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Original research

# CLINICAL CHARACTERISTICS AND IN - HOSPITAL OUTCOME OF ACUTE CORONARY SYNDROME IN PATIENTS WITH THREE - VESSEL AND/ OR LEFT MAIN CORONARY ARTERY DISEASE AFTER PERCUTANEOUS CORONARY INTERVENTION

Pham Duc Dat[1], Tran Nguyen Thu Thuy[1], Tong Ho Trong Binh[1], Ho Anh Binh[2], Tran Quoc Bao[2]
[1]Department of Interventional Cardiology, 115 People's Hospital
[2]Cardiovascular center, Hue Central Hospital

**ABSTRACT**

***ABackground:*** *Many studies in Vietnam have shown that there is an increasing number of patients hospitalized due to acute coronary syndrome (ACS) with multivessel stenosis and/or with left main stenosis [1]. The SYNTAX score based on the results of percutaneous coronary angiography is valuable for risk stratification of patients requiring coronary revascularization, especially for those with multivessel coronary artery disease, then optimizing the clinicians' decision on percutaneous coronary intervention or bypass surgery for these patients. This study aims to: (1) investigate some clinical characteristics of ACS patients with multivessel and/or left main coronary artery disease (LMCAD); (2) characterize coronary artery lesions according to SYNTAX score by the results of percutaneous coronary angiography; and (3) evaluate intervention outcomes and in - hospital outcomes of these patients treated by percutaneous coronary intervention.*

***Methods:*** *121 patients with three - vessel and/or LMCAD treated at 115 People's Hospital in Ho Chi Minh city, from July 2019 to July 2020. Research design: retrospective; collecting clinical characteristics, and coronary intervention results during the in - hospital stay.*

***Results:*** *Mean age 66.03 ± 11.84, male/female ratio 3/1; average total coronary lesions 3.1 ± 1.2 lesions in left anterior descending (LAD) and right coronary artery (RCA), mean SYNTAX score 27.7 ± 6.21; Short - term intervention outcomes: anatomical success 99.2%, procedural success 98.34%, major in - hospital main cardiovascular events including fatal death and other - causes mortality during hospitalization was 2.4%, the cumulative intra - and post - procedure complications was 8.2%.*

***Key words:*** *Acute coronary syndrome (ACS), multivessel disease, percutaneous coronary intervention (PCI)*

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**Corresponding author:**
Ho Anh Binh
Email:
drhoanhbinh@gmail.com
Phone: 0913489896

## I. INTRODUCTION

Many studies in Vietnam have shown that there is an increasing number of ACS prevalence with multivessel stenosis and/or with left main stenosis [1]. Management of the disease is the greatest challenge due to difficulties in treatment and unfavorable outcomes. In the past, coronary artery bypass grafting used to be the standard care for these patients. Percutaneous coronary intervention (PCI) was introduced in 1977. Experience with this approach, coupled with improved technology, has made it possible to treat increasingly complex lesions.

The SYNTAX score based on the results of percutaneous coronary angiography has been proven

to have a value in risk stratification of patients with severe coronary artery disease [2]. Many studies have shown that this score helps to stratify both short - term and long - term prognostic risks in patients with multivessel coronary artery disease and define the populations of patients for whom only one revascularization method will be effective.

Therefore, we conducted the study to: (1) investigate some clinical characteristics of ACS patients with multivessel and/or left main coronary artery disease (LMCAD); (2) characterize coronary artery lesions according to SYNTAX score by the results of percutaneous coronary angiography; and (3) evaluate intervention outcomes and in - hospital outcomes of these patients treated by percutaneous coronary intervention.

## II. MATERIALS AND METHODS

A retrospective study was conducted on ACS patients with three - vessel and/or left main coronary artery disease in 115 People's Hospital, from July 2019 to July 2020.

Criteria for registry enrolment: ≥ 18 years old, diagnosed with three - vessel and/or LMCAD on invasive coronary angiography, selective treated with PCI. Exclusion criteria: severe left main coronary artery stenosis, severe coronary artery calcification with a history of previous bypass surgery; refusing coronary intervention.

Single - vessel CAD was referred to the presence of a ≥ 50% stenosis of one of the three main coronary arteries: right coronary artery (RCA), left circumflex artery (LCX), and left anterior descending (LAD) ≥ 50% stenosis of Left main coronary artery (LM) was seen as two - vessel CAD (equivalent to ≥ 50% stenosis of both LAD and LCX).

The SYNTAX II scale was calculated by using The SYNTAX Score software. Patients are divided into three groups based on SYNTAX scores: low (≤ 22); intermediate (23 to 32); high (≥ 33).

