0	0	0	0	1	0.1	3	0.1
Graft	**8**	**0.7**	**7**	**1.4**	**3**	**0.6**	**5**	**1.1**	**15**	**0.9**	**23**	**0.9**
LIMA	1	0.1	1	0.2	1	0.2	0	0	2	0.1	3	0.1
SVG1	6	0.5	4	0.8	2	0.4	3	0.7	9	0.6	15	0.6
SVG2	1	0.1	1	0.2	0	0	1	0.2	2	0.1	3	0.1
SVG3	0	0	1	0.2	0	0	1	0.2	2	0.1	2	0.1

Table 4.2.23 Characteristics of PCI procedures performed for lesion with description of CTO >3months only, NCVD-PCI Registry, 2007-2012

	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
PCI status, No. (%)												
Elective	1090	95.8	465	91.2	500	93.6	406	91.4	1371	92.1	2461	93.7
NSTEMI/UA	26	2.3	28	5.5	22	4.1	19	4.3	69	4.7	95	3.6
AMI	20	1.7	17	3.3	12	2.3	19	4.3	48	3.2	68	2.6
Not available	0	0	0	0	0	0	0	0	0	0	0	0
Missing	2	0.2	0	0	0	0	0	0	0	0	2	0.1
#Percutaneous entry, No. (%)												
Brachial	17	1.5	4	0.8	4	0.7	4	0.9	12	0.8	29	1.1
Radial	349	30.7	196	38.4	174	32.6	180	40.5	550	37.0	899	34.2
Femoral	702	61.7	319	62.5	333	62.4	252	56.8	904	60.8	1606	61.2
French size, No. (%)												
5	17	1.5	9	1.8	2	0.4	4	0.9	15	1.0	32	1.2
6	766	67.3	367	72.0	393	73.6	337	75.9	1097	73.7	1863	80.0
7	309	27.2	117	22.9	118	22.1	72	16.2	307	20.6	616	23.5
8	23	2.0	4	0.8	3	0.5	0	0	7	0.5	30	1.1
Others	0	0	0	0	1	0.2	0	0	1	0.1	1	0.0
Not available	16	1.4	8	1.5	3	0.6	3	0.7	14	0.9	30	1.1
Missing	7	0.6	5	1.0	14	2.6	28	6.3	47	3.2	54	2.1

	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Closure device, No. (%)												
No	1057	92.9	482	94.5	466	87.3	378	85.1	1326	89.1	2383	90.7
Seal	40	3.5	14	2.7	10	1.9	10	2.3	34	2.3	74	2.8
Suture	10	0.9	4	0.8	6	1.1	11	2.5	21	1.4	31	1.2
Others	3	0.3	1	0.2	0	0	0	0	1	0.1	4	0.2
Not available	15	1.3	1	0.2	3	0.5	8	1.8	12	0.8	27	1.0
Missing	13	1.1	8	1.6	49	9.2	37	8.3	94	6.3	107	4.1
#Extent of coronary disease, No. (%)												
Single vessel disease	448	39.4	249	48.8	256	47.9	141	31.8	646	43.4	1094	41.7
Multiple vessel disease	680	59.8	253	49.6	159	29.8	237	53.4	649	43.6	1329	50.6
Graft	8	0.7	6	1.2	0	0	10	2.3	16	1.1	24	0.9
Left main	4	0.4	5	1.0	2	0.4	1	0.2	8	0.5	12	0.5
Fluoroscopy time, min												
N	968		487		498		351		1336		2304	
Mean (SD)	31.1 (20.2)		32.5 (23.7)		31.0 (21.3)		33.6 (23.5)		32.2 (22.8)		31.8 (21.7)	
Median (min,max)	26.8 (2.1, 147.0)		26.1 (2.4, 174.4)		26.5 (3.7, 178.0)		28.0 (2.0, 150.0)		26.8 (2.0, 178.0)		26.8 (2.0, 178.0)	
Not available, No. (%)	156	13.7	9	1.8	12	2.2	37	8.3	58	3.9	214	8.1
Missing, No. (%)	14	1.2	14	2.7	24	4.5	56	12.6	94	6.3	108	4.1

