Thrombus aspiration for the treatment of definite stent thrombosis

Utilisation de la thrombo-aspiration pour le traitement des thromboses de stent

Gilles Lemesle, Rachid Bouallal, Arnaud Sudre, Cédric Delhaye, Guillaume Rosey, Jean-Marc Lablanche

Service de cardiologie B et hémodynamique, hôpital cardiologique, centre hospitalier régional et universitaire de Lille, boulevard Pr-J.-Leclercq, 59037 Lille cedex, France

Received 2 April 2009; received in revised form 22 October 2009; accepted 23 October 2009
Available online 15 January 2010

Summary
Background. — Thrombus aspiration (TA) has been associated with high rates of thrombotic material retrieval, which results in improved myocardial reperfusion. In addition, a recent study has shown that systematic TA for treatment of ST-segment elevation myocardial infarction (STEMI) related to de novo lesions improves patient outcomes.


Methods. — Between 2004 and 2006, we indexed 24 patients presenting with definite ST. All patients underwent TA (Export Medtronic® 6F catheter) followed by PCI for ST treatment. Baseline clinical and angiographic characteristics, and complications related to the TA device were indexed.

Results. — The median time of ST occurrence was 7 days. All patients except one presented with STEMI. Bare-metal and drug-eluting ST represented 70.8% and 29.2% of cases, respectively. Mean stent length was 18.8 ± 5.6 mm; mean stent diameter was 2.8 ± 0.4 mm; mean number of implanted stents was 1.58 ± 0.7. There was no failure to cross the catheter and no TA device-related complications were reported. The numbers of patients with initial thrombolysis in myocardial infarction (TIMI) flow grades 0, 1 and 2 were 15 (62.5%), 3 (12.5%) and 6 (25.0%), respectively. No patient had TIMI flow grade 3 before TA. After TA, 16 (66.7%) patients had TIMI flow grade 3; final procedural success was obtained in 23 (95.8%) patients. The 1-year death rate was 12.5%.

Abbreviations: MACE, major adverse cardiovascular events; PCI, percutaneous coronary intervention; STEMI, ST-segment elevation myocardial infarction; TA, thrombus aspiration; TIMI, thrombolysis in myocardial infarction; ST, stent thrombosis.

* Corresponding author. Fax: +33 3 20 44 48 98.
E-mail address: jmlablanche@chru-lille.fr (J.-M. Lablanche).

1875-2136/$ — see front matter © 2009 Elsevier Masson SAS. All rights reserved.
doi:10.1016/j.acvd.2009.10.004
Conclusions. — In our experience, TA before PCI for ST treatment shows promising results, providing high rates of immediate reperfusion and final angiographic success, and low death rates, compared with the literature. 
© 2009 Elsevier Masson SAS. All rights reserved.

Introduction

TA in patients undergoing primary PCI for the treatment of STEMI related to de novo lesions has been shown to be feasible, safe and associated with improved myocardial reperfusion and outcomes [1—3]. Indeed, in the thrombus aspiration during percutaneous coronary intervention in acute myocardial infarction (TAPAS) trial [4], TA before stenting resulted in lower cardiac mortality and lower incidence of the composite endpoint of cardiac death or non-fatal reinfarction at 1 year.

Stent thrombosis is a rare event but is usually associated with poor outcomes [5—10]. In addition, large thrombus burden in this context is the rule rather than the exception and the benefit of systematic TA in patients presenting with stent thrombosis is still poorly described. The present study reports a single-centre experience of systematic TA for the treatment of patients undergoing primary PCI for stent thrombosis.

Methods

Population and study design

Between August 2004 and December 2006, we indexed all patients presenting with definite stent thrombosis (according to the Academic Research Consortium definition) and treated by primary PCI in our centre. All patients included in this study underwent TA before PCI for stent thrombosis treatment. Patients with previous thrombolysis and patients treated by emergent coronary artery bypass surgery were excluded.

PCI procedures for stent thrombosis treatment

The device used for TA was the Export Medtronic® 6F catheter. Then PCI, with or without coronary stent implantation, was performed in accordance with the standard technique usually used in our catheterization laboratory.
All patients were pretreated with an intravenous bolus of aspirin 500 mg and an intravenous bolus of heparin 50 IU/kg; they also received a 300–600 mg loading dose of clopidogrel. The use of glycoprotein IIb/IIIa inhibitors and new stent implantation were at the discretion of the physicians and were driven by clinical and angiographic outcomes. Post-procedural treatment consisted of a combination of unfractionated heparin (12 IU/kg/h) or enoxaparin (0.1 mg/kg twice a day) in all patients for at least 72 h and dual antiplatelet therapy with aspirin 75 mg and clopidogrel 75 mg once daily for at least 1 year.

