



UPDATE IN RADIOLOGY

Twenty-five years after the first TIPS in Spain[☆]



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Abstract The incorporation, 25 years ago, of transjugular intrahepatic portosystemic shunting, better known by the acronym TIPS, represents an indisputable improvement in the treatment and management of patients with symptoms due to portal hypertension. This article discusses the origins of the technique and the technical innovations that have been progressively added through the years. The implantation of coated stents, which protect the stent from processes in the parenchymal track that can lead to stenosis, have helped ensure long-term patency, thus reducing the need for reintervention. Solid evidence from valuable publications has situated TIPS at the forefront of the treatment options in a wide variety of clinical situations associated with portal hypertension.

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PALABRAS CLAVE

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Veinticinco años tras los primeros TIPS en España

Resumen La incorporación, hace ya 25 años, de la derivación portosistémica percutánea intrahepática (conocida por todos como TIPS) ha supuesto un indudable avance terapéutico en el manejo de los pacientes con sintomatología derivada de la hipertensión portal. En este artículo se pretende recordar sus orígenes así como las innovaciones técnicas posteriores que fueron añadiéndose progresivamente. Con la implantación de las prótesis cubiertas, que enfundan el trayecto parenquimatoso, se ha conseguido asegurar la permeabilidad a largo plazo de la conexión, con lo que disminuyen las necesidades de reintervención. Las sólidas evidencias obtenidas desde valiosas publicaciones sitúan el TIPS en un lugar preferente entre el compendio terapéutico de una gran variedad de situaciones clínicas asociadas a la presencia de hipertensión portal.

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Introduction

It has been 25 years since the first percutaneous portocaval connection was performed in Spain (1991). That is why it is interesting to check and update briefly the technical progress and results obtained. The procedure is performed to alliviate certain complications of portal hypertension and consists of placing a device (endograft) with which portal blood is steered into the inferior vena cava. Overall the procedure is performed via transjugular access and through the transparenchymatous puncture of an intrahepatic portal branch. The acronym TIPS (Transjugular Intrahepatic Portosystemic Shunt) is universally accepted though the recommended Spanish denomination, as defined in a document with national consensus, is "intrahepatic percutaneous portosystemic shunt".¹ In this document we will describe the clinical repercussions of portal hypertension (digestive hemorrhage and ascites) defined as the elevation of the pressure gradient between portal and systemic circulations.

History

Portography and early description of the TIPS technique

Whipple is credited with the earliest attempts at surgically treat complications derived from portal hypertension, though by 1896 Jaboulay and Briau had already considered the possibility of connecting the vena cava and the portal vein by surgically implanting a device between the two.² Since then the radiological vision of the portal system has been a great technological challenge. Sousa Pereira is credited with the earliest direct portographies in 1949, and very likely, Ayres de Sousa was the first one to ever provide detailed images of direct portography and study portal hemodynamics.³ The access used was the transplenic one. Later other authors published other direct portal accesses, among them the umbilical or the hemorrhoidal ones. Rösch was the first to describe transjugular portal access (it had already been used for transjugular cholangiography). TIPS is conceptually based on this and its first experimental study was published in 1969.^{4,5}

It was then that Rösch defined the fundamental details of this procedure: (1) catheterization through the transjugular pathway of a suprahepatic vein; (2) transparietohepatic puncture, with a stiff needle, of the portal vein; (3) dilation of the transparenchymatous tract, and (4) implantation of a tubular device that steers portal blood into the inferior vena cava.⁶ The problem was that at the time there were no angioplasty balloons to inflate the tract or metal endografts. From the visionary, fundamental articles by Rösch to Richter's publication of the first patient who underwent TIPS in 1989⁷ until today 20 years of continuous research and improvement have gone by. The most important advances were: the clinical additions of the angioplasty balloon⁸ to dilate, with patency of several days, the transhepatic tract, and the application in animal experimentation of the first expandable-balloon endografts (Palmaz) with which it was possible to obtain a lasting functioning of the shunt.⁹

The first TIPS

The first successful TIPS was performed at a Freiburg Hospital by a team of radiologists from Freiburg, Heidelberg and San Antonio, Texas (U.S.A.), on January 28th 1988.⁷ The case was published in 1989 in a local magazine. An article published in *Radiology* in 1990 revealed the procedure.¹⁰ The basic aspects of his procedure included the following:

1. Brockenbrough transseptal needles for transvenous puncture, they are smaller in gauge and consistency than the "Ross modified" needles used originally by Rösch.
2. To be able to identify the portal vein, such vein was previously accessed through the transparietohepatic pathway by placing a Dormia basket in the right portal branch. Under fluoroscopic guidance, the transjugular needle was advanced until its tip was placed inside the basket. Direct transhepatic puncture increased sensitively the morbidity (due to bleeding) of the procedure.
3. The device used was an expandable balloon (Palmaz) so it was rigid. Given that the transhepatic trajectory between the hepatic and portal veins is always curved, the implantation of several rigid grafts gave the tract angles that complicated the correct functioning of the TIPS.

The earliest articles by the Freiburg-Heidelberg group^{10,11} had a great impact on the hospitals interested in managing patients with liver disease, but it was necessary to modify several technical aspects, among them the puncture guidance and the device to be used. In order to avoid transhepatic puncture and obtain a portography with enough diagnostic quality during the procedure one CO₂¹² venous (suprahepatic) injection began to be used. A comparative study proved that with this method -easy and available it was possible to obtain images with a quality similar to those of direct portographies and better than those of portographies obtained during the venous return in a mesenteric arteriography.¹³ However the fluoroscopic control of the transparenchymatous needle advancement, with or without previous opacification of the portal vein does not provide any 3D information on where the tip is or where the portal vein is entered. This is only attained by controlling the advancement of the needle through ultrasounds which can be done either externally (transcutaneously)¹⁴ or intravascularly (Intravascular Ultrasound, IVUS) after the femoral introduction of the device.¹⁵ Taking into account the lesser hospital availability of the latter they both allow us to access the portal vein on the first "pass", to select the entry to an intrahepatic portal branch (reduction of the risk of free bleeding during the procedure) and significantly decrease the volume of iodized contrast used.

Modifications of the early technique

In 1987, Rousseau presented a novel self-expandable vascular device (Wallstent), which was flexible and had low thrombogenicity.¹⁶ These characteristics allowed it to be considered an excellent alternative to expandable balloon stents and its use in TIPS was researched from 1989 to 1990 (Fig. 1). The first case in which a wallstent was implanted to

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