STEMI: LEFT MAIN CULPRIT





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STEMI: LEFT MAIN CULPRIT ARTERY (WHAT DO WE KNOW?)

- STEMI due to a left main (LM) culprit artery is an uncommon but potentially devastating clinical event (.8 5.4%)
- Limited data regarding the clinical characteristics and outcomes
- Meta-analysis JACC Int 2013 (12 studies with 977 patients with "unprotected LM STEMI" (26% cardiogenic shock), 9 single center and only 3 included cardiac arrest
- Will show Midwest STEMI Consortium contemporary data:
 - 4 specific subtypes with different outcomes







IS THE SURGEON RELEVANT TO THIS TOPIC?







Last Weekend On Call: The Final Exam



- 50-yo woman with acute onset "tearing in my chest" at 1:30am at work.
- VF x2 at New Ulm ED with lateral STEMI, transferred via Level 1 protocol
- Arrived in cardiogenic shock with O2 sats 70% and BP 80's

Initial EKG



Subsequent EKG



Initial Angiogram

Left Main







Call the surgeon! Conservative care! Circumstances beyond our control!



"Oh, Lord! Here come circumstances beyond our control."

Final Angiogram





6 years later:

- LVEF 60%: min ant hypo
- Asymptomatic
- Published her book!



Unprotected left main revascularization in patients with acute coronary syndromes





GRACE REGISTRY: TYPE OF REVASCULARIZATION OVER TIME IN ACS INVOLVING UNPROTECTED LM





CUMULATIVE DEATH VS REVASCULARIZATION STRATEGY AS A TIME-VARYING CO-VARIETE





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Primary Percutaneous Coronary Intervention for Unprotected Left Main Disease in Patients With Acute ST-Segment Elevation Myocardial Infarction

The AMIS (Acute Myocardial Infarction in Switzerland) Plus Registry Experience

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CLINICAL PRESENTATION OF LEFT MAIN STEMI

Primary Percutaneous Coronary Intervention for Unprotected Left Main Disease in Patients With Acute ST-Segment Elevation Myocardial Infarction

AMIS Plus

The AMIS (Acute Myocardial Infarction in Switzerland) Plus Registry Experience

	LM PCI	Non LM PCI	p-value
	n=348	n=6318	
Age, mean (SD)	63.5 (12.2)	61.9 (12.4)	0.02
Women, n (%)	87/348 (25.0)	1455/6318 (23.0)	0.4
Resuscitation prior to admission, n (%)	37/348 (10.6)	400/6318 (6.3)	<0.001
Cardiogenic shock at admission, n (%)	42/344 (12.2)	217/6279 (3.5)	<0.001
Dyspnea	107/307 (34.9%)	1287/5507 (23.4%)	< 0.001
IABP, n (%)	48/343 (14.0)	400/8244 (8.4%)	<0.001
Vasopressor, n (%)	56/341 (16.4)	641/6194 (10.3)	<0.001



OUTCOMES

Primary Percutaneous Coronary Intervention for Unprotected Left Main Disease in Patients With Acute ST-Segment Elevation Myocardial Infarction

The AMIS (Acute Myocardial Infarction in Switzerland) Plus Registry Experience

AMIS Plus

	Primary ULM PCI n=348	Primary Non-LM PCI, n =6318	p-value
In-hospital death, n (%)	38/348 (10.9)	241/6318 (3.8)	<0.001
In-hospital death, pts. with CS at admission, n (%)	23/42 (54.8)	77/217 (35.5)	0.024
MACCE, n (%) (death, re-infarction, stroke)	43/346 (12.4)	314/6291 (5.0)	<0.001
Re-infarction, n (%)	4/346 (1.2)	56/6289 (0.9)	0.55
Cerebrovascular events, n (%)	5/346 (1.4)	42/6289 (0.7)	0.10







CLINICAL PRESENTATION OF LEFT MAIN ACS

The National Cardiovascular Data Registry (NCDR)