**Film review**

All coronary angiograms were reviewed by two cardiologists (A.S. and R.B.). The culprit lesion of stent thrombosis, initial TIMI flow grade, TIMI flow grade just after TA and final TIMI flow grade were analysed.

**Follow-up**

Clinical follow-up at 1 year was conducted by phone contact or office visits. In cases of new hospitalization, data were obtained by a systematic review of the discharge letter. During the 1-year follow-up period, the composite endpoint, which included death, recurrent myocardial infarction and recurrent stent thrombosis, was indexed systematically.

**Definitions**

*Final procedural success* was defined as normal TIMI flow grade 3 with a residual stenosis <30%. According to the Academic Research Consortium definition, *definite stent thrombosis* was defined as an angiographic confirmation of stent thrombosis (the presence of a thrombus that originates in the stent or in the segment 5 mm proximal or distal to the stent) associated with the presence of at least one of the following criteria within a 48-h time window:

- acute onset of ischaemic symptoms at rest;
- new ischaemic electrocardiogram changes that suggest acute ischaemia;
- typical rise and fall in cardiac biomarkers [12].

In patients where *recurrent myocardial infarction* was suspected from clinical signs or symptoms after the initial infarction, an immediate measurement of troponin and a second sample 6 h later were obtained; recurrent myocardial infarction was diagnosed if there was an increase in the value in the second sample of ≥20% [13].

**Statistical analysis**

Continuous variables are expressed as mean ± standard deviation, except for the delays, which are expressed as median [25th–75th percentile]. Categorical variables are expressed as absolute number and percentage.

**Results**

**Population**

During the study period, 31 patients presented with definite stent thrombosis in our centre. Patients with prehospital thrombolysis (n = 5) and patients treated by emergent coronary artery bypass surgery (n = 2) were excluded. Finally, 24 patients presented with definite stent thrombosis and underwent TA followed by PCI during the target period, and were considered for the present study. The median time of stent
thrombosis occurrence was 7 days [3–54]. Early stent thrombosis was most frequent and occurred in 70.8% of the cases with a median time of 4.5 days.

Baseline characteristics of the patients are shown in Table 1. The mean age of patients was 60.1 ± 12.3 years and 41.7% were diabetic. The mean stent length was 18.8 ± 5.6 mm and the mean stent diameter was 2.8 ± 0.4 mm. Twenty-three (95.8%) patients presented with STEMI; the last patient presented with non-STEMI. The left anterior descending artery was the main location of the stent thrombosis (58.3% of cases) followed by the right coronary artery (37.5% of cases).

Altogether, 18 (75%) patients were on dual antiplatelet therapy at the time of stent thrombosis; recent (<15 days) cessations of aspirin (n=1) and clopidogrel (n=1) were noted.

The stent thrombosis treatment is detailed in Table 2. TA before PCI was performed in all patients. Glycoprotein IIb/IIIa inhibitors were used in 58.3% of cases and a new stent was implanted in 79.2% of cases.

Feasibility and safety

All TAs were performed by using the Export Medtronic® 6F catheter. The technique was feasible in all cases. The numbers of patients with initial TIMI flow grade 0, 1 and 2 were 15 (62.5%), 3 (12.5%) and 6 (25.0%), respectively. No patient had TIMI flow grade 3 before TA use. After TA the number of patients with TIMI flow grade 3 was 16 (66.7%). Final procedural success was obtained in 23 (95.8%) patients (Fig. 1).

There were no major complications related to the TA technique itself: no visible dissection, no coronary artery perforation, no catheter thrombosis occurrence and no stroke.