	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Fluoroscopy total dose, mGy												
N	482		343		358		151		852		1334	
Mean (SD)	1348.4 (5597.3)		5525.3 (64757.5)		1586.3 (5053.1)		20371.0 (88643.9)		6501.3 (55908.2)		4639.4 (44865.7)	
Median (min,max)	190.5 (6.7, 78539.0)		501.1 (1.2, 1199417.0)		297.4 (0.9, 87493.0)		629.7 (28.7, 656032.0)		413.0 (0.9, 1199417.0)		280.0 (0.9, 1199417.0)	
Not available, No. (%)	611	53.7	135	26.5	95	17.8	141	31.8	371	24.9	982	37.4
Missing, No. (%)	45	4.0	32	6.3	81	15.2	152	34.2	265	17.8	310	11.8
Contrast type, No. (%)												
Ionic	12	1.1	0	0	6	1.1	1	0.2	7	0.5	19	0.7
Non-ionic	961	84.4	505	99.0	504	94.4	421	94.8	1430	96.1	2391	91.1
Not available	159	14.0	3	0.6	5	0.9	6	1.4	14	0.9	173	6.6
Missing	6	0.5	2	0.4	19	3.6	16	3.6	37	2.5	43	1.6
Contrast volume, ml												
N	972		487		514		401		1402		2374	
Mean (SD)	213.7 (79.8)		225.8 (92.7)		221.5 (84.6)		213.9 (91.7)		220.8 (89.6)		217.9 (85.8)	
Median (min,max)	200.0 (18.0, 500.0)		200.0 (30.0, 500.0)		200.0 (50.0, 500.0)		200.0 (24.0, 500.0)		200.0 (24.0, 500.0)		200.0 (18.0, 500.0)	
Not available, No. (%)	155	13.6	11	2.2	11	2.1	17	3.8	39	2.6	194	7.4
Missing, No. (%)	11	1.0	12	2.4	9	1.7	26	5.9	47	3.2	58	2.2

	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Thrombolytics prior to PCI procedure in STEMI, No. (%)												
Total no. of procedures among STEMI patients	220	100	97	100	120	100	42	100	259	100	479	100
Yes	14	6.4	8	8.2	8	6.7	5	11.9	21	8.1	35	7.3
No	206	93.6	89	91.8	112	93.3	37	88.1	238	91.9	444	92.7
Missing	0	0	0	0	0	0	0	0	0	0	0	0
Post-procedure stenosis												
N	1096		503		479		381		1363		2459	
Mean (SD)	20.7 (39.2)		15.0 (34.7)		19.9 (39.3)		26.0 (43.2)		19.8 (39.0)		20.2 (39.1)	
Median (min,max)	0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)		0.0 (0.0, 100.0)	
Missing, No. (%)	42	3.7	7	1.4	55	10.3	63	14.2	125	8.4	167	6.4
Estimated lesion length, mm												
N	916		465		478		362		1305		2221	
Mean (SD)	35.2 (19.7)		36.0 (22.3)		34.3 (21.0)		35.0 (23.1)		35.1 (22.1)		35.1 (21.1)	
Median (min,max)	30.0 (6.0, 99.0)		30.0 (8.0, 140.0)		30.0 (5.0, 115.0)		28.5 (5.0, 120.0)		30.0 (5.0, 140.0)		30.0 (5.0, 140.0)	
Missing, No. (%)	222	19.5	45	8.8	56	10.5	82	18.5	183	12.3	405	15.4

