Incidence and Predictors of Stent Thrombosis after Percutaneous Coronary Intervention in Acute Myocardial Infarction

Sungmin Lim, Yoon Seok Koh, Hee Yeol Kim, Ik Jun Choi, Eun Ho Choo, Jin Jin Kim, Mineok Chang, Jae Gyung Kim, Donggyu Moon, Hun-Jun Park, Pum Joon Kim, Kiyuk Chang, Wook Sung Chung, Minkyu Kang, Tae-Hoon Kim, Jong Min Lee, Yoon Seok Choi, Chul Soo Park, Suk Min Seo, Dong Il Shin, Doo Soo Jeon, Chan Jun Kim, Mahn Won Park, Sung-Ho Her, Keon Woong Moon, Ki Dong Yoo, Byung-Hee Hwang, Dong-Bin Kim, Doo Sun Sim, Keun-Ho Park, Ju Han Kim, Young Joon Hong, Youngkeun Ahn, Myung Ho Jeong, Ki-Bae Seung

Department of Cardiovascular Medicine, Seoul St. Mary's Hospital, The Catholic University of Korea, Seoul

Department of Cardiology, Chonnam National University Hospital, Gwangju

Potential conflicts of interest

- I do not have any potential conflict of interest

Introduction

Incidence of ST in BMS and DES

- **Incidence of ST: very different according to trial**
  - ST incidence up to 4 years of BMS: 1.5 %
  - ST incidence up to 4 years of SES: 1.7 %
  - ST incidence up to 4 years of PES: 1.8 %

ST: definite or probable

Mauri L, et al. N Engl J Med 2007;356:1020-9.

  - ST incidence up to 2 years of BMS: 2.6 %
  - ST incidence up to 2 years of older DES: 2.4 %
  - ST incidence up to 2 years of new DES: 1.1 %

ST: definite

Sarno G, et al. Eur Heart J 2012;33:606-13 (SCAAR registry).

Incidence of ST in ACS

- **Incidence of ST in ACS**

➢ **ST incidence up to 1 years of BMS or DES: 2.2 %**

ST: definite or probable

Palmerini T, et al. Circ Cardiovasc Interv 2011;4:577-84 (ACUITY trial)

➢ **ST incidence up to 3 years of BMS or DES: 4.9 %**

ST: definite or probable

Dangas GD, et al. J Am Coll Cardiol 2012;59:1752-9 (HORIZONS-AMI)

➢ **ST incidence up to 3 years of BMS : 3.5 %**

ST: definite

Mhgaieth F, et al. Circ J 2012;76:634-40 (Tunicia)

Incidence of Very Late ST

- **Incidence of very late ST with 1st –generation DES**

Study	Year	Patients, n	Stent	FU, y	VRST, %/y
ESTROFA	2008	23,500	SES/PES	3	0.27
SCAAR	2009	42,150	SES/PES	3	0.3
DESIRE-LATE	2010	1,010	SES/PES	5	0.22
Jensen	2010	12,374	SES/PES	3	0.21
Simsek	2010	1,444	SES/PES	4	0.2
BERN/Rotterdam	2011	8,146	SES/P		0.52

Faxon DP. Circulation 2012;125:562-

Predictors of ST

- **Considerable predictors**
  - Acute myocardial infarction
  - Low ejection fraction
  - Small stent diameter
  - Young age
  - LAD intervention
  - Insulin-treated DM
  - Number of diseased vessel
  - Discontinuation of clopidogrel within 3 months

Park KW, et al. Circ J 2011;75:1626-32 (KoST registry).
Palmerini T, et al. Circ Cardiovasc Interv 2011;4:577-84 (ACUITY trial).