### Table 2 Stent thrombosis treatment (definite stent thrombosis, n = 24).

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-hospital thrombolysis</td>
<td>0</td>
</tr>
<tr>
<td>Clopidogrel loading dose of 600 mg</td>
<td>7 (29.2)</td>
</tr>
<tr>
<td>Clopidogrel loading dose of 300 mg</td>
<td>17 (70.8)</td>
</tr>
<tr>
<td>Glycoprotein IIb/IIIa inhibitors</td>
<td>14 (58.3)</td>
</tr>
<tr>
<td>Thrombus aspiration</td>
<td>24 (100)</td>
</tr>
<tr>
<td>New stent implantation (mm)</td>
<td>19 (79.2)</td>
</tr>
<tr>
<td>Type of stent</td>
<td></td>
</tr>
<tr>
<td>Bare-metal stent</td>
<td>18 (75)</td>
</tr>
<tr>
<td>Sirolimus stent</td>
<td>0</td>
</tr>
<tr>
<td>Paclitaxel stent</td>
<td>1 (4.2)</td>
</tr>
<tr>
<td>Number of stents</td>
<td>1.3 ± 0.2</td>
</tr>
<tr>
<td>Total stent length (mm)</td>
<td>21.3 ± 2.3</td>
</tr>
<tr>
<td>Stent diameter (mm)</td>
<td>2.7 ± 0.3</td>
</tr>
<tr>
<td>Stent/artery ratio</td>
<td>1 ± 0.1</td>
</tr>
<tr>
<td>Post-dilatation after stent implantation</td>
<td>10 (41.7)</td>
</tr>
<tr>
<td>Maximal balloon pressure (bars)</td>
<td>14.2 ± 0.9</td>
</tr>
<tr>
<td>Angiographic success</td>
<td>23 (95.8)</td>
</tr>
</tbody>
</table>

Data are mean ± standard deviation or number (%).

### Follow-up

The 1-year follow-up after the stent thrombosis episode is detailed in Table 3. The rate of major adverse cardiovascular events (MACE), including death, recurrent myocardial infarction and recurrent stent thrombosis, was 20.8% at 1 year. There were three (12.5%) deaths and four (16.7%) recurrent stent thromboses leading to four (16.7%) recurrent myocardial infarctions. All events occurred within the first months after the first stent thrombosis.

### Discussion

We report here our single-centre experience of systematic TA use before PCI for stent thrombosis treatment. The present study shows promising results. Indeed, TA use facilitated high rates of immediate reperfusion, high rates of final...
procedural success (up to 95.8%) and low rates of MACE at 1 year.

Stent thrombosis is a rare but severe complication of PCI. According to the literature, the cumulative incidence of definite stent thrombosis ranges between 1 and 1.5% at 1 year. Nevertheless, although not frequent, stent thrombosis remains a severe complication, responsible for high rates of mortality (20–40%) and morbidity, including non-fatal myocardial infarction in 70% of cases [5–7,10,14]. In addition, after a first episode, recurrent stent thrombosis occurs in 15–30% of cases [15,16].

Consequently, the treatment of this complication is still critical for cardiologists. In this context, Wenaweser et al. have reported that the achievement of final procedural success, defined as TIMI flow grade 3 and residual stenosis <50%, was the only predictor of death in a population of patients presenting with definite stent thrombosis [16]. In addition, TA use before PCI for treatment of STEMI related to a de novo lesion has been shown to improve TIMI flow grade [2,3,17–19], resulting in an important outcome improvement at 1 year [4]. Large thrombus burden has been reported to be the rule rather than the exception in stent thrombosis. Therefore, it may be of interest to use TA devices for stent thrombosis treatment.

In our study, TA using the Export Medtronic® 6F catheter was feasible in all patients and safe, with no related complications. Further, TA use facilitated immediate reperfusion in two-thirds of cases and final procedural success in 95.8% of cases, which are higher rates than those reported in the literature. Indeed, final procedural success after definite stent thrombosis has been reported to be around 80% in a large trial [20]. Our results are consistent with previous reports. Indeed, small retrospective studies (including fewer than 20 patients) have shown that systematic TA use for stent thrombosis treatment improves the reperfusion success rate up to 90% [21–23]. In addition, the rates of MACE and death in the present study were only 20.8% and 12.5% at 1 year, respectively, which are lower than rates reported previously [5–10]. Finally, TA before balloon angioplasty or stenting during primary PCI in STEMI has been shown to reduce the occurrence of distal embolization by removing macroscopic clots in the majority of cases in previous reports [24].

Study limitations

The small sample size and retrospective design are the principal limitations of the present study. In addition, systematic anatomopathological analyses of the retrieved material are lacking and may have been of interest. However, our results are consistent with previous reports supporting TA use for the treatment of stent thrombosis and STEMI related to de novo lesions. Further studies are needed to enable definite conclusions to be drawn on the benefit of systematic TA use in stent thrombosis treatment.

Conclusions

In the present study, TA use for the treatment of definite stent thrombosis showed promising results. In addition, the use of this device resulted in high rates of immediate and final myocardial reperfusion (up to 96%) and low rates of MACE at 1 year, which are much better than results reported in the literature in this context. Nevertheless, additional studies assessing the efficiency of systematic TA use for the treatment of stent thrombosis are needed.

References


