

MINISTRY OF EDUCATION AND TRAINING

MINISTRY OF HEALTH

HANOI MEDICAL UNIVERSITY



HOANG VAN

**RESEARCH ON THE RESULTS AND INFLUENTIAL
FACTORS OF STENT IMPLANTATION METHOD IN
THE TREATMENT OF LEFT MAIN CORONARY
ARTERY LESION**

Major : INTERNAL CARDIOLOGY

Code : 62 72 01 41

SUMMARY OF MEDICAL DOCTOR DISSERTATION

HANOI – 2016

The work is finished at:

HANOI MEDICAL UNIVERSITY

Supervisor:

Associate Professor, Doctor NGUYEN QUANG TUAN

Defender 1:

Defender 2:

Defender 3:

The dissertation shall be defended at Dissertation Assessment
Board at Hanoi Medical University

At.....hour.....date.....month.....year

The dissertation can be referenced at:

- National Library
- HMU library
- Central Medical Information library

INTRODUCTION TO THE DISSERTATION

1. Introductory statements

Left main coronary artery (LMCA) lesion is identified when the vascular diameter of the LMCA on angiogram is more than 50% narrowed. 4-8% patients with coronary artery diseases has LMCA stenosis more than 50%. Many research shows that patients with LMCA lesion could have bad outcome because they suffer higher mortality risks than those with lesion in other branches of coronary artery. The objective in treating patients with LMCA lesion as well as lesion in other coronary artery branches is to re-establish the normal flow for the narrowed coronary artery. According to the recommendation of American Heart Association, coronary artery bypass surgery is still the most suitable treatment method for patients with LMCA lesion, especially in patients with syntax score > 33. However, in Vietnam, currently (2011), there are still many limitations in the method of coronary artery bypass surgery, leading to many different results in different cardiovascular centers in the country. Meanwhile, implantation stent in coronary artery is becoming more and more developed in terms of techniques and skills, with the support of other devices during stent implantation process such as IVUS, Rotablator... especially the introduction of the new generation anti-restenosis drug eluting stents and new medicines. Therefore, the implantation of stent in the left main coronary artery is becoming more common in the world as well as in Vietnam. In Vietnam, there has not been an adequate research about the results and safety of stent implantation method in treating LMCA lesion. Therefore, we conduct the research “**Research on the results and influential factors of stent implantation method in the treatment of left main coronary artery lesion**” for two objectives:

1. Researching the early results and results after one year of stent implantation method in the treatment of left main coronary artery lesion.

2. Surveying some influential factors on the treatment results in some patients which receive stent implantation in left main coronary artery.

2. Contribution of the dissertation

Unprotected LMCA intervention has rather high success rate; it is also safe and quite effective: success rate in angiogram is 98.8%; success rate of the implantation is 97.6%. The rate of complications which are related to the implantation is low (6%). The survival rate after an average follow-up period of time 30.67 ± 9.15 month is 95% and the rate of patients who continue to live healthily without any cardiovascular events is 81.25%.

The mortality risk from LMCA intervention in patients with acute myocardial infarction, even without heart shocks is 10.5 times higher than that in patients without acute myocardial infarction.

Patients with dominant left coronary artery system, when implanted with stent to treat unprotected LMCA lesion, have a mortality risk which is 8.7 times higher than those with dominant right coronary artery system.

Patients who receive LMCA intervention and have syntax score ≥ 33 will have target artery revascularization 6.6 times higher than those with lower syntax scores.

3. Structure of the dissertation

The dissertation comprises of 137 pages, including the following parts: introductory statements: 3 pages, overview: 25 pages, research object and methods: 25 pages, research results: 36 pages, discussion: 45 pages, conclusion: 2 pages, recommendation: 1 page. The dissertation includes 17 tables, 22 graphs, 23 images, 2 charts and 188 references (both English and Vietnamese).

Chapter 1

OVERVIEW

1.1. Histology anatomy of LMCA

The LMCA has a similar structure as other coronary artery branches, including intima, media and adventice. However, it contains more smooth muscle cells and elastic fibers than other coronary arteries; also, they are orthogonal.

1.2. Anatomy of LMCA

LMCA usually originates from left coronary sinus, running for 1-25 mm then divides into left anterior descending artery – LAD and circumflex. These branches provide 75% of the left heart muscle in case of dominant on the right coronary system and 100% in case of dominant in the left coronary system.

1.3. LMCA diseases due to atherosclerosis

At the branch division of LMCA, the opposite position of circumflex as well as parts near LAD, there is an increasing atherosclerosis. Regarding the flow kinetics in coronary artery, after the flow is divided due to the branch division of coronary artery, there will be an eddy flow at the division position. This is due to a gradual decrease in the pressure of the flow from inside to outside. All studies show that the atherosclerosis is mainly formed and broken where flow pressure is low and where there are eddy flows. The mechanism is unclear, however, many hypothesis suggest that this is because many adhesive factors are collected here, which slow down the flow and increase inflammatory factors, thereby speeding up the formation of atherosclerosis. On the other hand, when atherosclerosis develops, it will decrease vascular diameter and increase the flow pressure on the atherosclerosis, thereby the chance of it breaking is higher.

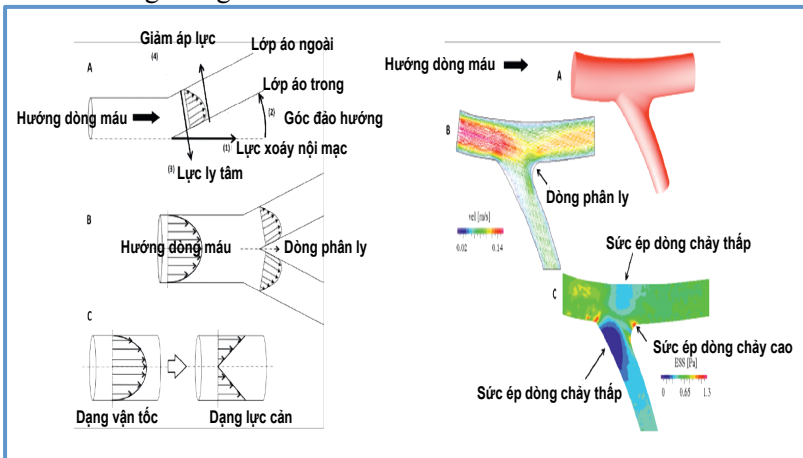


Figure 1.1. The kinematics of flow in coronary artery and the formation and breakage of atherosclerosis where flow pressure is low.

