

Application of Guidezilla Extension Catheter in Thrombus Aspiration During Percutaneous Coronary Intervention

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Abstract

Acute myocardial infarction (AMI) poses a significant threat to human health and safety, representing a coronary heart disease that can affect human life. Percutaneous coronary intervention (PCI) is considered the optimal method for saving the lives of AMI patients and optimizing treatment outcomes in emergency settings. However, over the years of research and clinical data, it has been observed that PCI also has certain limitations, such as the occurrence of a no-reflow phenomenon or the re-occlusion of small arteries in the distal myocardium by small thrombi. Therefore, based on recent research, this article aims to elaborate on the effectiveness and safety of the Guidezilla extension catheter in thrombus aspiration during percutaneous coronary intervention, while comparing it with traditional aspiration catheters. The objective is to provide clinicians with new treatment options and improve patient outcomes.

Keywords: myocardial infarction, PCI, Guidezilla extension catheter, thrombus aspiration

1. Introduction

Acute myocardial infarction (AMI) is a type of coronary heart disease caused by vascular organic changes caused by coronary atherosclerosis. (Chinese Association of Cardiology, 2015) If the atherosclerotic coronary artery in AMI patients ruptured acutely, the endogenous coagulation pathway and hypercoagulability were activated, resulting in thrombosis, which eventually blocked the coronary artery, reduced blood perfusion, and put the patient's myocardial cells in an oxygen-poor and ischemic state. In terms of the internal environment, when this pathological

state lasts for too long, it will lead to myocardial cell necrosis. (He, C., Yuan, J. Q., Ma, Y. L., Wang, C. S., Jiang, L., Zhang, J. H., & et al, 2017) Common clinical symptoms of AMI are persistent severe pain behind the sternum, increased body temperature, increased white blood cell content, increased serum myocardial enzymes, and pathological changes in electrocardiogram, accompanied by arrhythmia, heart failure, and shock, indicating that the patient is in the serious process of acute coronary syndrome.

According to relevant statistics, after decades of standardized prevention of cardiovascular

diseases in developed countries, the incidence of cardiovascular diseases caused by AMI has decreased significantly, while China has shown a rapid growth trend. (Hu, S., Yang, Y., Zheng, Z., Chen, W., Gao, R., Liu, L., & et al, 2019) From 2001 to 2011, the hospitalization rate of AMI patients in China increased nearly four times (from 4.6 million to 18.1 million male patients, and from 1.91 million to 8.1 million female patients). (Du, X., Patel, A., Anderson, C. S., Dong, J., & Ma, C, 2019) Since 2013, the mortality rate of acute myocardial infarction in rural areas has been significantly higher than that in urban areas. (Yang, J., Yang, Y., Xu, H., Gao, X., Li, W., Wang, Y., & et al, 2017)

For patients who seek medical treatment in time and have relevant indications, percutaneous coronary intervention (PCI) has a positive effect on saving the lives of AMI patients and optimizing postoperative recovery in emergency treatment. PCI is mainly a treatment method that needs to dredge the vessels blocked by thrombus within 3 to 6 hours, and up to 12 hours, to restore blood perfusion and restore oxygen and nutrition supply to myocardial cells through ischemia-reperfusion, and then restore and save the dying myocardium, and finally restore the normal function of the damaged myocardial cells of patients (He, F., Sun, X., Zhang, S., Yu, P., Xing, X., Li, H., & et al, 2019). However, from many clinical treatment data, PCI also has certain defects, which will not appear reflow phenomenon, that is, the ischemic area cannot be fully perfused in time. Thrombus in coronary arteries is one of the factors leading to coronary microvascular dysfunction. However, in recent years, relevant studies have shown that the use of thrombus aspiration technology in interventional therapy can effectively aspiration thrombus to reduce the risk of distal micro thrombosis formation, and the Guidezilla extended catheter lumen is larger than traditional catheters, and the aspiration effect is better. This technology does not require occlusion of coronary blood flow, nor does it affect myocardial perfusion (Xu, L., Chen, A., Tang, C., & Li, D, 2019).