	STE	EMI	NSTEMI			
	UPLMCA (N=434)	PLMCA (N=116)	UPLMCA (N=387)	PLMCA (N=610)	All (N=1547)	p-Value
			Cardiac status			
NYHA class						
Ι	11.5%	16.4%	14.0%	16.1%	14.3%	< 0.0001
II	2.7%	3.4%	8.3%	10.7%	7.3%	
III	10.8%	21.5%	26.1%	37.4%	25.9%	
IV	74.9%	58.6%	51.7%	35.9%	52.5%	
Cardiogenic shock	66.4%	31.9%	32.6%	8.0%	32.3%	< 0.0001



OUTCOMES

NCDR Unprotected vs Protected LM





MSC LM CULPRIT METHODS

- Comprehensive, prospective STEMI program databases (2005-2019) at Smidt Heart Institute at Cedars Sinai in Los Angeles, CA, Minneapolis Heart Institute at Abbott Northwestern Hospital in Minneapolis, MN, and Prairie Cardiovascular Health in Springfield, IL
- Evaluated the demographics, clinical characteristics, and outcomes of STEMI patients with a LM culprit compared to non-left main culprit





BASELINE CHARACTERISTICS

- 8277 Consecutive STEMI patients, 84 LM Culprit (1%)
- Older, Lower EF
- More CA and CS

	Left Main Culprit (n=84)	Non-Left Main Culprit (n=8193	P-Value
Age (Years), mean(SD)	67.6±13.1	62.3 ± 13.5	<0.001
Male (%)	67.9%	72.0%	0.40
BMI, mean(SD)	28.0 ± 6.6	29.2 ± 6.8	0.12
Hypertension (%)	70.0%	60.4%	0.081
Dyslipidemia (%)	59.2%	56.2%	0.60
Diabetes (%)	22.5%	20.0%	0.58
History of CAD (%)	39.5%	29.6%	0.053
History of PCI (%)	22.2%	22.2%	0.99
History of MI (%)	27.9%	20.3%	0.097
History of CABG (%)	12.4%	6.7%	0.045
Cardiac Arrest Pre-PCI (%)	16.7%	7.9%	0.003
Cardiogenic Shock Pre-PCI (%)	32.5%	5.9%	<0.001
Killip Class 1 (%)	65.9%	89.0%	<0.001
2/4 (%)	34.2%	11.0%	40.001
Anterior MI (%)	56.0%	33.8%	<0.001
Ejection Fraction (%), mean(SD)	37.2 ± 15.1	47.1 ± 12.5	<0.001



LM STEMI SUB-TYPES

Four distinct clinical scenarios occurred :

- 1. Unprotected LM total occlusion (TIMI 0/1 flow)
- 2. Subtotal LM culprit with TIMI 2/3 flow
- 3. Protected LM occlusion
- 4. Spontaneous LM dissection



FREQUENCY



LEFT MAIN OCCLUSION (24%)



SUBTOTAL OCCLUSION (60%)





PROTECTED LEFT MAIN (S/P CABG) (11%)



LEFT MAIN DISSECTION (5%)





- More likely to have TIMI 2/3 flow (59.7% vs 38.7% p<0.001) prior to intervention, but less likely post intervention (93.2% vs. 97.6%; p<0.001)
- PCI less likely performed 63.1% vs 95.1%
- Significantly higher rate of in-hospital mortality (28.9% vs 4.5%, p<0.001)



CONCLUSIONS

- Patients with STEMI due to LM artery are a small, but high-risk population with four distinctly different clinical presentations
- Emergency PCI is not only feasible but life saving
- Higher rates of mortality in-hospital and long-term, especially with Card Shock and Occluded unprotected LM
- Importantly, the numbers of patients with a LM culprit dying prior to hospital presentation is unknown!





LEFT MAIN STEMI/NSTEMI



Interventional issues:

Stabilize the patient.

Consider mechanical circulatory support. (IABP, Impella, ECMO...)

Fast revascularization of the first accessible vessel, restoration of the flow

as fast as possible, but aim for complete revascularization.