1.4. Diagnosis of LMCA lesion

1.4.1. Clinical: not specific

1.4.2. Non-invasive diagnosis method

1.4.2.1. Electrocardiogram: have suggestive meaning in acute myocardial infarction

a. ST decreases in DII, DIII, aVF and LAFB (left front branching block) with sensitivity 88%.

b. ST increases in aVR and aVL with specific level 98%.

1.4.2.2. Cardiovascular ultrasound through chest wall: low sensitivity 58-67%

1.4.2.3. Angiogram by Computed Tomography: positive diagnosis value can increase up to 83-90% and negative diagnosis value can increase up to 99%.

1.4.2.4. Magnetic resonance imaging: sensitivity level about 97% and specific level 70%. However, it is rarely applied due to long surveying time.

1.4.3. Invasive diagnosis method

1.4.3.1. Percutaneous coronary intervention (PCI): is considered the golden standard to evaluate LMCA lesion. Lesion diagnosis is meaning when the vascular diameter of LMCA when narrow $\geq 50\%$.

1.4.3.2. Invascular ultrasound: diagnose LMCA lesion when the diameter at the narrowest place is < 3 mm or the area of the narrowest vascular is < 6 mm².

1.4.3.3. Measuring reserve of coronary by conductor with pressure wire (FFR): narrowed LMCA is diagnosed when FFR $< 0,8$.

1.5. Treatment of LMCA lesion

1.5.1. Internal treatment

1.5.1.1. Treatment with drugs: losing weight, physical exercises, quitting smoking and etc.

1.5.1.2. Treatment with drugs: antiplatelet, statin, anti angina drug...and other therapies.

1.5.2. Coronary artery bypass surgery

According to recommendations of the American Heart Association (AHA) 2011 and European Society of Cardiology (ESC) 2014, surgery is indicated for patients with LMCA diseases, including:

- Patients with severely calcified LMCA
- Decreased functions of left ventricular

- Patients with diabetes, especially insulin-dependent diabetes
- Patients with complex lesion in many coronary artery branches, and appropriate coronary artery surgery for bypass surgery (and especially if Euro SCORE is low)
- Lesion in the parts away from main coronary artery at the branching position, attached with decreased functions of left ventricular or complete blockage of RCA, or with complex lesions of other coronary artery branches (SYNTAX SCORE is high).

1.5.3. Percutaneous coronary intervention (PCI)

❖ *Priority indication of stent implantation:*

- Patients with low risks, good left ventricular systolic function, no lesion in the parts away from main coronary artery and no calcified main coronary artery, no in the parts near main coronary artery, balanced lesion and very few combined lesions of other branches (light or average degree according to SYNTAX). These patients usually have good results after stent implantation.
- Patients with acute myocardial infarction, blockage in LMCA during intervention, and shocks. In these cases, PCI is the fastest method to revascularize artery; however, clinical results are still limited compared with stable patients.
- *Considering of stent implantation :*

Patients with reserved left ventricular systolic function and no calcified parts away from main coronary artery, at the position dividing LAD and LCx. PCI intervention can be considered in cases:

- Old patients
- Patient with small LCx branch
- Patients who have no other combined lesions (Syntax score is low or average)
- Patients do not have diabetes
- Patients who are not appropriate for surgery:
 - Distal branches not appropriate for bypass surgery
 - High risk of surgery (high Euro SCORE)
 - Have serious combined diseases

1.6. Some intervention results in the treatment of LMCA lesion.

1.6.1. In the world

Initial studies about simple angioplasty balloon for the treatment of LMCA lesion reported by Gruntzig and al in 1979 have very disappointing results due to high rate of acute myocardial infarction and mortality rate.

The introduction of normal stents has changed the role of PCI intervention and increased the rate of applying intervention strategies for this special lesion group. Stent implantation for unprotected main coronary artery lesion has partly overcome the weaknesses of simple angioplasty balloon. Some studies were conducted to evaluate the feasibility, efficiency and safety of normal stent implantation for LMCA parts. Very different results are reported due to the differences in sample size and treated lesions. In general, mortality rate after 30 days ranges between 0% and 14% and mortality rate after 1-2 years ranges from 3% to 31%. Although it has been seen from studies that: normal stent implantation leads to lower post-intervention mortality rate than simple angioplasty balloon, restenosis rate after 1 year is too high, from 15-34%.

The introduction of anti-restenosis drug eluting stents marks a new era in LMCA intervention. Initial observation studies as well as random, multi-centered studies such as LE MANS study, PRCOMBAT trial, SYNTAX trial all show that: stent implantation in LMCA in suitable lesions (Syntax score ≤ 32) has similar short-term and long-term effects with bypass surgery; stroke rate is even lower in intervention group than surgery group.

1.6.2. In Vietnam

Duong Thu Anh conducted initial researches about the early effects of PCI in the treatment of 73 patients with unprotected narrow LMCA. The result shows a high success rate (98.6%), safety and survival rate after 1 year is 89.2%. Post-intervention mortality mainly occurred in patients with reduced ventricular functions less than $< 50\%$. However, this research has not stated the relationship between the complexity of LMCA lesion and treatment results, as well as influential factors on the efficiency of this treatment method.

Chapter 2

RESEARCH OBJECT AND METHOD

2.1. RESEARCH OBJECT

2.1.1. Selection criteria.

Including patients who meet the following requirements:

- LMCA from 50% narrowed on angiogram, may be with or without lesions in other coronary artery branches.
- Having angina and/or symptoms of cardiac ischemia on non-blood examination such as electrocardiogram, stress ultrasound
- Patients and their families accept intervention.
- Patients with syntax score ≥ 33 , but their families refuse surgery, also choose intervention method.

