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Short- and long-term evolution of the endoluminal diameter of underdilated stents in transjugular intrahepatic portosystemic shunt

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KEYWORDS
Transjugular intrahepatic portosystemic shunt (TIPS);
Stent;
Interventional radiology

Abstract
Purpose: The purpose of this study was to evaluate the short- and long-term evolution of endoluminal diameter of covered metallic stents that were underdilated at the time of transjugular intrahepatic portosystemic shunt (TIPS) creation.
Materiel and methods: Sixteen patients (13 men, 3 women) with a mean age of 57.6 years ± 7.9 (SD) were retrospectively included. All patients had had TIPS creation using a 10-mm diameter covered stent (VIATORR®) that was underdilated (i.e., 8 mm) at the time of stent placement. Measurements of the mean circulating diameter of the stents were retrospectively performed on angiographic examinations every 6 months up to 2 years.
Results: The endoluminal stent diameter early enlarged from 8.96 mm ± 1.12 (SD) to 10 mm ± 1.45 (SD) after 6 months ($P = 0.04$) with no further significant changes over time after 12 months (10.28 mm ± 1.9 mm), 18 months (9.93 ± 1.51 mm) and 24 months (9.92 ± 0.9 mm).
Conclusion: Our results demonstrate a passive expansion of initially underdilated covered stents during the six months following TIPS creation. This should be taken into account regarding hepatic encephalopathy prevention during TIPS placement.

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The creation of transjugular intrahepatic portosystemic shunts (TIPS) is a well-accepted technique for the treatment of complications of portal hypertension [1—4]. TIPS technique was implemented 10 years ago by the use of covered stents that have demonstrated improved long-term patency and lower rate of occlusion, allowing the study of their long-term evolution [5—7]. Because of the induced decrease in portosystemic pressure gradient (PPG), some authors have raised concerns regarding complications, such as hepatic encephalopathy or worsening of liver dysfunction [8—10]. Underexpansion of the stent at the time of TIPS creation is usually performed, in order to balance those risks with the necessary reduction of PPG while allowing further dilatation in case of insufficient clinical and hemodynamic efficacy.

Empirical evidence and, recently, scientific publications suggested that underdilatation was not long-lasting and that the external diameter of underdilated covered stents increases over time, tending to return to its original, nominal diameter [11,12]. However, computed tomography (CT) measurements do not allow the evaluation of internal and functional stent diameter because they do not take into account the thickness of the stent wall and possible pseudointimal tissue that narrows the lumen and, assumably, limits stent expansion.

The purpose of this study was to evaluate the short- and long-term evolution of endoluminal diameter of covered metallic stents that were underdilated at the time of TIPS creation.

Material and methods

Patients characteristics

All patients who underwent a successful TIPS placement using a 10-mm covered stent (VIATORR®, Gore & Associates Inc, Newark, DE, USA) that was underdilated at 8 mm in our center from March 2008 to July 2009 were selected for retrospective analysis. Details regarding inclusion and exclusion criteria have been previously described elsewhere [13]. Briefly, patients were eligible for TIPS creation if they had a validated indication according to Baveno IV criteria [14], except for acute uncontrolled hemorrhage. The study protocol was approved by the institutional Ethics Committee, and each patient gave his written informed consent. This study has been registered at Clinical Trials.com (number 00593528).

Nineteen consecutive patients were initially included from Fig. 1. Three of them were excluded because of missing data and the remaining 16 patients were included in the analysis. There were 13 men and 3 women, with a mean age of 57.6 years ± 7.9 (SD) (range: 43—74 years). Detailed baseline demographics were retrieved from medical records and are summarized in Table 1. Among these 16 patients, 5 underwent a second angioplasty for stent dysfunction (two patients at 6 months, two patients at 12 months and one patient at 18 months). One patient died during the follow-up at 18 months. Outcomes were therefore analyzed with a mean follow-up time of 18.7 months (rang: 6—24 months). The successive analysis at 6- (M6), 12- (M12), 18- (M18) and 24 months (M24) following TIPS creation was based on 12, 11, 8 and 9 patients, respectively.

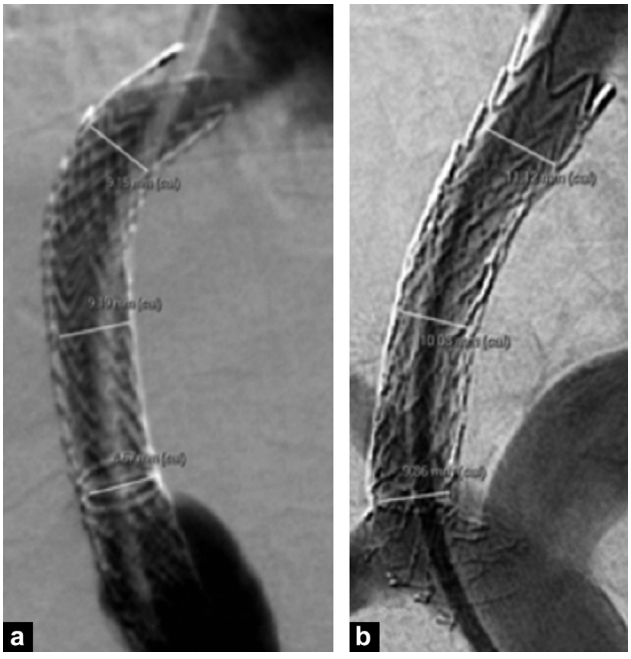

Figure 1. a: portal venogram obtained immediately after TIPS creation and (b), 6 months later in a patient with refractory ascites. The mean in stent diameter measurement reveals a re-expansion of the initially underdilated stent.

After TIPS creation, angiography with PPG measurements was scheduled every six months over a follow-up period of 2 years. One patient underwent angiography at 36 months due to a breach in previous controls (missing data at 6-, 12- and 18 months) so this patient was not included. In case of dysfunction, appropriate treatment, such as balloon

Table 1 Demographic data and liver disease characteristics of 16 patients who had transjugular intrahepatic postosystemic shunt.

Variables	Value
Gender	
Male	13 (81)
Female	3(19)
Age	57.6 [43—74]
Cause of cirrhosis	
Alcohol abuse	13
NASH	2
Viral hepatitis	1
Child-Pugh	
A	3
B	9
C	4
TIPS indication	
Refractory ascites	7
Variceal bleeding	8
Portal vein thrombosis	1
Mean follow-up (months)	18.7 [6—24]

Numbers in parentheses are percentages. Numbers in brackets are ranges.

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