Objectives

- We evaluated that the incidence and predictors of stent thrombosis in acute myocardial infarction patients over 4 years

Method

COREA-AMI : Multicenter MI registry

- **COREA-AMI (COnvergent REgistry of cAtholic and chonnAm university of AMI)**
  - **Retrospective multicenter registry**
  - **4,748 patients with AMI underwent PCI**
  - **Jan. 2004 – Dec. 2009**
  - **Including STEMI and NSTEMI**
  - **Median follow up duration: 43.5 month (IQR 29.5 – 59.9)**

Study Flow Chart

4,720 AMI patients underwent PCI by BMS or DES from Jan, 2004 to December, 2009

Catholic Medical Center
Chonnam Nat'l University Hospital

Median FU
: 43.5 month
(IQR 29.5–59.9)

Excluded
- **Age <20**
- **Medical therapy**
- **Unclear stent type**

No ST (n=4,584)

BMS (n=434)

DES (n=4,150)

ST (n=136)

BMS (n=17)

DES (n=119)

Definition of ST

- **ARC's (Academic Research Consortium) definition**
  - **Definite ST**
  - **Probable ST**

- **Early ST : 0 ~ 30 days**
- **Late ST : 31 ~ 365 days**
- **Very late ST : 1 year ~**

Statistical analysis

- Using SAS
- Independent t-test for continuous variables
- Chi-square test for categorical variables
- Kaplan-Meier analysis with Log-rank
- Multivariate Cox regression analysis for predictors of ST
- P<0.05: statistically significant

Results

Stent Thrombosis

- **Stent thrombosis : n=136**

Stent thrombosis	Definite	Probable	Total
ALL	110	26	136
Early	30	15	45
Late	36	1	37
Very late	44	10	54