2.1.2. Elimination criteria.

We eliminate the following patients from the study:

- Acute myocardial infarction with cardiac shocks.
- Not to be prescribed with Clopidogrel and Aspirin.
- Having received coronary artery bypass surgery before.
- Having LM intervention, LAD or LCx ostiums.
- Having from two CTO lesions.
- Having cardiac valvular diseases.
- Having cerebrovascular accident (CVA) in the last 3 months.
- Having serious internal diseases such as end-stage cancer, severe hepatic failure, renal failure (creatinin $\geq 2,5$ mg/dl = 221 μ mol/l)...

2.2. RESEARCH METHOD

Non-control interventions, retrospective and prospective study.

2.2.1. Research design

The research is implemented in two phases.

Phase I: Retrospective study on medical records of patients who received LMCA interventions at Vietnam Institute of Cardiology, between January 2012 and December 2010.

Phase II: Prospective study on patients who received LMCA interventions from January 2011 to December 2014.

2.2.2. Choosing research objects

All research objects who satisfied selection criteria and did not meet elimination criteria will all be included in the study in time order, irrespective of age and gender.

2.2.3. Implementation steps

2.2.3.1. For retrospective patients: Examine medical records in reserve room about medical history, clinical condition when admitted

into the hospital. Record signs of angina, sort of breath and main cardiac events, as well as blood test, cardiac ultrasound, electrocardiogram, images of LMCA and LMCA intervention during hospitalization. We recorded drug doses and the amount of drugs used by patients during hospitalization and clinical conditions when discharged from hospital. CD-ROM disc saved LMCA images and intervention of patients were also retrieved by us to evaluate syntax score to evaluate the complex lesion of coronary artery. All these information are recorded by us in medical records.

2.2.3.2. With prospective students:

Clinical examination: Patients were examined carefully about medical history and clinical conditions when admitted into hospital, especially angina, vessel, blood pressure, sort of breath level according to NYHA and acute cardiac failure according to Killip, at the same time making medical records according to separate research sample.

Patients did the tests: Doppler cardiac ultrasound, electrocardiogram, cardiac enzymes, serum biochemistry, electrolyte analyzer, blood lipid.

LMCA imaging and intervention is carried out at imaging room of Vietnam Institute of Cardiology and Hanoi Cardiac Hospital. Parameters such as reference vastracular diamaters and the percentage (%) of narrow diameters before and after intervention was calculated basing on QCA software of angiogram device. In addition, LMCA intervention results are assessed basing on TIMI and TMP scale. Imaging results and coronary artery intervention are recorded on CD-ROM.

All patients in the research were assessed for the level of complex lesion in coronary artery basing on syntax scale.

After intervention, patients were observed in terms of clinical progress such as angina, sort of breath, vessel, blood pressure and main cardiac events (death, acute myocardial infarction, re-emergency intervention, cerebrovascular accident). In addition, patients re-did some tests such as serum biochemistry, cardiac enzyme, electrocardiogram and some other tests when necessary during hospitalization after intervention.

2.2.4. Patient treatment and observation procedures

2.2.4.1. Treatment procedure

Patients were given anti-clotting drugs and antiplatelet drugs according to recommended scheme of Vietnam Institute of Cardiology in 2008 and recommendation of American Heart Association in 2011, including Aspirin 150 – 325 mg, and Clopidogrel 300 – 600 mg. Heparin with low molecule (Enoxaparin) 1 mg/kg was injected under skin every 12 hours if it was acute coronary syndrome; heparin was stopped after successful intervention. In addition, patients were given anti-blood lipid disorder drug, angiotensin-converting, and/or beta blocker if appropriate. Patients were also given other drugs for accompanying diseases such as diabetes and high blood pressure according to current recommendations.

❖ ***Coronary artery imaging and LMCA intervention***

❖ ***After intervention***

Patients continued to use antiplatelet drugs including clopidogrel 150 mg/day x first 7 days after intervention, then 75 mg/day in the next 12 months at the minimum and aspirin 100 mg/day for long period of time. Lower lipidemia drugs, beta blocker, statin, angiotensin-converting were given according to test result and clinical conditions of patients.

2.2.4.2. Observation procedure

a, Observing retrospective patients

After selected, patients in this group were invited to re-examination, clinical examination and do necessary clinical tests such as blood test, cardiac ultrasound. From this, we evaluated cardiac events after intervention (death, myocardial infarction, target coronary artery revascularization and cerebrovascular accident). At the same time, patients were hospitalized or coronary artery imaging if observation time was ≥ 12 months.

We eliminated patients who did not meet criteria for observation.

b, Observing prospective patients

Clinical observation after hospital discharge: evaluating cardiac failure according to NYHA, angina and main cardiac events (death, myocardial infarction, target coronary artery revascularization and cerebrovascular accident) after intervention by examination or interview by phone.

Clinical observation after hospital discharge: perform basic serum biochemistry and necessary tests at 1, 6 and 12 months; Doppler cardiac ultrasound was also implemented at 6 – 12 months after intervention.

Coronary artery imaging for all research objects at 12 months after intervention or at any time if there were typical signs of angina; however, this was not carried out for patients with high risk with imaging and those without angina symptoms.

Chapter 3 RESEARCH RESULTS

Our study included 84 patients (23 retrospective patients and 61 prospective patients) who were suitable with diagnosis criteria and no elimination criteria and implanted stent in LMCA at Vietnam Institute of Cardiology and Hanoi Cardiac Hospital between January 2010 and December 2014.