Criteria for successful intervention includes:

* Assessment of coronary artery flow according to the TIMI scale [3]

• Anatomical success [4]: is considered when residual lumen diameter is < 20%, no arterial wall dissection, normal flow in the culprit artery (TIMI -3).

• Procedural success [5]: includes surgical success and no major complications (death, myocardial infarction (MI), and emergency coronary bypass) during the hospital stay.

Major events include all - cause mortality, stroke, MI, or the need for repeating coronary revascularization during the hospital stay [6].

* Acute renal failure after intervention: [7]

Data analysis using SPSS 22 software. Data are presented by using percentages for qualitative variables and in form of mean ± standard deviation for continuous variables. Using the two - proportional comparison test by T-Test and Mann Whitney, $p < 0.05$ is considered to be statistically significant.

## III. RESULTS

In this study, a total of 121 patients who met the inclusion criteria during the study period were surveyed.

**Table 1:** Some clinical characteristics of the study population

| Characteristics | Value | Ratio % (N = 121) |
|---|---|---|
| The average age | 66.03 ± 11.84 | |
| Over 65 years old | 63 | 51.7 |
| Male | 94 | 77.9 |
| **Prehistoric** | | |
| Current smoker | 44 | 36.1 |
| Hypertension | 97 | 79.5 |
| Diabetes | 41 | 39.3 |
| Dyslipidemia | 62 | 68.9 |

| Characteristics | Value | Ratio % (N = 121) |
|---|---|---|
| Prior MI or CAD | 15 | 12.3 |
| Prior stroke | 8 | 6.6 |
| Chronic kidney disease | 25 | 20.5 |
| **Clinical** | | |
| ST - elevation MI | 59 | |
| Non - ST - elevation MI | 40 | |
| Unstable angina | 22 | |
| NYHA class 3 - 4 | 11 | 9 |
| Arrhythmia | 4 | 3.3 |
| WBC > 11 (G/L) | 12 | 9.9 |
| EF < 40% | 20 | 16.5 |

**Table 2:** Some clinical characteristics of the study population

| Characteristics | Mean ± Standard Deviation |
|---|---|
| Heart rate | 76.2 ± 14.4 |
| Systolic blood pressure (mmHg) | 110.41 ± 17.6 |
| Diastolic blood pressure (mmHg) | 67.38 ± 9.34 |
| BMI | 23.38 ± 2.65 |
| Glucose (mmol/L) | 7.41 ± 4.51 |
| Creatinine (µmol/L) | 93.05 ± 24.72 |
| Total cholesterol (mmol/L) | 5.08 ± 1.33 |
| LDL - Cholesterol(mmol/L) | 3.43 ± 1.47 |
| Triglycerides (mmol/L) | 1.97 ± 1.06 |
| EF (%) | 56.43 ± 10.51 |

More than half the patients had elevated blood glucose levels > 200 mg/dl (57.8%), of whom about 50% had no previous history of diabetes. Moreover, nearly half of the patients met the criteria for metabolic syndrome.

**Table 3:** Coronary artery disease and SYNTAX score

| SYNTAX | Coronary artery disease | | | | | Total (%) | p |
|---|---|---|---|---|---|---|---|
| | 3VD | LM+3VD | LM+2VD | LM+1VD | LM | | |
| 22 | 16 | 7 | 4 | 2 | 0 | 29 (23.9%) | 0.02 |
| 23 - 32 | 62 | 11 | 7 | 2 | 1 | 82 (67.8%) | |
| 33 | 5 | 2 | 1 | 2 | 0 | 10 (8.3%) | |
| Total (%) | 83 (68%) | 20 (16.3%) | 1 (9.8%) | 6 (4.9%) | 1 (0.8%) | 121 | |

The average SYNTAX score in our study was 27.04 ± 5.78. The majority of patients in the study had severe coronary artery disease with the SYNTAX score of 23 - 32, with 82 patients accounting for 67.8%, the remaining 29 patients (23.9%) had mild CAD (SYNTAX score ≤ 22) and 10 patients had severe CAD **(Table 3)**. There was a statistically significant correlation between the degree of coronary injury and the SYNTAX value (p = 0.02).