- **All definite ST : confirmed by coronary angiography**

Clinical Baseline Characteristics

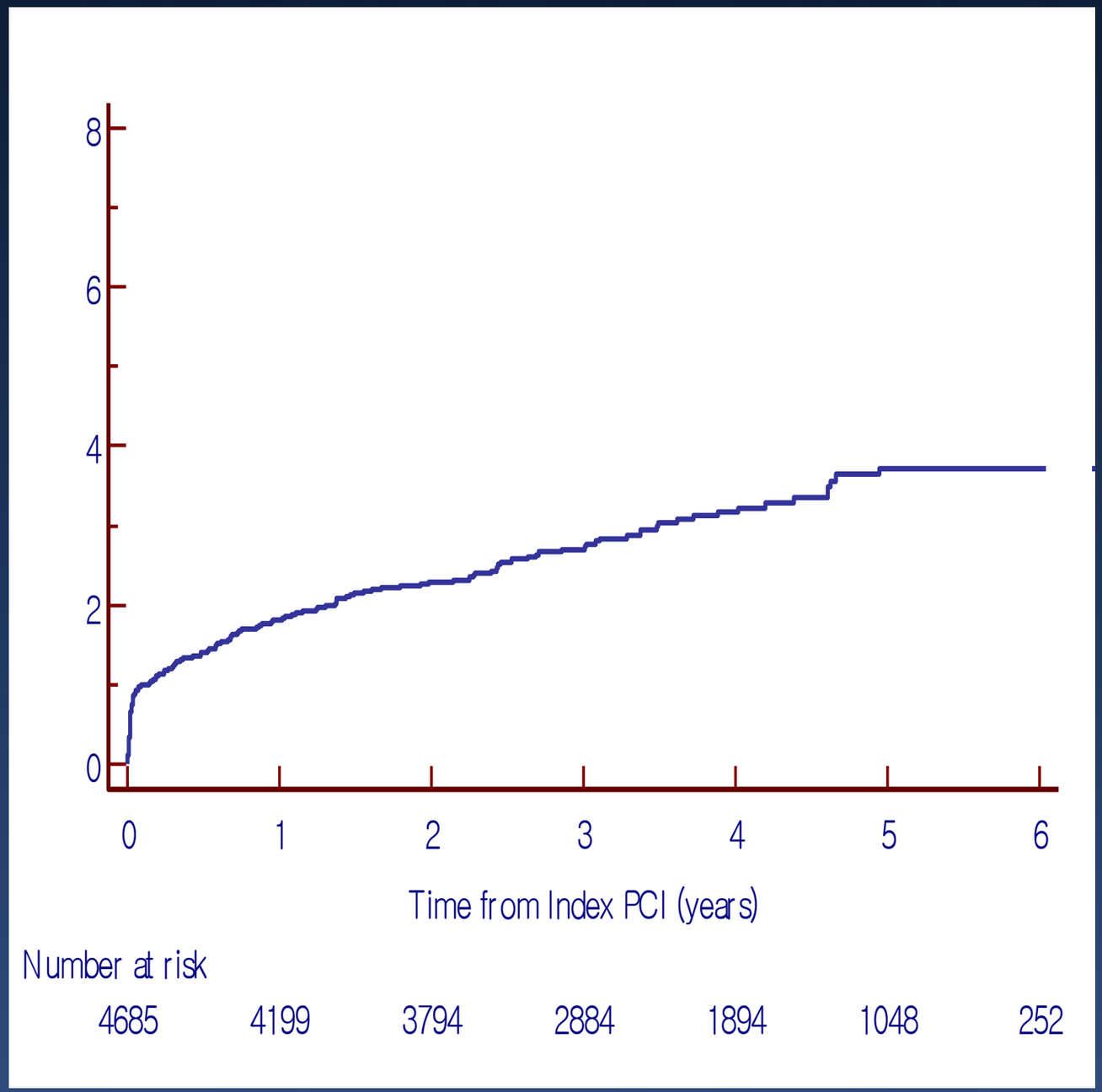
Variables	No stent thrombosis (n= 4584)	Stent thrombosis (n= 136)	p-value
Age	64.0 (53.0-72.0)	62.0 (52.0-72.0)	0.675
≥65	2213 (48.3)	59 (43.4)	0.260
Male	3292 (71.8)	93 (68.4)	0.381
BMI	24.1 (22.1-26.1)	23.8 (21.5-26.0)	0.250
Hypertension	2283 (49.8)	72 (52.9)	0.471
Diabetes mellitus	1439 (31.4)	42 (30.9)	0.900
Hypercholesterolemia	1295 (29.4)	37 (27.8)	0.691
Current smoker	1958 (42.7)	62 (45.6)	0.504
Renal insufficiency	1082 (23.6)	40 (29.4)	0.119
Previous PCI	181 (4.0)	6 (4.4)	0.785
Previous MI	164 (3.6)	9 (6.6)	0.097
Previous stroke	206 (4.5)	4 (2.9)	0.387
Ejection Fraction	55.0 (46.0-62.0)	52.0 (42.0-60.0)	0.001
Hemoglobin, g/dL	13.6 (11.9-15.0)	13.0 (11.4-14.6)	0.056
hsCRP, mg/L	6.5 (1.9-24.4)	9.1 (2.6-31.7)	0.084
Clinical presentation			0.189
NSTEMI	1772 (38.7)	45 (33.1)	
STEMI	2812 (61.3)	91 (66.9)	

Values are expressed as n (%) or mean (±SD)

Angiographic Baseline Characteristics

Variables	No stent thrombosis (n= 4584)	Stent thrombosis (n= 136)	p-value
Extent of disease			0.990
1 vessel disease	2195 (47.9)	63 (46.7)	
2 vessel disease	1342 (29.3)	40 (29.6)	
3 vessel disease	904 (19.7)	28 (20.7)	
LM disease	138 (3.0)	4 (3.0)	
Culprit vessel			0.976
LAD	2198 (48.0)	67 (49.3)	
LCX	729 (15.9)	24 (17.6)	
RCA	1540 (33.6)	43 (31.6)	
Left main	103 (2.2)	2 (1.5)	
Initial TIMI flow 0~1	2252 (49.3)	67 (49.6)	0.934
Stent number	1.14 (0.77-1.51)	1.13 (0.76-1.50)	0.608
Stent diameter	3.21 (2.78-3.64)	3.15 (2.68-3.62)	0.129
Stent length	27.4 (15.0-39.8)	26.8 (13.7-39.9)	0.556
Use of IVUS	1261 (27.5)	41 (30.2)	0.498
Use of GP IIb/IIIa inhibitor	855 (18.7)	31 (22.8)	0.223
No reflow	623 (13.6)	27 (19.9)	0.037
Type of stent			
Bare metal stent	434 (9.5)	17 (12.5)	0.236
Drug eluting stent	4150 (90.5)	119 (87.5)	