3.1. SOME GENERAL CHARACTERISTICS OF PATIENTS

3.1.1.Characteristics of age and gender

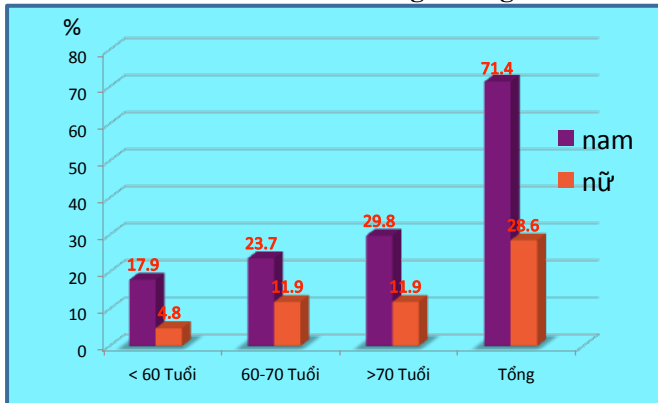


Diagram 3.1. Distribution according to age and gender

3.1.2. Distribution of coronary artery of research objects

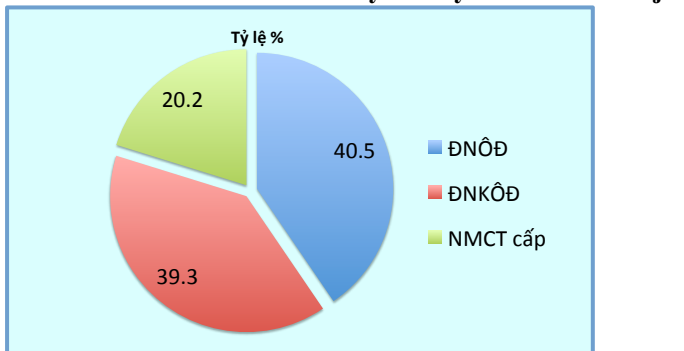


Diagram 3.2. Distribution of coronary artery diseases of research objects

3.1.3. Characteristics of cardiac failure according to NYHA

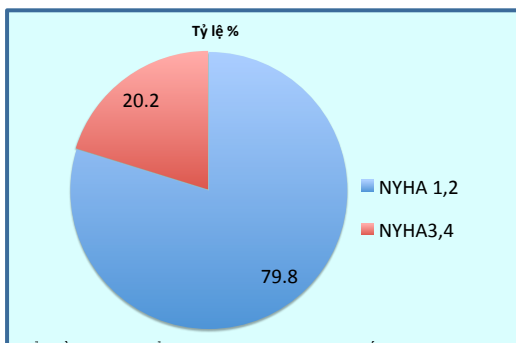


Diagram 3.3. Cardiac failure characteristics according to NYHA of research objects

3.1.4. Clinical and paraclinical of research objects

Table 3.1. Some clinical and paraclinical features of research objects

Features	Number of patients	%
Medical history		
Typical angina	41	48,8
Untypical angina	39	46,4
No angina	4	4,8
Myocardial infarction	3	3,6
Cerebrovascular accident	5	6,0
Coronary artery intervention	9	9,6
Blood lipid disorder	57	67,8
Diabetes	22	26,8
Smoking	32	38,1
High blood pressure	65	77,4
Clinical symptoms		
Heart rate ≥ 100	8	9,5
Killip 3,4	0	0
Paraclinical symptoms		
Heart rate disorder	4	4,9
White blood > 11 (G/L)	16	19
Paraclinical symptoms	Average \pm standard deviation	

Creatinin before intervention (mcmol/l)	89,6 ± 21,4
Creatinin after intervention (umol/l)	90,53 ± 18,9
Cholesterol (mmol/l)	5,1 ± 1,21
Triglycerid (mmol/l)	2,2 ± 1,06
HDL-C (mmol/l)	1,0 ± 0,32
LDL-C (mmol/l)	3,1 ± 1,03
EF (%)	58,5 ± 14,8
White blood	8,9 ± 2,6
BMI	22,84 ± 2,1

Table 3.2. Some clinical and para-clinical symptoms of acute myocardial infarction group and no myocardial infarction group

Features	Myocardial infarction group (n= 17)		No myocardial infarction group (n= 67)		P
	n	%	n	%	
Age	65,18 ± 12,9		67,79 ± 9,4		0,34
Systolic blood pressure	120,94 ± 17,34		142,04 ± 17,75		0,001
Diastolic blood pressure	83,36 ± 8,85		77,65 ± 10,32		0,048
NYHA	2,12 ± 0,93		1,43 ± 0,76		0,01
Cardiac frequency	92,8 ± 16,6		81,96 ± 8,7		0,018
EF (%)	46,06 ± 10,9		61,72 ± 14,02		0,001
White blood	10,05 ± 4,21		8,66 ± 2,11		0,06
Creatinin blood	83,2 ± 25,02		90,5 ± 20,39		0,21
	n	%	n	%	
History of typical angina	5	29,4	36	53,7	0,129
Smoking	7	41,17	25	37,3	0,77
High blood pressure	10	58,8	55	82,08	0,042
Electrocardiogram	3	17,6	19	28,36	0,37
Blood lipid disorder	10	58,8	48	71,6	0,46
History of cerebrovascular accident	1	5,8	4	5,9	0,98
History of myocardial infarction	0	0	3	4,5	0,87