Stents(DES) and technique according to recommendations:

whenever possible 1 stent technique or, depending on the hemodynamic

conditions, a simple 2 stent technique

Attempt to achieve optimal result (OCT, IVUS)



CONCLUSIONS

STEMI due to LM culprit lesion is a rare but serious condition.

Patients surviving the first month have a good mid-term prognosis.

Advanced age, cardiogenic shock, and unsuccessful PCI are independent predictors of early and mid-term survival.



ADJUSTED OVERALL SURVIVAL IN PATIENTS WITH OR WITHOUT CARDIOGENIC SHOCK ON ADMISSION





OUTCOMES

A Systematic Review and Meta-Analysis on Primary Percutaneous Coronary Intervention of an Unprotected Left Main Coronary Artery Culprit Lesion in the Setting of Acute Myocardial Infarction

Table 2. 30-Day All-Cause Mortality of Patients Among the Different Studies						
First Author (Ref. #)	Cardiogenic Shock (%)	No Cardiogenic Shock (%)	Weight Factor			
Yip et al. (29)	43 (6/14)	0 (0/4)	2.43			
De Luca et al. (20)	80 (12/15)	22 (2/9)	4.40			
Lee et al. (23)	43 (6/14)	50 (2/4)	2.43			
Valeur et al. (28)	70 (7/10)	0 (0/2)	1.30			
Hurtado et al. (21)	57 (16/28)	29 (4/14)	7.30			
Bonello et al. (19)	44 (4/9)	0 (0/4)	2.16			
Montalescot et al. (24)	40 (10/25)	13 (38/293)	18.01			
Jensen et al. (22)	55 (16/29)	14 (6/42)	13.41			
Pepe et al. (26)	31 (4/13)	33 (3/9)	4.16			
Pedrazzini et al. (25)	55 (23/42)	5 (15/306)	28.87			
AMC cohort (this study)	78 (29/37)	33 (6/18)	9.90			
Barlis et al. (18)	60 (3/5)	0 (0/15)	2.93			
Tan et al. (27)	64 (7/11)	0 (0/5)	2.69			
Values are % (n/N). AMC = Academic Medical Center.						



OUTCOMES

Early and Mid-Term Clinical Outcome of Emergency PCI in Patients with STEMI due to Unprotected Left Main Coronary Artery Disease



Fig. 1. Kaplan–Meier Survival curves between LMCA and non-LMCA group. After 30 days, there was no significant difference in cardiac death between uLMCA and non-uLMCA uLMCA: Unprotected left main coronary artery.

After 30 days - no difference in mortality b/n primary LM and non-LM PCI in patients with STEMI.



MULTIVARIATE PREDICTORS ASSOCIATED WITH IN-HOSPITAL MORTALITY

Variable	OR [CI]	Wald Chi Square	p Value
Age /10 year increase	1.2 [1.02-1.4]	5.30	0.021
Female	0.8 [0.6-1.2]	1.11	0.29
Race: White vs Other	0.7 [0.5-1.1]	2.10	0.15
Diabetes mellitus	1.0 [0.7-1.4]	0.02	0.89
Primary PCI	0.6 [0.4-0.97]	4.34	0.03
CVD	1.3 [0.8-2.0]	1.02	0.32
Glomerular filtration rate/10 unit increase	0.9 [0.8-0.97]	7.25	0.007
NYHA class 4	1.2 [0.8-1.7]	0.83	0.36
NSTEMI - No prior CABG	2.6 [1.5-4.2]	13.4	0.0003
STEMI - No prior CABG	5.0 [3.0-8.4]	38.5	<.0001
STEMI - prior CABG	2.0 [0.96-3.9]	3.43	0.064
Cardiogenic Shock	7.5 [5.2-10.8]	113.41	<.0001
Pre IABP	2.3 [1.1-4.7]	5.51	0.018
Salvage PCI	4.3 [2.3-8.1]	19.87	<.0001
Pre-procedure TIMI flow 0/1	2.3 [1.6-3.3]	19.67	<.0001
Bifurcation lesion	1.2 [0.8-1.7]	1.1	0.3020
Annual PCI volume per 100 increase	1.0 [0.9-1.03]	0.3	0.6137



