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Catheterization and Cardiovascular Interventions 63:299–306 (2004)

Improved Performance of a New Thrombus Aspiration Catheter: Outcomes From In Vitro Experiments and a Case Presentation

Masami Sakurada,[1] MD, Yuji Ikari,[2]* MD, and Takaaki Isshiki,[3] MD

Thrombus vacuum catheter (TVAC) is a new thrombus aspiration catheter. The catheter has a beak-shaped distal tip and a shaft with spring support. Based on in vitro tests, these design features showed improved ability to pass through a simulated coronary artery model with a bend and to aspirate gel. TVAC has an outer diameter of 4.5 Fr and is available with a 7 Fr guide. We report a case of acute myocardial infarction that was successfully treated with TVAC after use of other aspiration devices failed in its treatment. Since protection of microcirculation in coronary reperfusion may be essential in acute myocardial infarction, TVAC is a promising device to help achieve this goal. ***Catheter Cardiovasc Interv 2004;63:299–306.*** © 2004 Wiley-Liss, Inc.

Key words: acute myocardial infarction; percutaneous coronary intervention; embolism

INTRODUCTION

Survival rate in acute myocardial infarction has improved after introduction of thrombolysis and direct percutaneous coronary intervention (PCI). However, based on a meta-analysis, mortality rate is still 4.4% of those cases treated by direct PCI [1]. Coronary embolism is frequently observed in autopsy cases following PCI or thrombolysis [2]. In acute myocardial infarction (AMI), no-reflow phenomenon indicates poor prognosis even with successful dilatation of occluded arteries [3]. Normal epicardial flow and normal tissue level myocardial perfusion are essential for low risk of mortality both in thrombolysis [4] and in PCI [5]. Although abnormal tissue level myocardial perfusion may be caused by several mechanisms, one of the major reasons is considered to be embolism of atheroma as well as thrombus. If distal embolism can be safely avoided, mortality rate could be improved. Thus, there is a need for development of devices that avoid distal embolism when used in treatment of AMI.

In this report, we describe a new aspiration catheter named thrombus vacuum catheter (TVAC). With this device, simple aspiration is easy for patients with AMI. TVAC has a special design in the distal tip and shaft, which facilitates better passing and aspiration. This is the first report describing experimental use of this new device.

MATERIALS AND METHODS

TVAC Catheter

TVAC (Nipro, Osaka, Japan) is an aspiration catheter made of polyamide-elastomer with an outer diameter of 4.5 Fr, an inner diameter of 0.90 mm^2, and a length of 1,350 mm. The catheter has support material inside the lumen throughout the catheter. TVAC can be used with a 0.014″ guidewire and a 7 Fr guide catheter. The shape of the distal tip is unique in that it looks like the beak of a duck (Fig. 1). TVAC is connected to a collecting bottle with a collecting filter via a 2 m connecting tube. Just prior to use, the collecting bottle is connected to a vacuum pump through a hydrophobic filter. The vacuum pump can generate negative pressures of 600–760 mm Hg, which can be continuously controlled by a switch.

Description of Catheters

A comparison of the aspiration catheters is shown in Table I. Thrombuster (Kaneka, Osaka, Japan) and PercuSurge Export catheter (Medtronics, Minneapolis, MN) have larger outer diameters. TVAC and Rescue catheter (Boston Scientific, Natick, MA) have support wires inside the tube similar to a balloon catheter. The inner

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