	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Lesion result, No. (%)												
Successful	896	78.7	436	85.5	435	81.5	340	76.6	1211	81.4	2107	80.2
Unsuccessful	236	20.7	73	14.3	99	18.5	104	23.4	276	18.5	512	19.5
Not available	2	0.2	1	0.2	0	0	0	0	1	0.1	3	0.1
Missing	4	0.4	0	0	0	0	0	0	0	0	4	0.2
*Stent length, mm												
N	835		406		394		314		1114		1949	
Mean (SD)	46.1 (23.5)		45.3 (25.1)		43.6 (24.1)		43.9 (24.7)		44.3 (24.6)		45.1 (24.2)	
Median (min,max)	41.0 (8.0, 131.0)		38.0 (10.0, 141.0)		38.0 (8.0, 138.0)		36.5 (10.0, 152.0)		38.0 (8.0, 152.0)		38.0 (8.0, 152.0)	
Not available, No. (%)	303	26.6	104	20.4	140	26.2	130	29.3	374	25.1	677	25.8
**Stent diameter, mm												
N	835		406		392		314		1112		1947	
Mean (SD)	2.9 (0.4)		2.8 (0.4)		2.9 (0.4)		2.8 (0.4)		2.8 (0.4)		2.8 (0.4)	
Median (min,max)	2.8 (2.3, 4.7)		2.8 (2.0, 4.5)		2.8 (2.3, 4.0)		2.8 (2.0, 4.5)		2.8 (2.0, 4.5)		2.8 (2.0, 4.7)	
Not available, No. (%)	303	26.6	104	20.4	142	26.6	130	29.3	376	25.3	679	25.9
Maximum balloon size used, mm												
N	894		449		447		342		1238		2132	
Mean (SD)	2.9 (0.6)		2.9 (0.6)		2.9 (0.6)		2.9 (0.6)		2.9 (0.6)		2.9 (0.6)	
Median (min,max)	3.0 (1.3, 5.0)		3.0 (1.3, 5.0)		3.0 (1.0, 4.5)		3.0 (1.0, 5.0)		3.0 (1.0, 5.0)		3.0 (1.0, 5.0)	
Missing, No. (%)	244	21.4	61	12.0	87	16.3	102	23.0	250	16.8	494	18.8

	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Maximum stent/balloon deploy pressure, atm												
N	869		440		421		321		1182		2051	
Mean (SD)	16.2 (3.9)		16.0 (4.1)		16.5 (4.2)		16.7 (4.6)		16.4 (4.3)		16.3 (4.1)	
Median (min,max)	16.0 (4.0, 29.0)		16.0 (4.0, 30.0)		16.0 (6.0, 30.0)		16.0 (4.0 ,30.0)		16.0 (4.0, 30.0)		16.0 (4.0, 30.0)	
Missing, No. (%)	269	23.6	70	13.7	113	21.2	123	27.7	306	20.6	575	21.9

#Patients are allowed to have more than one type of category
** Summation of stent length was used for lesions which were treated with more than one stent*
*** Average of stent diameter was used for lesions which were treated with more than one stent*

Table 4.2.24 Types of stents used for lesion with description of CTO >3months only, NCVD-PCI Registry, 2007-2012

Types of stents for lesion with CTO >3mo	2007-2009 Total no. of stents used = 1764		2010 Total no. of stents used = 798		2011 Total no. of stents used = 801		2012 Total no. of stents used = 653		2010-2012 Total no. of stents used = 2252		2007-2012 Total no. of stents used = 4016	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Drug eluting stent	1142	64.7	601	75.3	578	72.2	446	68.3	1625	72.2	2767	68.9
Bare metal stent	277	15.7	79	9.9	62	7.7	54	8.3	195	8.7	472	11.8
Bio-absorbable stent	0	0	0	0	0	0	1	0.2	1	0	1	0
Antibody coated	14	0.8	10	1.3	9	1.1	2	0.3	21	0.9	35	0.9
*Others	32	1.8	6	0.8	17	2.1	22	3.4	45	2.0	77	1.9
Covered stent	1	0.1	0	0	0	0	0	0	0	0	1	0

** Stents which are not listed in the NCVD-PCI Stent List*

Table 4.2.25 Types of devices used during Percutaneous Coronary Intervention for lesion with description of CTO >3months only, NCVD-PCI Registry, 2007-2012