Incidence of ST



- **Total incidence of ST**

  : 3.74 %

- **Annual incidence of VLST**

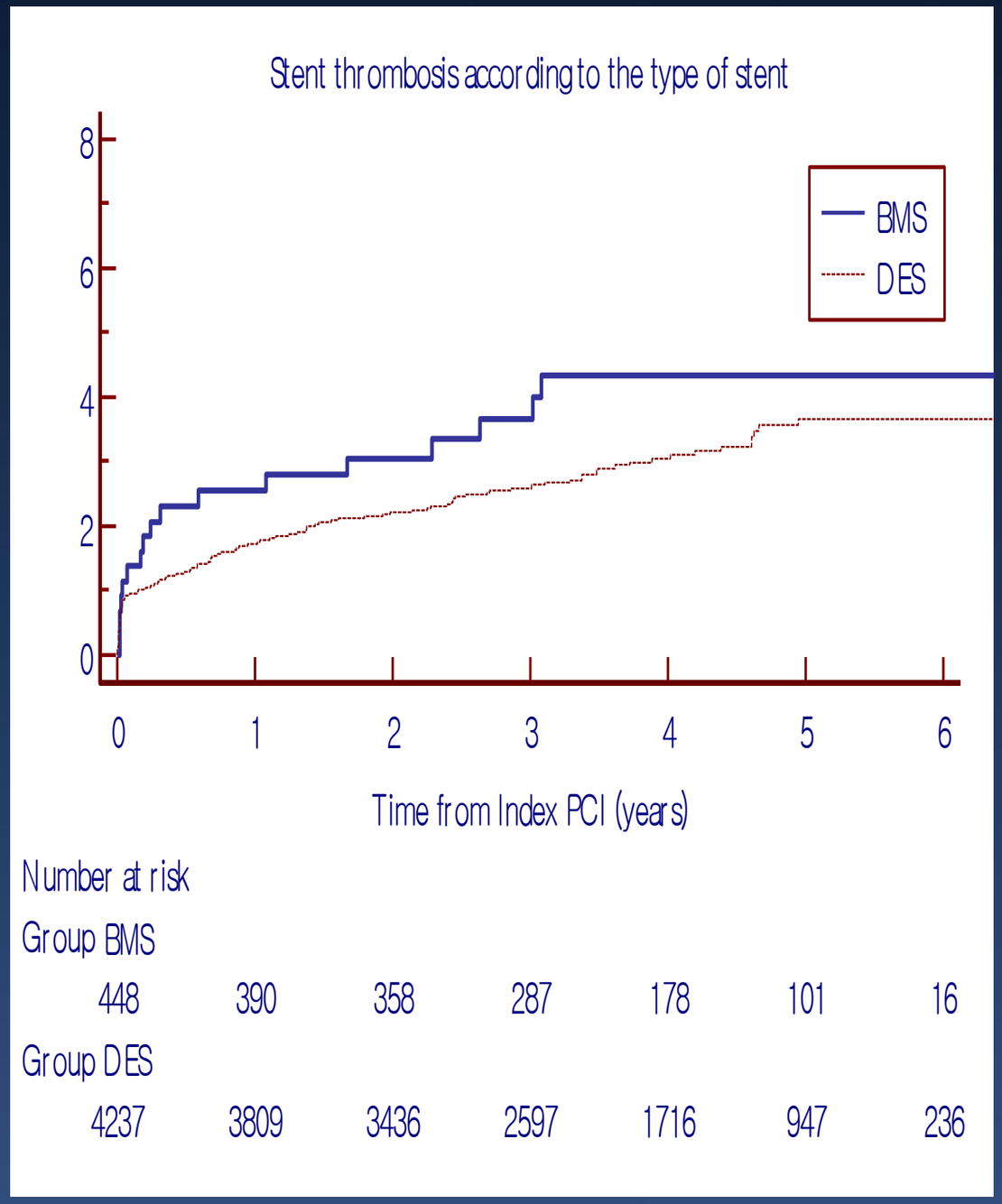
  : 0.49 %

  (0.45 ~ 0.56)