3.2. LMCA IMAGING AND INTERVENTION RESULTS

3.2.1. Images of coronary artery

3.2.1.1. Lesion at branch division according to the classification of Medina

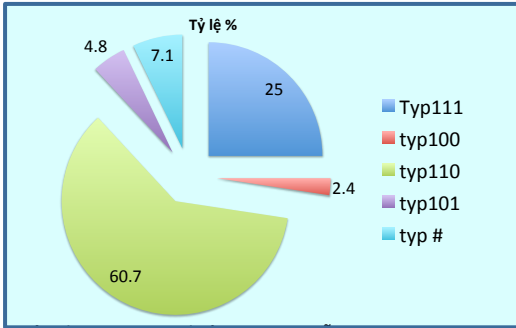


Diagram 3.4. Distribution of lesion at branch division according to Medina

3.2.1.2. Combined lesion in coronary artery lesions

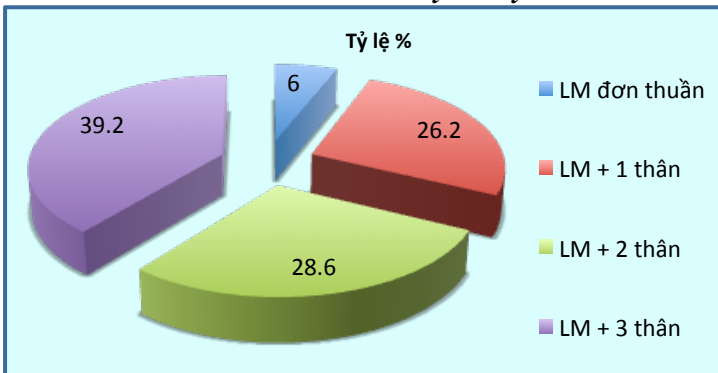


Diagram 3.5. LM lesion combined with other coronary artery branches

3.2.1.3. Lesion in coronary artery system according to syntax score

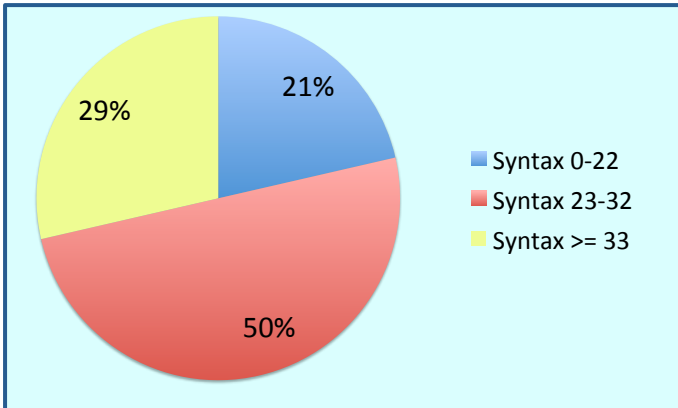


Diagram 3.6. Lesion in coronary artery system according to syntax score

3.2.1.4. Distribution of coronary artery system of research group

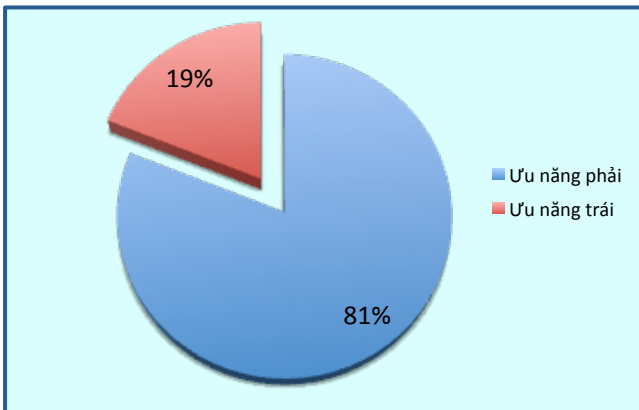


Diagram 3.7. Distribution of dominant of coronary artery system of research group

3.2.2. Intervention result of LMCA

3.2.2.1. Stent implantation techniques used in the study

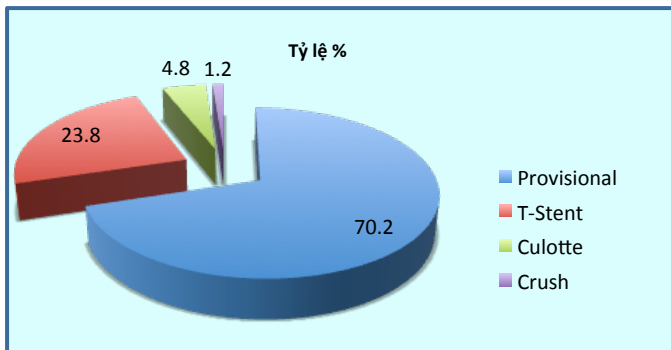


Diagram 3.8. Stent implantation techniques used in the research

3.2.2.2. Number of coronary artery branches intervened

Table 3.3. Number of coronary artery branches intervened

Lesion location	Number of patients	Percentage %
Only main coronary artery intervention	4	4,8
Intervention in main coronary artery + circumflex	5	6
Intervention in main coronary artery + LAD	50	59,4
Intervention in main coronary artery + right coronary artery	0	0
Intervention in main coronary artery + LAD and circumflex	25	29,8
Total	84	100

3.2.2.3. Economic parameters of main coronary artery intervention in research group

Table 3.4. Technical intervention parameters in LMCA

Technical parameters	Average ± deviation
Average diameter of reference coronary artery (mm)	3,31± 0,27
Average length of lesion (mm)	22,17± 6,51
Average diameter of stent (mm)	3,29± 0,26
Average length of stent (mm)	27,17 ± 7,5
Max average pressure balloon when implantation stent (atm)	17,68 ± 3,01
Average diameter of post dilated balloon (mm)	3,47 ± 0,34

Average length of post dilated balloon (mm)	15,37 ± 2,4
Average pressure of dilated balloon (atm)	22,9 ± 3,1
Number of average stents (piece)	1,42 ± 0,6

3.2.2.4. Success of procedures

Successful of procedures are when residual vascular diameter is < 20% narrowed, no coronary artery dissection, normal flow in culprit artery (TIMI-3).

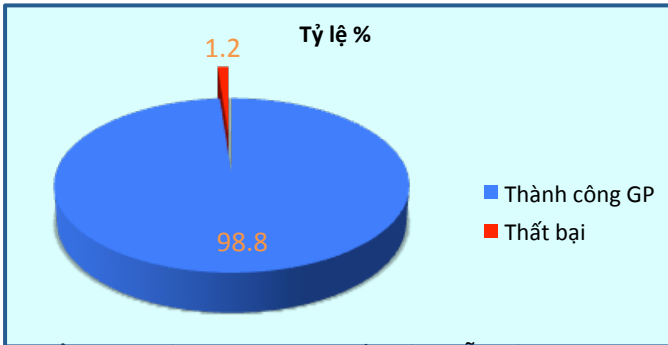


Diagram 3.9. Success rate of implantation in research group

3.2.2.5. Success of imlantation

Success of implantation: successful implantation and no severe complications during hospitalization (death, cerebrovascular accident, myocardial infarction, and emergency bypass surgery).