Combined with relevant research in recent years, the use of Guidezilla extended catheter interventional therapy in the first aid of AMI patients has positive significance in reducing the risk of terminal microthrombus, complications, and recurrence rate for thrombus dredging and aspiration.

2. Overview of Guidezilla Extended Catheter

Guidezilla extended catheter is composed of a 120cm proximal wave tube and a 25cm stainless steel single-lumen catheter, so the extended catheter has stronger invasiveness, transportability, and durability compared with traditional catheters (Burzotta, F., Trani, C., Mazzari, M. A., Mongiardo, R., Rebuzzi, A. G., Buffon, A., & et al, 2005). In addition, the 25cm single-lumen catheter has two platinum-iridium marking bands, which can be seen under X-ray, thus having a positive significance for intraoperative catheter localization. Due to its special material structure, the braided layer can provide more wall support for the complex and tortuous coronary artery. At the same time, the stainless steel round head of the Guidezilla extended catheter is embedded, preventing the adverse consequences of excessive correction of the coronary artery. The non-invasive Guidezilla extended catheter tip has better elasticity, which can effectively reduce the trauma to the patient's vessels during the operation, and has a positive protective significance for reducing the risk of postoperative complications (A, D. S. S. J., A, P. S. Y., B, P. J. C., C, P. K. N., D, D. X., E, P. P. W., & et al, 2011).

Since 2015, the wide application of Guidezilla extended catheter has been started in China. At the same time, the insertion of a surgical catheter into the deep coronary artery provides more stable support for surgical catheter insertion than the traditional insertion, thus facilitating the intervention and transport of intraoperative balloons or stents (Mahmood, A., Banerjee, S., & Brilakis, E. S, 2011). According to relevant clinical practice studies, Guidezilla extended catheter has a positive impact and significance for the precise delivery of microcatheters, balloons, and stents to the lesion blockage end in the blood vessel due to its unique material and structure (Von Sohsten, R., Oz, R., Marone, G., & et al, 1998).

Compared with the traditional thrombus aspiration catheter, the advantages of Guidezilla extended catheter are as follows: 1) The design of Guidezilla extended catheter takes into account the replacement problem and optimizes it, which makes it simple to replace and easy to operate, and allows it to accurately reach the lesion at the end of the blood vessel like a balloon; 2) The outer diameter of Guidezilla extended catheter is smaller, its outer surface is smoother, and it has a more flexible head, which

is less likely to damage the coronary artery or be safer and more effective when occlusion occurs (Duong, T., Christopoulos, G., Luna, M., & et al, 2015).

3. Treatment Methods for Acute Myocardial Infarction

Percutaneous coronary intervention (PCI) is a common and effective treatment for acute myocardial infarction (AMI), which covers a variety of interventional therapy techniques, such as guided plaque resection, plaque resection and aspiration, plaque rotary resection, stent implantation, etc. The most commonly used PCI techniques are coronary stent placement and coronary thrombus or plaque aspiration. According to research, the survival rate of AMI patients treated with PCI is significantly improved. In addition to PCI treatment, thrombolytic therapy, delayed PCI, coronary artery bypass grafting (CABG) and other treatment methods can also be used in clinical practice, each with its indications. In summary, PCI plays an important role in the treatment of clinical AMI patients and can be

combined with drug or thrombolytic therapy to greatly improve the prognosis and survival rate of patients.

4. Overview of PCI for Acute Myocardial Infarction

Percutaneous coronary intervention (PCI) is the preferred clinical treatment for acute myocardial infarction (AMI) (Liu, Y., Zhang, L., & Yang, Y, 2020). It mainly restores the normal physiological function of stenotic or occluded coronary arteries through catheter cardiac insertion technology, thus achieving the purpose of improving vascular blood perfusion and restoring the normal internal environment of the myocardium (Gargiulo, G., Esposito, G., Avvedimento, M., ... , & Montalescot, G, 2020). Coronary artery surgery can be classified according to different technical methods, such as percutaneous coronary balloon angioplasty (PTCA), coronary stent implantation, coronary turning, coronary thrombectomy, balloon cutting, etc. In this article, thrombectomy is mainly discussed.