Incidence of ST according to Stent Type

Stent thrombosis	BMS (n=451)	DES (n=4269)	*p-value*
ALL, % (n)	4.35 (17/451)	3.67 (119/4269)	0.226
Early	1.37(6/451)	0.91 (38/4269)	0.353
Late	1.20 (5/427)	0.84 (33/4074)	0.424
Very late	1.84 (6/387)	1.96 (48/3800)	0.680
1 - 2 year	0.52 (2/387)	0.46 (17/3800)	0.848
2 - 3 year	0.62 (2/355)	0.43 (13/3430)	0.623
3 - 4 year	0.71 (2/285)	0.47 (10/2594)	0.420
4 year -	- (0/177)	0.63 (8/1716)	0.366

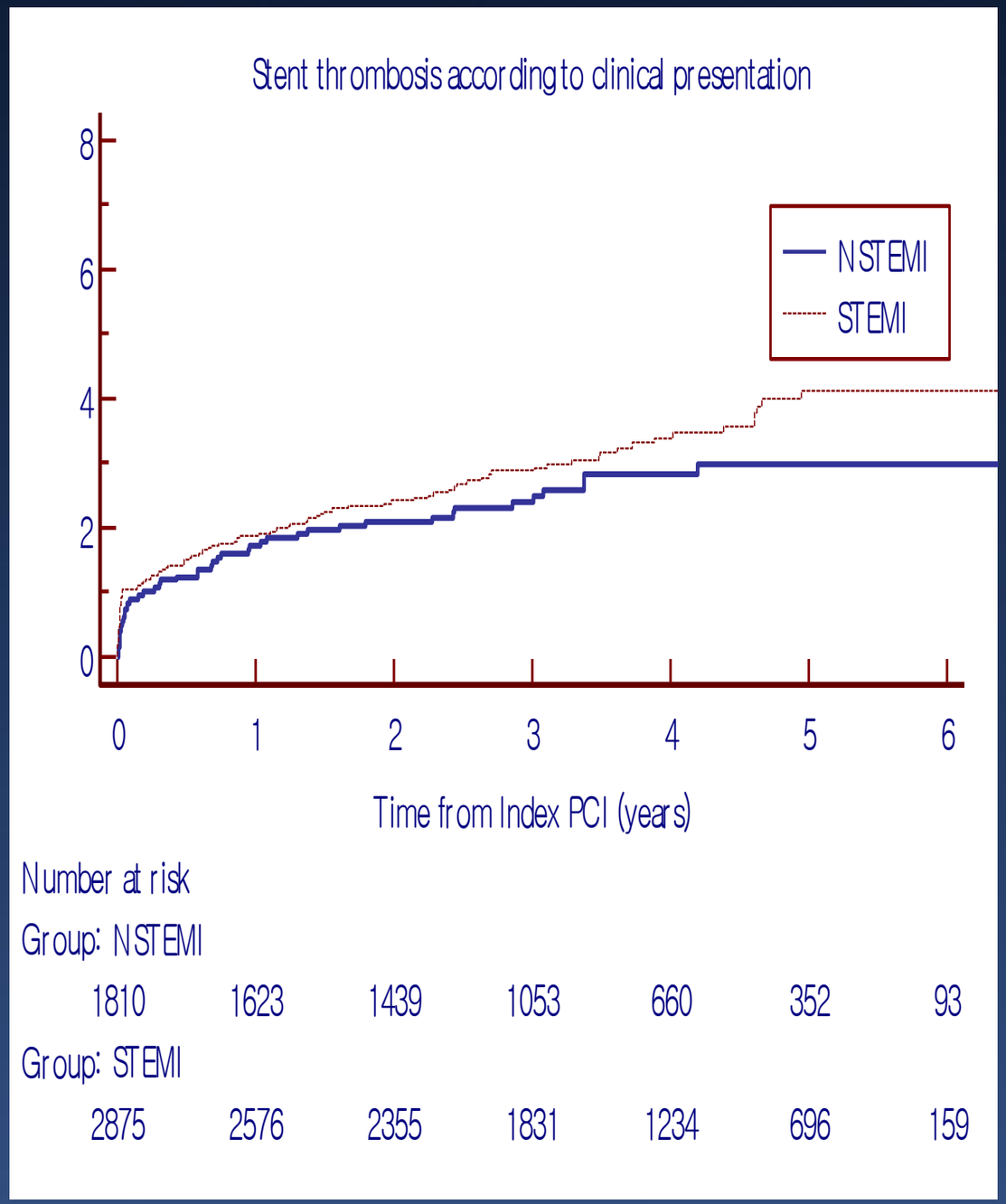
Values are expressed as % (n)



