British Journal of Healthcare and Medical Research - Vol. 12, No. 02
Publication Date: April 25, 2025
DOI:10.14738/bjhr.1202.18734.
Barakat, F., Rössle, M., & Reimer, P. (2025). Y-type of Stenting for Revision of a Transjugular Intrahepatic Portosystemic Shunt (TIPS): A Case Report. British Journal of Healthcare and Medical Research, Vol - 12(02). 477-483.

Y-type of Stenting for Revision of a Transjugular Intrahepatic Portosystemic Shunt (TIPS): A Case Report

Fuad Barakat
Städtisches Klinikum, Radiology, Karlsruhe, Germany

Martin Rössle
University Hospital, Gastroenterology, Freiburg, Germany

Peter Reimer
Städtisches Klinikum, Radiology, Karlsruhe, Germany

ABSTRACT

Purpose: To describe the technique of y-stenting in a patient receiving TIPS revision for thrombotic shunt occlusion. Methods: This report describes a patient receiving TIPS for refractory ascites. At primary implantation, the stent migrated slightly towards the inferior caval vein, a plausible explanation for thrombotic stent occlusion and partial thrombosis of the inferior caval vein. Refractory ascites recurred indicating TIPS revision which was performed after a 2-week anticoagulation treatment. At revision, catheterization of the stent failed and a parallel TIPS was discussed, but eventually disregarded because of a very narrow intrahepatic portal branch which was completely occupied by the former Viatorr stent. Result: A y-type of stenting was performed by lateral puncture of the Viatorr stent and implantation of an additional stent through the wall of the primary stent. The intervention was uncomplicated, reduced the portosystemic gradient effectively, and resulted in complete clinical response. Conclusions and clinical significance: This case demonstrates the feasibility of y-stenting. The technique may be superior to parallel stenting because it avoids the risk of parenchymal and portal vein injury.

Keywords: transjugular intrahepatic portosystemic shunt, TIPS, revision, parallel TIPS, stent thrombosis, Viatorr stent.

MAIN POINTS

1. Stent placement or migration into the inferior caval vein should be avoided strictly since it may cause local thrombosis of the stent and the inferior caval vein.
2. If TIPS revision is indicated and recatheterization of the stent fails, y-stenting may be an option.
3. In comparison to parallel stenting, y-stenting may be the better option because it avoids the risk of parenchymal and portal vein injury.

PURPOSE

Shunt failure is an intrinsic problem in patients having received TIPS implantation. It has considerably been reduced by PTFE covering of stents but shunt revision is still required in about 7-30% of patients during the first year of follow-up (1-7). Several clinical and histological

studies attributed the positive effect of PTFE-covering to its barrier function against bile salts (8-12), a hypothesis however, which has not been confirmed in a flow-model (13). Another reason for shunt stenosis may be an unfortunate geometry of the TIPS channel causing a turbulent blood flow facilitating thrombus formation or intimal proliferation. Thus, a suboptimal position and angle of the stent endings at the portal, hepatic venous or caval veins seemed to be associated with a higher incidence of shunt failure, a finding which was seen in 8 studies (14-21), but not confirmed in 2 other studies (22, 23). In any case, shunt revision is indicated when symptoms of portal hypertension persist or recur, or after sonographic or radiological diagnosis of shunt dysfunction (24).

Catheterization of the stenosed or occluded shunt tract is the first action of shunt revision. After angiographic verification of the underlying problem, angioplasty of the stenosis, cranial elongation of the stent up to the edge of the inferior caval vein, or stent-in-stent implantation are the measures of choice (25). If shunt catheterization is not feasible or an unfortunate geometry argues against reopening of the shunt, a parallel shunt may be indicated (26-28).

This case report describes a patient with an unfortunate TIPS geometry possibly responsible for shunt occlusion with recurrence of refractory ascites. Catheterization of the occluded stent failed and parallel stenting was discarded due to anatomical reasons.