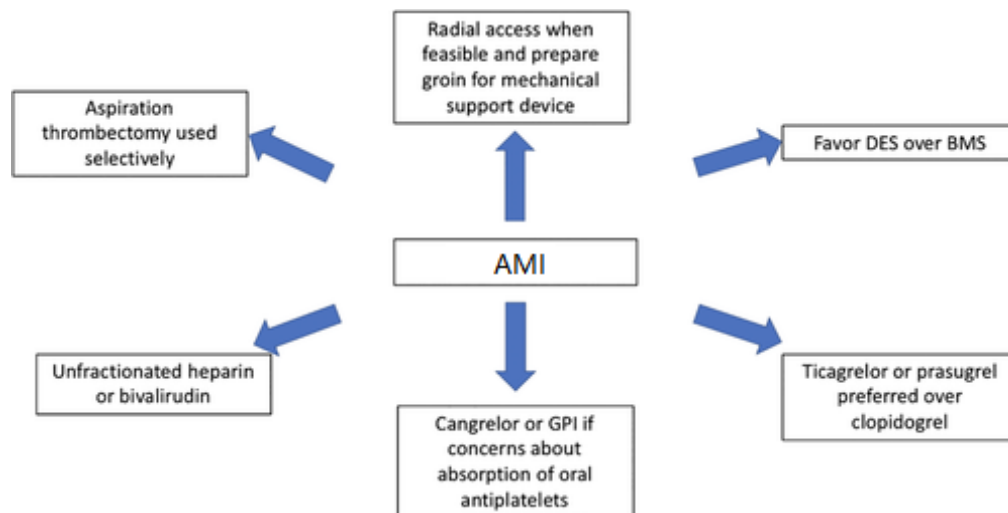


Figure 1. PCI treatment strategies for acute myocardial infarction

5. Application of Guidezilla Extended Catheter in PCI

The use of traditional catheters to aspirate thrombi in PCI may lead to the risk of distal microthrombosis. Guidezilla extended catheter has a larger internal cavity than traditional catheters, which can directly aspirate large blockages of thrombi through the catheter effectively, reducing the risk of distal microthrombosis. At the same time, the lumen of Guidezilla extended catheter is large, which can

be used for stents, balloons, etc. This method is one of the most common cases of Guidezilla extended catheter in AMI patients. Patients with complex AMI can not only aspirate thrombi through the Guidezilla extended catheter but also adopt other surgical methods through the Guidezilla extended catheter, to diversify treatment options and select different treatment methods according to different individuals. (Shen, Z., Zhang, H., Lai, P., & Yang, G, 2021)

6. Data and Methods

6.1 General Information

44 patients with acute myocardial infarction admitted to the First Ward of the Department of Cardiology, the Second Hospital of Lanzhou University from April 2022 to December 2022 were selected as the research objects. They were divided into the experimental group (22 cases) and the control group (22 cases) by random lottery. Patients with liver and kidney function diseases, other serious systemic diseases, and surgical contraindications were excluded. There were 28 males and 16 females, aged 32-86, with an average age of (64.18±2.56) years. There was

no statistically significant difference in gender, age, medical history, and other general data between the two groups ($P>0.05$), which can be compared. Selection criteria: Patients with acute inferior myocardial infarction who met the clinical diagnostic criteria of the "Guidelines for the Diagnosis and Treatment of Acute ST-segment Elevation Myocardial Infarction (2019)". This study was approved by the Ethics Committee of the Second Hospital of Lanzhou University, and the informed consent and informed consent of patients and their families were signed.