Incidence of ST according to Diagnosis

Stent thrombosis	NSTEMI (n=1817)	STEMI (n=2903)	*p-value*
ALL, % (n)	2.99 (45/1817)	4.14 (91/2903)	0.236
Early	0.84 (15/1817)	1.02 (29/2903)	0.518
Late	0.89 (15/1749)	0.86 (23/2752)	0.927
Very late	1.29 (15/1617)	2.31 (39/2570)	0.167
1 - 2 year	0.38 (6/1617)	0.48 (13/2570)	0.535
2 - 3 year	0.32 (4/1435)	0.52 (11/2350)	0.399
3 - 4 year	0.47 (4/1052)	0.53 (8/1827)	0.869
4 year -	0.17 (1/660)	0.77 (7/1233)	0.199

Values are expressed as % (n)



Results

- ST : associated with high mortality rate
  - 30-day mortality : 16.9% (23/136)
  - Total mortality : 30.9% (42/136)

- The incidence of ST according to discontinuation of clopidogrel

Stent thrombosis	All patients (n=136)	Clopidogrel Use (n=107)	Discontinuation (n=29)
ALL			
Early	45	43	1
Late	37	34	4
Very late	54	30	24

Predictors of ST

➢ **Predictors of total stent thrombosis**

Variables	Hazard ratio	95% confidence interval	P Value
No reflow	2.025	1.313-3.122	0.001
LV ejection fraction	0.978	0.963-0.992	0.002
Anemia	1.502	1.059-2.132	0.023
Stent diameter <3.0mm	1.499	1.011-2.221	0.044
DM	0.935	0.644-1.357	0.723
DES	0.798	0.474-1.343	0.396
STEMI	1.369	0.945-1.982	0.097

Cox hazard regression models. Variables which p value <0.1 on univariable analyses among all baseline variables, DM, type of stent, and clinical presentation.

Predictors of ST

➢ **Predictors of stent thrombosis according to timing**

Variables	Hazard ratio	95% confidence interval	P Value
Early ST			
LV EF	0.975	0.951-0.999	0.039
Late ST			
No reflow	2.668	1.292-5.508	0.008
LV EF	0.971	0.946-0.998	0.032
Very late ST			
No reflow	2.448	1.213-4.940	0.012
Previous MI	2.846	1.125-7.198	0.027
Anemia	1.826	1.056-3.159	0.031

Summary

- The incidence of ST in AMI over 5 years : 3.74 %
- The annual incidence of VLST in AMI : 0.49 %
- No difference between BMS and DES
- No difference between STEMI and NSTEMI
- The predictors of ST

: No reflow, low LV EF, anemia, and stent diameter <3.0mm

Conclusion

Stent thrombosis is not uncommon and continues to occur in patient with AMI underwent PCI irrespective of stent type or clinical diagnosis.

Thank You for Your Attention