#Intracoronary devices used for lesion with CTO >3months	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Balloon only	90	7.9	55	10.8	32	6.0	37	8.3	124	8.3	214	8.1
Drug eluting balloon	38	3.3	19	3.7	35	6.6	46	10.4	100	6.7	138	5.3
Drug eluting stent	640	56.2	351	68.8	348	65.2	287	64.6	986	66.3	1626	61.9
Cutting balloon	10	0.9	3	0.6	6	1.1	7	1.6	16	1.1	26	1.0
IVUS	50	4.4	21	4.1	22	4.1	20	4.5	63	4.2	113	4.3
Rotablator	6	0.5	11	2.2	5	0.9	2	0.5	18	1.2	24	0.9
Bare metal stent	207	18.2	54	10.6	42	7.9	35	7.9	131	8.8	338	12.9
Distal embolic protection	2	0.2	0	0	2	0.4	4	0.9	6	0.4	8	0.3
Others	254	22.3	65	12.7	91	17.0	94	21.2	250	16.8	504	19.2

#Patients are allowed to have more than one type of category

Table 4.2.26 Types of post procedure complications for lesion with description of CTO >3months only, NCVD-PCI Registry, 2007-2012

*Types of complication for lesion with CTO>3mo	2007-2009 Total no. of lesions = 1138		2010 Total no. of lesions = 510		2011 Total no. of lesions = 534		2012 Total no. of lesions = 444		2010-2012 Total no. of lesions = 1488		2007-2012 Total no. of lesions = 2626	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Dissection	99	8.7	38	7.5	13	2.4	9	2.0	60	4.0	159	6.1
No reflow	25	2.2	9	1.8	11	2.1	10	2.3	30	2.0	55	2.1
Transient	10	52.6	6	75.0	7	77.8	3	30.0	16	59.3	26	56.5
Persistent	9	47.4	2	25.0	2	22.2	7	70.0	11	40.7	20	43.5
Not available/ Missing	6		1		2		0		3		9	
Perforation	13	1.1	5	1.0	0	0	4	0.9	9	0.6	22	0.8

** Results only showed for number of patients who were reported to have the complications*

Table 4.2.27 Duration of Thienopyridine in patients who underwent PCI and lesion with description of CTO >3months only, NCVD-PCI Registry, 2007-2012

Year	Duration of clopidogrel/ticlopidine (months)	#Intracoronary devices used					
		Balloon only		Drug eluting stent		Bare metal stent	
		No.	%	No.	%	No.	%
2007-2009 Total no. of lesions = 1138	1	19	21.1	8	1.3	79	38.2
	3	8	8.9	5	0.8	13	6.3
	6	13	14.4	84	13.1	31	15.0
	12	24	26.7	422	65.9	60	29.0
	>12	7	7.8	98	15.3	11	5.3
	Not available	18	20.0	22	3.4	10	4.8
	Missing	1	1.1	1	0.2	3	1.4
	Total	**90**	**100.0**	**640**	**100.0**	**207**	**100.0**
2010-2012 Total no. of lesions = 1488	1	23	18.5	8	0.8	32	24.4
	3	11	8.9	7	0.7	11	8.4
	6	2	1.6	7	0.7	10	7.6
	12	49	39.5	851	86.3	66	50.4
	>12	5	4.0	67	6.8	2	1.5
	Not available	32	25.8	15	1.5	0	0
	Missing	2	1.7	31	3.2	10	7.7
	Total	**124**	**100.0**	**986**	**100.0**	**131**	**100.0**
2007-2012 Total no. of lesions = 2626	1	42	19.6	16	1.0	111	32.8
	3	19	8.9	12	0.7	24	7.1
	6	15	7.0	91	5.6	41	12.1
	12	73	34.1	1273	78.3	126	37.3
	>12	12	5.6	165	10.1	13	3.8
	Not available	50	23.4	37	2.3	10	3.1
	Missing	3	1.4	32	2.0	13	3.8
	Total	**214**	**100.0**	**1626**	**100.0**	**338**	**99.9**

#Patients are allowed to have more than one type of category