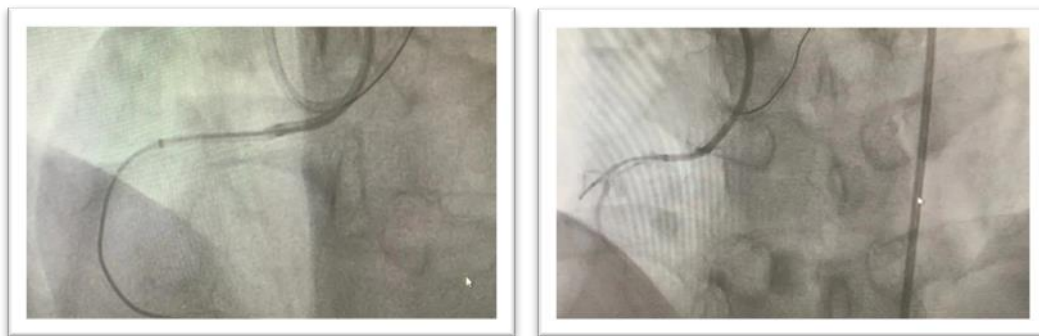


Figure 2. An example of percutaneous coronary intervention (PCI) aspiration of thrombus using Guidezilla extended catheter in chronic incomplete occlusion of the left ascending artery.

6.2 Methods

6.2.1 Control Group

The control group received conventional treatment. During the perioperative period, all patients were treated with anti-myocardial ischemia, inhibition of myocardial remodeling, and anti-platelet therapy before surgery. The patients were given aspirin, clopidogrel, and heparin. The control group received percutaneous coronary intervention.

6.2.2 Experimental Group

The experimental group used a Guidezilla extended catheter to aspirate thrombus based on the control group: after the guide catheter and guide wire reached the specified position, the Guidezilla extended catheter was pushed into the guide catheter along the catheter. The Guidezilla extended catheter was slowly pushed into the proximal vessel under the X-ray fluoroscopy environment. The position of the catheter was determined by the head marker of the Guidezilla extended catheter. After the extended catheter reached the specified position, the Guidezilla extended catheter was fixed.

6.3 Observation Indicators

The surgical success rate and complication rate of the two groups were compared. The surgical success, intraoperative and in-hospital complications, and follow-up adverse events of all patients were observed. The Global Registry of Acute Coronary Events (GRACE) score was used for risk assessment. Coronary angiography and functional evaluation (such as flow reserve fraction) were performed before discharge to evaluate the long-term risk of the patients.

6.4 Statistical Methods

Coronary angiography and cardiac function evaluation data of patients at an early stage, before discharge, and at review were analyzed with SPSS 27.0 software. Quantitative data were expressed as arithmetic mean $\pm$ standard deviation ($\bar{x} \pm s$), and a t-test was used for comparison between the two groups. Qualitative data were expressed as ratios, and the χ^2 test was used for comparison. The difference was statistically significant at $p<0.05$ level.

7. Results

7.1 Comparison of Surgical Success Rate Between the Two Groups

Surgical success criteria: after thrombus

aspiration, the residual stenosis of the target vessel lumen was less than 20%, the TIMI blood flow was grade III, and there was no death, myocardial infarction, emergency target lesion revascularization, and other important clinical complications during hospitalization.

The surgical success rate of the experimental group was 95.45% (21/22), and that of the control group was 86.36% (19/22), with a statistically significant difference ($P < 0.05$).

7.2 Intraoperative and In-Hospital Complications in the Experimental Group

There was no death or acute myocardial infarction during the surgery and in-hospital

period. When the Guidezilla extended catheter was used, catheter incarceration occurred, and the pressure returned to normal after the Guidezilla extended catheter was pulled out. There was no interlayer or rupture of the vessel, acute stent thrombosis, lead perforation, or cardiac embolism.

7.3 Comparison of Total Incidence of Complications Between the Two Groups

The total incidence of complications in the experimental group was lower than that in the control group, with a statistically significant difference ($P < 0.05$) (Table 1).