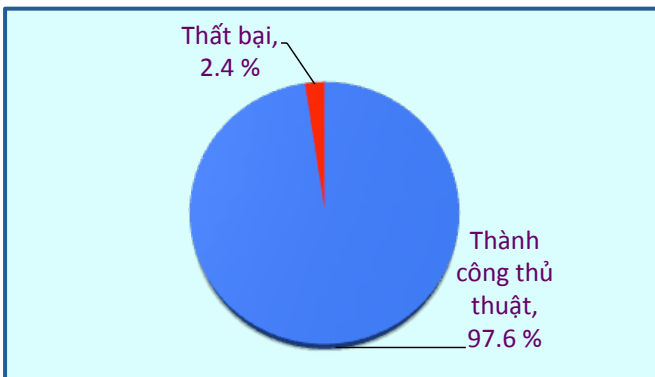


Diagram 3.10. Implantation success rate in research group

3.2.2.6. Complications during and after interventions

Table 3.5. Complications during and after interventions

Complication	Number of patients	Rate %
Acute renal failure	1	1,2
Cerebrovascular accident	1	1,2
Blood clotting in implantation position	2	2,4
Mortality	1	1,2
Total	5	6

3.3. LONGITUDINAL OBSERVATION RESULTS

Among the 84 research patients, except for 1 death during intervention, 2 deaths at 2 – 3 months after intervention and 3 cases of lost contact during observation period because of objective reasons, we observed a total of 78 patients from hospital discharge until the last contact, average observation period is $30,67 \pm 9,15$ months (from 13 – 36 months).

3.3.1. Improvement sort of breath with time (according to NYHA)**Table 3.6. Improvement in sort of breath symptoms after observation period**

NYHA	At hospital discharge	After 12 months	P
Average NYHA	$1,3 \pm 0,51$	$1,03 \pm 0,16$	0,003
NYHA 1 – 2	81 (97,6%)	78(100%)	0,38
NYHA 3 – 4	2 (2,4%)	0 (0%)	0,08

3.3.2. Improvement of left ventricular function on cardiac ultrasound**Table 3.7. Improvement of left ventricular function on cardiac ultrasound by group**

Research group	Everage EF on admission n= 84	Everage EF after 12 months n= 78	P
General group (n=78)	$59,43 \pm 14,52$	$62,25 \pm 11,09$	0,004
Non – ACS (n=64)	$62,21 \pm 13,56$	$64,12 \pm 10,06$	0,085
ACS (n=14)	$46,35 \pm 11,78$	$53,43 \pm 11,86$	0,0001

3.3.3. Coronary artery imaging results after 12-month intervention

In the group of patients that we took coronary artery images, we found 62 cases, 77,5% of the observed patients; results in table 3.8.

Table 3.8. Coronary artery imaging after 12-month intervention

Features	Coronary artery imaging after 12-month intervention	Percentage %
Stent restenosis	2	3,2
Progressive narrow target artery	5	8,06
Good vascularized stent in main artery	60	96,8

3.3.4. Main events during observation period

During average observation period $30,67 \pm 9,15$ months, we observed 80 patients with event rates as in diagram 3.11.

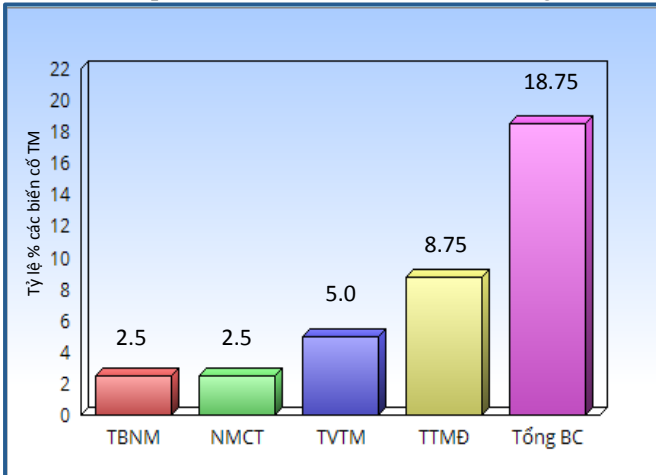


Diagram 3.11. Main cardiac events during observation period

TBMN: cerebrovascular accident; NMCT: myocardial infarction; TVTM: cardiac mortality; TTMD: target artery revascularization.

3.4. SOME INFLUENTIAL FACTORS ON TREATMENT RESULTS

3.4.1. Some influential factors on mortality rate

Table 3.8. analysis of some influential factors on mortality rate

Features	Mortality group (n=6)	Survival group (n=75)	Odds Ratio (95% CI)	p
Cardiac frequency ≥ 100	1 (16,7%)	6 (8,0%)	2,3 (0,23-23,02)	0,42
ACS	4 (66,7%)	12 (16%)	10,5 (1,7-63,9)	0,0013

EF < 40%	3 (50%)	18 (24%)	2,85 (0,63-13,1)	0,18
Main artery + ≥ 2 branch lesions	5 (83,3%)	50 (66,7%)	2,5 (0,27-22,5)	0,658
Dominant LMCA	4 (66,7%)	14 (18,7%)	8,7 (1,49-52,4)	0,005
Medina 1-1-1	1 (16,7%)	20 (26,7%)	0,51 (0,07-4,6)	0,5
2 stent intervention	1 (16,7%)	24 (32,0%)	0,42 (0,04-3,8)	0,66

3.4.2. Some influential factors on target artery revascularization

Table 3.9. Analysis some influential factors on target artery revascularization

Features	TVR group (n=7)	Unalive group (n=73)	Odds Ratio (95% CI)	P
Diabetes	4 (57,1%)	32 (43,8%)	1,58 (0,33-7,6)	0,42
Smoking addicted	2 (28,6%)	26 (35,6%)	0,7 (0,15-3,37)	0,49
Previous stent coronary artery	2 (28,6%)	7 (9,5%)	3,1 (0,68-13,3)	0,18
Main artery + ≥ 2 branch lesions	5 (71,4%)	46 (63,0%)	1,5 (0,23-7,23)	0,56
Syntax score ≥ 33	5 (71,4%)	0 (27,4%)	6,6 (1,2-36,9)	0,016
LM 2 stent intervention	3 (42,9%)	20 (27,4%)	1,87 (0,3-9,14)	0,34

Chapter 4 DISUSSION

4.1. Early results of LMCA stent implantation

4.1.1. Imaging results of coronary artery

Imaging results of coronary artery of the research group shows that: 94% of patients suffered from main artery lesion and lesion in at least 1 more branch, only 6% had mere main coronary artery lesion. This result reflected the diversity and complexity of lesion.

When calculating syntax score, there was up to 29% with syntax score > 33 and 50% with syntax score 23-32. According to medical literature, for patients with syntax score ≥ 33 surgery would benefit them more; however, in our research, we implemented interventions because these patients had high risks from surgery; also, patients refused surgery and preferred intervention.