RESULTS

- Of the 8,277 consecutive STEMI patients at the three centers, 84 patients (1%) had a LM artery culprit
- Compared to patients with non-LM culprit, LM culprit artery patients were older with lower ejection fractions and more likely to have cardiac arrest (16.7% vs 7.9%; p= 0.003) and cardiogenic shock (32.5% vs 5.9%; p <0.001) on presentation



PROCEDURAL CHARACTERISTICS

	Left Main Culprit (n=84)	Non-Left Main Culprit (n=8193	P-Value
Culprit Artery			
Left Main (%)			
LAD (%)	100%	0%	
LCx/Intermediate (%)	0%	36.5%	
RCA (%)	0%	14.4%	<0.001
Graft (%)	0%	44.4%	10.001
Multiple Potential, (%)	0%	2.9%	
	0%	1.8%	
TIMI Flow Pre §PCI			
0/1 (%)	40.3%	61.3%	
2/3 (%)	59.7%	38.7%	<0.001
TIMI Flow Post PCI			
0/1 (%)	6.9%	2.4%	
2/3 (%)	93.2%	97.6%	<0.001
PCI Performed, (%)	63.1%	95.1%	
In-hospital Death (%)	28.9%	4.5%	<0.001





ANGIOGRAPHIC FINDINGS

The National Cardiovascular Data Registry (NCDR)

	STEMI		NSTEMI			
	UPLMCA (N=434)	PLMCA (N=116)	UPLMCA (N=387)	PLMCA (N=610)	All (N=1547)	p-Value
			PCI status			
		Chara	cteristics pre PCI			
Denovo lesion	97.7%	89.7%	98.5%	85.7%	92.6%	< 0.0001
Bifurcation lesion	39.6%	25%	30.2%	27.5%	31.4%	0.0001
Lesion length (mm)	14.4±8.0	13.5±7.0	12.6±8.3	13.6±9.0	13.6±8.5	< 0.0001
Lesion stenosis (%)	93.3±14.9	91.8±11.4	84.1±17.9	87.2±13.2	88.5±15.3	<0.0001
TIMI flow						
0	53%	32.8%	13.4%	10.2%	24.7%	<0.0001
1	19.1%	9.5%	11.1%	11.6%	13.5%	
2	12.4%	23.3%	18.6%	23.8%	19.3%	
3	14.5%	33.6%	56.3%	53.6%	41.8%	



CLINICAL PRESENTATION OF LEFT MAIN ACS

	Year	N	Presentation	Shock	In-hospital Death
DeLuca [5]	2003	24	STEMI	75%	58%
Tang [7]	2007	11	AMI	82%	82%
Yip [8]	2001	18		78%	33%
Marso [9]	1999	40	STEMI (70%)	92%	55%
Chia [10]	2009	20	STEMI	80%	65%
Hurtado [11]	2009	71	STEMI (59%)	66%	47%
Lee [12]	2008	62	STEMI (37%)	24%	8%
Lee [14]	2004	18	STEMI	78%	44%
Prasad [15]	2009	28	STEMI	62%	36%
Ramos [16]	2008	9	STEMI	78%	55%
Sakai [17]	2004	38	AMI	74%	55%
Tan [18]	2008	16	STEMI	69%	46%
Perdazzini [20]	2011	348	STEMI	12%	11%*
Valeur [21]	2005	12	STEMI	83%	58%
Yamane [22]	2005	25	STEMI (64%)	100%*	32% (30 day)
Jensen [23]	2010	71	STEMI	41%	31% (30 day)
Wang [28]	2006	11	STEMI	55%	46%
Christiansen [29]	2006	27	STEMI	?	37% (30 day)
Pappalardo [30]	2011	48	STEMI (45%)	45%	21%†