Table 1. Comparison of the total incidence of complications in the two groups

group	Number of cases	Total occurrence	Total incidence (%)
Experimental group	22	1	4.55
Control group	22	4	18.18
χ^2			5.485
P			0.021

7.4 Follow-up of Major Adverse Cardiac Events

The experimental group was followed up for 3 months, and no major adverse cardiac events were found.

8. Discussion

According to relevant studies (Li, Q., Liu, J., Lu, M., Zhao, H., Ma, Y., Cao, C., ... , & Wang, Y, 2019; Yang, Y., Song, L., Li, X., Qian, J., Dou, K., Mu, C., ... , & Zhang, Y, 2019), the incidence of AMI in China is rapidly increasing, seriously endangering the lives and health of Chinese people. Early and timely treatment is important, and can better improve the prognosis of patients. (Chen, J., Huang, K., & Wang, N, 2019; Li, J., Wang, W., Zhou, H., & Ding, H, 2019) Percutaneous coronary intervention (PCI) is the best way to save the lives of AMI patients and optimize the treatment outcomes. However, PCI also has certain disadvantages, such as causing distal vascular microcirculation disorders, which have a certain impact on the success rate and safety of the operation, and bring about complications. (Zheng, F., Song, Q., Lu, C., & Lian, Z, 2021; Desoutter, J., Jacob, V., & Guillaume, N, 2020) According to some studies (Xu, J., Zhang, F., Zheng, J., Li, Y., & Shao, J, 2020; Luo, J., Liu, H., Ma, C., Han, W., Yang, S., Ma, D., & Others, 2008), Guidezilla extended catheters

can be used in emergency PCI as a delivery device. Because the Guidezilla extended catheter has a larger internal cavity than traditional catheters, it can directly and effectively aspirate large blocked thrombi through the catheter, reducing the risk of distal microthrombosis. Therefore, this project proposes to directly aspirate proximal large thrombi with a Guidezilla extended catheter to improve coronary hemodynamics, thereby producing the same or better therapeutic effect as traditional PCI, and reducing the incidence of corresponding complications. However, some patients may also experience Guidezilla extended catheter incarceration, because the diameter of the extended catheter is larger, which is prone to friction with the proximal damaged vessels before reaching the large thrombus, aggravating the damage of the intima. Therefore, this is one of the contraindications for Guidezilla extended catheter thrombectomy.

The results of this project show that the surgical success rate of the experimental group is higher than that of the control group, and the difference between the two groups is statistically significant ($P < 0.05$). Only 1 case of catheter incarceration occurred during and after the operation in the experimental group, and there was no vascular dissection or rupture, acute

stent thrombosis, wire perforation, or cardiac compression embolism. The overall incidence of complications in the experimental group is lower than that of the control group, and the difference between the two groups is statistically significant ($P < 0.05$). In percutaneous coronary intervention using a Guidezilla extended catheter, the high safety of thrombus aspiration can improve the therapeutic effect and reduce the incidence of complications.

In summary, for patients with acute myocardial infarction, the use of Guidezilla extended catheter for thrombus aspiration in percutaneous coronary intervention is effective, which can improve the success rate of the operation, reduce postoperative complications, and reduce the occurrence of major cardiac adverse events. It has high safety and can be used for clinical treatment and promotion.

9. Prospects

Acute myocardial infarction is a type of coronary heart disease, which has a great impact on the life and health of patients. Although there are mature treatment methods for percutaneous coronary intervention in clinical practice, there are still some shortcomings. Through the thrombus aspiration effect of Guidezilla extended catheter in PCI, large thrombi can be effectively sucked, thus reducing the complications caused by PCI, and improving the safety and success rate of the operation. At the same time, it provides a certain basis for the selection of diversified and personalized coronary surgery. The application of Guidezilla extended catheter thrombus aspiration can bring more choices for clinical treatment, and the effect of thrombus aspiration is good. It can improve the success rate of surgery and reduce postoperative complications to a certain extent. The occurrence of major adverse cardiac events after surgery is less, and the safety is higher. It can be widely used in clinical treatment, and more in-depth research can be carried out to put forward better treatment plans on this basis.

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