4.1.2. Success rate of the implantation

The operation was considered successful when residual vascular diameter was $< 20\%$ narrow, no coronary artery dissection, normal flow in culprit artery (TIMI-3).

The 84 patients in the research were implanted stents by various techniques (provisional-stent, T-stent, Culotte and Crush). The choice of 1 stent or 2 stent implantation depends on the Medina type of main artery lesion, the dominant function of coronary artery system and the angle formed between LAD and Circumflex. The technical parameters presented in table 3.4 shows adequate conditioning for stent to approach artery wall and cover all lesion. However, in one case, immediately after implanted stent without flow, there was an ineffective ventricular fibrillation leading to mortality. The other 83 patients after intervention had flow TIMI 3, residual narrow $< 10\%$ because there are no coronary artery dissection in coronary artery after intervention. Therefore, success rate of implantation in our research was 98.8% (diagram 3.9). Success implantation rate in our search was similar to the result of Duong Thu Anh, which was 98.6%; of SJ Park - 100%; and Lee - 98%.

4.1.3. Success rate of the procedure

Success rate of the procedure include successful intervention and no severe complications (mortality, cerebrovascular accident, myocardial infarction, and emergency bypass surgery during hospitalization)

In other research about unprotected LMCA interventions, the rate of mortality at hospital was affected by the choices of interevented patients. Mortality rate was 0- 4% in patients with main coronary artery lesion and increased to 13,7% with emergency intervention. Our research results show that 01 patient died immediately after stent implantation. This patient was admitted late in hospital after myocardial infarction before the third day; having

suffered from cardiac failure when arriving at hospital, heart rate 120 bpm, BP 120/70 mmHg, lung bronchiques on both sides, liver enlargement 3 cm below rib border. Angiogram shows main coronary artery was 70% narrow, 90% narrow LAD ostium and 99% narrow right coronary artery segment 2. Coronary artery system is more dominant on the left. Therefore, when this patient was admitted into the hospital, the patient already suffered from biventricular heart failure; this is an independent mortality predictor in patients with myocardial infarction. In addition, the imaging result of coronary artery shows that: main artery lesion and narrow right coronary artery; therefore after stent implantation, there are no flows. Right and left cardiac muscles lack blood supply, leading to a stop and ineffective emergency and mortality. Therefore, general mortality rate in our research was 1.2%.

Cerebrovascular accident was an uncommon complication after coronary artery intervention; however, it usually leaves serious complications, including death. According to Werner, the rate of cerebrovascular accident after intervention was 0,18-0,44%, in which risk factors include high age, history of cerebrovascular accident, high blood pressure, diabetes, carotid artery stenosis, heart failure, renal failure. In our research, 01 patient suffered from brain haemorrhage the second day after intervention. This patient is old (70 years old), history of high blood pressure, 2 previous cerebrovascular accidents and low left ventricular functions EF = 21%. Therefore, in this case, there are too many risk factors leading to cerebrovascular accident.

In general, procedure success in our research was 82/84 patients, equivalent to 97.6% (diagram 3.10). Our result was similar to that of Duong Thu Anh, with a success rate of 98.6%; Han with a success rate of 99.3%; and JS Park with a success rate of 99.2%.

4.1.4. Complication results related to the intervention

Table 3.5. showed complications related to intervention; in our research there were 05 cases, accounting for 6% of the total number of interventions. There are various symptoms such as blood clotting in implantation ostium, acute renal failure, mortality, cerebrovascular accident. The 02 mortality and cerebrovasuclar cases were mentioned previously. The two cases of blood clotting in implantation ostium were females; intervention was made through

thigh artery – these are two risk factors leading to blood clotting. In general, the rate of complications related to the intervention was low, mainly not serious complications which can be cured.

4.2. After 1 year result of stent implantation method in LMCA

Among 84 researched patients, except for 1 patient who died during intervention and 03 patients unable to contact during observation, we observed 80 patients (95,2%) from hospital discharge to last contact, with average observation period $30,67 \pm 9,15$ months (from 13-36 months).

4.2.1. Improving sort of breath symptom according to NYHA

The average NYHA level in our research (table 3.6) was improved obviously after 1 year intervention; from $1,3 \pm 0,51$ at hospital discharge to $1,03 \pm 0,6$ after 1 year observation with $P < 0,003$. This shows that the opening of main narrow artery has bettered heart functions, thereby improving clinical symptoms.

4.2.2. Improving left ventricular functions on cardiac ultrasound.

Table 3.7, when surveying parameters about left ventricular functions of research objects, we realize the average left ventricular functions after 01 year improved clearly compared with hospitalization period [$62,25 \pm 11,09$ compared with $59,43 \pm 14,52$; $p= 0,004$]; especially in acute acute myocardial infarction, ventricular functions also improved remarkably after 1 year intervention [$46,35 \pm 11,78$ at hospital admission compared with $53,43 \pm 11,86$ after 1 year intervention, $p= 0,0001$]; on the contrary, in the group without myocardial infarction, there were no changes of statistic significance in ventricular functions at hospital admission compared with after 12 month of intervention [$62,21 \pm 13,56$ compared with $64,12 \pm 10,06$; $p= 0,085$]. In short, from these results, we see that: coronary interventions in general and LMCA interventions in particular can improve greatly ventricular functions in patients with decreased ventricular functions.

4.2.3. Total of main cardiac events

Main cardiac events in our research include myocardial infarction, cerebrovascular accident, target artery revascularization and cardiac mortality.

Many studies have evaluated the efficiency of LMCA intervention compared with bypass surgery. Most results show that: there are no differences in mortality rate, cerebrovascular accident,

myocardial infarction between intervention and surgery in the treatment of narrow LMCA, however, the rate of target artery revascularization is obviously higher in intervention group than surgery group; and this is even clearer when complex lesion combine many coronary arteries.

In our research, total cardiac events happen in 15 patients, accounting for 18.75% (diagram 3.11), including cerebrovascular in 2 patients: 2,5%; myocardial infarction in 2 patients; 2,5%; target artery revascularization in 7 patients: 8,75% (in which 2 patients have stent restenosis) and cardiac mortality in 4 patients, 5%. The research result is also suitable with some other researches in the world.