**Table 4:** General intervention specifications

| Specifications | Mean ± Deviation |
|---|---|
| Mean diameter of the reference coronary artery (mm) | 3.27 ± 0.33 |
| Mean length of the lesion (mm) | 23.42 ± 6.31 |
| Mean diameter of the stent (mm) | 3.31 ± 0.19 |
| Mean length of the stent (mm) | 27.22 ± 6.9 |
| Mean maximum pressure during stent placement (atm) | 16.58 ± 3.01 |
| The average diameter of the Post ball (mm) | 3.47 ± 0.29 |
| The average length of the Post ball (mm) | 17.53 ± 2.3 |
| The average pressure of Post ball (atm) | 22.18 ± 2.9 |
| The average number of stents (pieces) | 3.1 ± 1.2 |

The mean diameter of the stent used in the study group's intervention was similar to that of the reference vessel (3.27 ± 0.33 versus 3.31 ± 0.19). The average length of the stent was longer than the length of the lesion (27.22 ± 6.9 compared with 23.42 ± 6.31)

**Table 5:** Some technical characteristics of the 1- stent LMA intervention group

| Provisional stent technique | Number of patients (n = 9) | |
|---|---|---|
| | N | Ratio % |
| Direct | 1 | 11.1 |
| Balloon dilation before stenting | 8 | 88.9 |
| High - pressure balloon angioplasty after stenting | 7 | 77.8 |
| Simultaneous balloon angioplasty after stenting | 3 | 33.3 |

Among the 9 patients who received intervention by the "provisional stent - planning to insert one stent" technique, only 1 patient received direct stenting, the remaining 8 patients (accounting for 88.9%) used the technique balloon angioplasty before stenting. High - pressure balloon angioplasty after stenting 7 cases (accounting for 77.8%). The kissing balloon technique included 3 cases (accounting for 33.3%).

**Table 6:** Complications during and after intervention

| Complications | Number of patients | Ratio % |
|---|---|---|
| Side branch occlusion | 2 | 1.6 |
| Severe arrhythmia | 2 | 1.6 |
| Hematoma at the puncture site | 2 | 1.6 |
| Acute kidney failure | 1 | 0.8 |

| Complications | Number of patients | Ratio % |
|---|---|---|
| Repeat revascularization | 0 | 0 |
| Stroke** | 1 | 0.8 |
| Death* | 2 | 1.6 |
| Cumulative Total | 10 | 8.2 |

There were a total of 3 deaths during the study period, including 2 deaths due to ventricular fibrillation (accounting for 1.6%) and 1 case of death due to cerebral hemorrhage (accounting for 0.8%).

**Table 7:** Factors associated with severe outcomes in hospital

| Factors | Cumulated severe cardiovascular events in - hospital stay | | |
|---|---|---|---|
| | OR | 95% CI | p |
| Age ≥ 80 | 2.8 | 0.99 - 7.96 | 0.045 |
| Male | 0.6 | 0.23 - 1.53 | 0.24 |
| Heart failure hospitalized | 8.11 | 2.85 - 23.08 | < 0.0001 |
| SYNTAX > 33 | 4.81 | 2.03 - 11.38 | < 0.0001 |
| Diabetes | 1.28 | 0.57 - 2.90 | 0.55 |

In patients with age ≥ 80, heart failure and SYNTAX > 33 were associated with severe outcomes during hospitalization with $p < 0.05$.

## IV. DISCUSSION

Our study shows that ACS with complex coronary artery disease often occurs in the elderly, and commonly in men. These patients typically have at least 2 or more cardiovascular risk factors, especially hypertension, and dyslipidemia. Our study also shows that patients with severe coronary artery disease are often hospitalized in the setting of STEMI.

It is noticeable that the laboratory examination at the time of admission was particularly high in the blood glucose level and LDL - cholesterol levels. This suggests that the prevalence of diabetes mellitus and dyslipidemia among patients with severe coronary artery disease is quite high. Increased blood glucose on admission is valuable for predicting mortality risk in the short - and medium - term. In particular, hyperglycemia on admission is a poor prognostic factor, increasing the risk of death in patients with acute myocardial infarction.

Regarding the characteristics of coronary artery lesions in our study, only 1 patient (accounting for 0.8%) had a single LMA lesion. The remaining 99.2% of patients had stenosis at least in two coronary branches or more; of which 68% were lesions of the three - vessel coronary artery, followed by 16.4% lesions of the LMA in combination with the three - vessel coronary artery, and the proportion of lesions of LMA associated with 2 branches coronary artery stenosis was 9.8% and single artery stenosis was 4.9%. Our research results are consistent with the research results of some domestic and international authors.

Author Bui Huu Minh Tri evaluated coronary injury in 105 patients with ST - segment elevation myocardial infarction, the results were similar to the majority of three - vessel coronary disease, followed by left main and three - vessel coronary artery disease, isolated LMA lesions were rare [8]. Serruys' study conducted RCT on 1800 patients with the acute coronary syndrome also showed that three - vessel coronary lesions predominate among severe CAD (accounting for 61%) [9].

Through the above studies, it was reported that left main stem lesions are rarely isolated, but most of the cases were combined with other coronary artery occlusions. This was not only a big challenge for cardiovascular intervention doctors but also a poor prognostic factor for short - term as well as long - term outcomes.