Table 4.1. Comparing our research results with some other authors

Name of research	n	Observation time (month)	MACCE (%)
Our research	84	30	18,75
Boudriot	201	12	19
LE MANS	105	12	30,75
PRECوبات	600	12	8,7
SYNTAX	705	60	36,9

There are different research results about rate of cardiac events due to different research objects and observation time.

4.3. Comments on some influential factors on treatment result

4.3.1. Some influential factors on mortality prediction

4.3.1.1. Main artery intervention in patients with acute myocardial infarction

In our research, LMCA intervention in patients with acute myocardial infarction without cardiac shocks lead to a mortality rate which is 10.5 times higher than the group without acute myocardial infarction (OR = 10,5; 95% CI from 1,7 to 63,9; p = 0,001). Therefore, acute myocardial infarction even without cardiac shocks is still an independent predictor of mortality in LMCA interventions (table 3.8). GRACE research analyzed 1799 patients with acute myocardial infarction due to LMCA, results show that both surgery and intervention lead to high mortality rate, especially the group with acute myocardial infarction with ST elevation.

4.3.1.2. Dominant left coronary artery system

With normal anatomy, LMCA with the two branches LAD and Circumflex which supply blood for almost the entire left ventricular muscles account for 75% in right dominant and 100% in left dominant. Therefore, when there is LMCA lesion in patients with left dominant, the cardiac ischemia is very widespread, leaving serious consequences in terms of blood pressure, especially when myocardial infarction leads to a complete blockage of this branch, normally leading to cardiac shocks, complex rate disorder and mortality. Therefore, dominant left artery is usually considered a predictor in patients with LMCA lesion. In our research, mortality rate increased 8.7 times in patient groups with dominant left coronary artery system when comparing with other patients ($p=0,005$) (table 3.8). Therefore, dominant left coronary artery system is an independent predictor in terms of mortality rate when intervening LMCA.

4.3.2. Some influential factors on target artery revascularization

4.3.2.1. Syntax score

Nowadays, the usage of syntax scale to evaluate the lesion complexity of coronary artery system has become rather common in coronary artery system intervention in general and LMCA intervention in particular. Syntax trials show that in patients with syntax score (0-32) there are no differences in cardiac mortality rate, myocardial infarction, cerebrovascular accidents and target artery vascularization compared with bypass surgery. On the contrary, with high syntax score (≥ 33 point), intervention group with a higher target artery revascularization higher than bypass surgery (34,1% compared with 11,6%, $p=0,001$), meanwhile there are no differences in mortality rate, myocardial infarction and cerebrovascular accident between intervention group and surgery group. Our research shows that patients with LMCA interventions with syntax score ≥ 33 have 6.6 time higher risk in target artery revascularization than patients with lower syntax scores with $p = 0,016$ (table 3.9). Therefore, syntax score ≥ 33 is an independent predictor about the target artery vascularization capacity in patients with LMCA intervention.

CONCLUSION

1. Stent implantation in the treatment of unprotected LMCA lesion is a method with high success rate, rather safe and effective.

- High success rate of intervention: Success rate of angiogram was 98,8%, success rate of procedure was 97,6%. Low rate of complications related to the procedure (6%).
- General rate after average observation time $30,67 \pm 9,15$ months was 95% and survival rate without cardiac events was 81,25%.
- Restenosis rate in stent after observation was low (3,2%).
- Most patients have improvements in cardiac failure symptoms according to NYHA (average NYHA at hospital discharge was $1,3 \pm 0,51$ and after observation was $1,03 \pm 0,16$ with $P < 0,05$).
- Left ventricular functions on ultrasound also improve after observation time (average EF at hospital discharge was $59,43 \pm 14,52\%$ and after observation period was $62,25 \pm 11,09$ with $p = 0,004$); especially in group with acute myocardial infarction (EF at hospital discharge was $46,35 \pm 11,78$ and after observation period was $53,43 \pm 11,86$ with $p = 0,0001$).
- Total main cardiac events during observation time were 18,75%, including cardiac mortality 5%, acute myocardial infarction 2,5%, cerebrovascular accident 2,5% and target artery revascularization 8,75%.

2. Some influential factors on treatment results

- LMCA interventions in patients with acute myocardial infarction even without cardiac shocks, still lead to 10.5 time higher mortality rate than group without acute myocardial infarction (OR = 10,5; 95%CI from 1,7 to 63,9; $p = 0,001$).
- Patients with dominant left coronary artery system, when implanted stents to treat unprotected LMCA lesions, have 8.7 time higher mortality rate than patients with right dominant coronary artery system (OR = 8,7 with 95% CI from 1,45 to 52.4; $p = 0,005$).
- Patients with LMCA interventions have syntax score ≥ 33 have a 6.6 time higher target artery revascularization risk than

patients with lower syntax score (OR = 6,6 with 95% CI from 1,2 to 36,9; $p = 0,016$).

- We see no relationship between left ventricular functions $EF < 40\%$; syntax score ≥ 33 ; main artery lesion combining with many coronary arteries, general interventions with 2 stents and myocardial infarction at hospital admission and total main cardiac events during observation period.

RECOMMENDATIONS

Stent implantation in the treatment of unprotected LMCA lesion is a safe and effective cardiac intervention, especially in cases with syntax score < 33 . Therefore, after considering the advantages and disadvantages in each patient, we can consider stent implantation for patients with suitable type of LMCA lesions. This could be implemented by experienced doctor in intervention, in big cardiac centers which have the capacity to implement emergency bypass surgery in case of intervention failure.

PUBLISHED WORKS RELATED TO THE DISSERATION

- 1. Hoang Van,** Nguyen Quang Tuan, Nguyen Quoc Thai et al “Left main coronary artery intervention under the guidance of intravascular ultrasound”. *Journal of medicinal practice, issue 12 (855)/2012, pp. 32-34.*
- 2. Hoang Van,** Nguyen Quang Tuan et al “Evaluating the safety and efficiency of stent implantation in the treatment of unprotected left main coronary artery lesion”. *Journal of medicinal practice, issue 3 (953)/2015, pp 64-66.*