Regarding the location of the culprit: 108/121 patients had damage to the LAD, accounting for the highest rate of 89.3%. Approximately 90% of patients had stenosis in the RCA, 82%. More than half of patients had stenosis in the LCx as the culprit artery, 77.9%. Thus, we found that the most common lesions were LAD, following RCA culprits.

In our study, coronary artery lesions were quite complicated with the high average SYNTAX score > 23, of which 67.8% of patients had SYNTAX score 23 - moderate coronary artery injury, the rest were severe coronary artery injury (SYNTAX score ≥ 33) (8.3%) and mild (SYNTAX score ≤ 22) accounting for 23.9%.

Evaluation of coronary intervention and short - term outcomes:

The success of the anatomical intervention in our study was similar to the results of Duong Thu Anh [10] 98.6%, and Lee [11] 98%.

This result was similar to the result of Vaquerizo B [12] but it was lower than the ULTIMATE trial [13]. The reason is explained that our study subjects were conducted mainly on patients with preserved left ventricular function, and there were no patients with cardiogenic shock. In contrast, the study of ULTIMATE registered high - risk subjects such as the elderly, multiple comorbidities, and especially acute MI with cardiogenic shock.

In our study, there was a patient (0.8%) with cerebral hemorrhage on the second day after the intervention. This patient was elderly (67 years old), treated hypertension for many years, and had twice prior stroke, and a reduced left ventricular function EF. Thus, this case had too many risk factors leading to stroke. The rate of MI in the hospital in our study was 0.8%, similar to the results of the Kim et al. study [14], 1.1%.

Hematoma at the puncture site can be encountered in different degrees. We encountered 2 cases (1.8%), both of these cases were female, with age > 65. A case had inguinal hematoma after femoral access, and another suffered from hematoma at the right wrist. After the intervention, both patients might not have sufficient compressing at the puncture site due to perspiration or early movement after the procedure. However, they were closely monitored, and discharged from the hospital after seven days of intervention without any severe complications. Farouque studied over 3508 patients and reported that the rate of hematoma was 0.74%. The study also showed that the risk factors of this were female, low weight. Although the rate of hematoma in our study was higher than Farouque [15], the risk of this complication in our study was as similar as this study.

Finally, there was only a case of acute renal failure after intervention (0.8%), which was a 70 - year - old male patient with a history of hypertension and diabetes for many years; After the procedure, blood creatinine increased by more than 50% compared to the time of admission, accompanied by oliguria. After a period of intensive treatment, kidney function recovered and the patient was discharged after 5 days of intervention. According to Gruberg [16], acute renal failure after an intervention is a rare but very dangerous complication because it is a risk factor for increased risk of bleeding, MI, and mortality, especially those with acute renal failure requiring dialysis. Our result was lower than that of Gruberg's study (4.5%), the reason might be explained that the study included patients with acute myocardial infarction accompanied by cardiogenic shock, moreover, our study sample size was small, so it did not fully reflect the proportion.

Thus, the short - term results of coronary artery revascularization with stent placement in our study were 119/121 patients, at about 98.34% (Figure 3.7). Our results are similar to those of Duong Thu Anh's trial [10] with a success rate of 98.6%; and Park SJ [17] with 99.2%.

Analysis of some factors affecting treatment results: We performed an analysis to clarify the correlation between clinical outcomes and cardiovascular risk factors and the SYNTAX score presented in In our study, the number of patients over 80 at risk of serious events during hospital stay was 2.8 times higher than patients in the younger age group, and there was a statistically significant difference. (OR = 2.8 with 95% CI 0.99 - 7.96; p = 0.045). According to our statistics, the group of heart failure patients according to the NYHA 3 - 4 classification at admission had a rate of serious events during the hospital stay 8.11 times higher than that of the group without heart failure. This is statistically significant (OR = 8.11 with 95% CI 2.85 - 23.08; p < 0.0001). Patients with a SYNTAX I score above 33 had a 4.81 - fold higher risk of serious adverse events during the hospital stay in the group with a SYNTAX score < 33 (OR = 4.81 95% CI 2.03 - 11). 38; p < 0.0001). Patients with diabetes had a 1.28 times higher risk of major events during hospital stay than patients without diabetes, but this difference was not statistically significant.

## V. CONCLUSION

Patients with three - vessel and/or LMCAD were more common in the elderly population, males with least 2 or more risk factors. Hypertension, dyslipidemia, and diabetes are common risk factors in this group. The most common coronary injury is a three - vessel disease, with LAD, and RCA being the most common lesions, concentrated in the SYNTAX group 22 - 32 points. The success rate of intervention on research subjects at Nhan Dan hospital is quite successful with high surgical and procedural success rates.

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