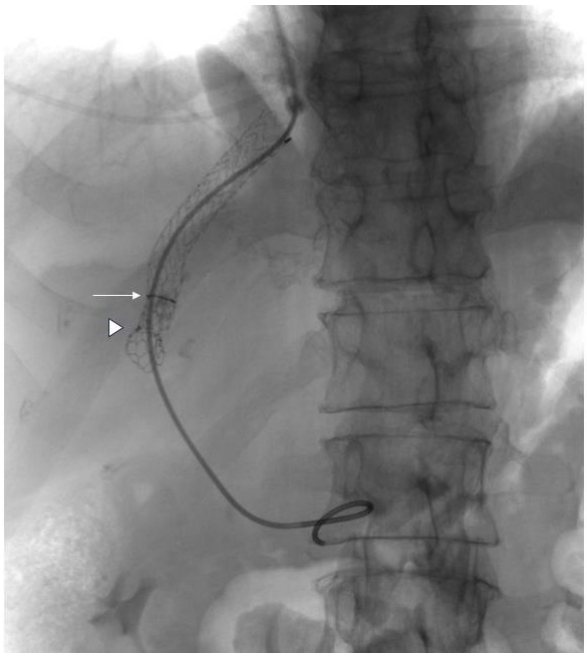
CASE PRESENTATION

A 66-year-old woman with a history of alcohol abuse developed refractory ascites.

Her laboratory values before the TIPS implantation were: haemoglobin 9.9 g/dl, platelet count 264/microliter, INR 1.1, creatinine 0.9 mg/dl, GPT 46 U/l. After having received 3 large volume paracenteses during the preceding year, TIPS implantation was performed in May 2024 using a Viatorr stent with a length of 8 cm (6 cm covering) and a diameter of 8 mm, thereby decreasing the portosystemic pressure gradient from 17 to 11 mmHg. As demonstrated in figure 1a, the Viatorr stent was slightly misplaced towards the right atrium with its proximal/cranial ending protruding into the inferior caval vein. This was associated with an incomplete covering of the distal parenchymal tract. The right portal vein branch was narrow and occupied by the uncovered mesh of the Viatorr stent (figure 1b). The main stem of the portal vein was sickle shaped and the diameter was <1 cm suggesting the presence of a mural thrombosis.

After a short ascites-free interval of 4 weeks the patient was readmitted with massive ascites again requiring paracentesis. A CT-scan demonstrated a thrombus on top of the caval stent ending and lack of stent flow assuming complete occlusion of the entire stent (figure 2a). The patient received anticoagulation with low molecular weight heparin until a revision was performed 2 weeks later.

At revision, cavography confirmed protrusion of the stent into the inferior caval vein and the thrombus on top of the stent (figure 2b). The catheterization of the stent failed including a cautious attempt of sharp entering using the TIPS puncture needle. Because of a narrow right portal vein branch which was already occluded by the stent, implantation of a parallel stent was discarded. Therefore, after introducing the catheter-needle set into the hepatic vein (figure 3a), the lateral covering of the Viatorr stent was punctured and a stiff Terumo guide wire advanced into the portal vein (figure 3b).

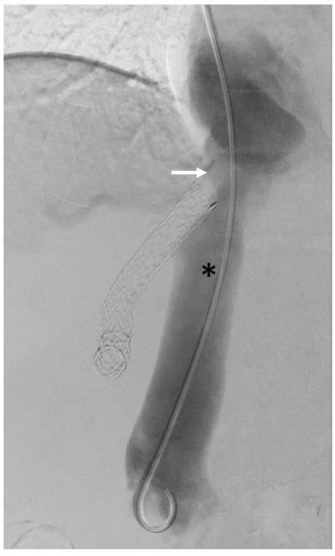


A. Primary stent implantation with proximal misplacement of the Viatorr stent towards the caval vein and lack of stent covering of the distal parenchymal tract. Arrow indicates distal end of covering (golden ring), arrow head indicates wall of the portal vein.

B. Final angiography of the primary TIPS intervention. White arrow indicates mural thrombosis of the stem of the portal vein. Please take note of the very small right portal branch.

Figure 1

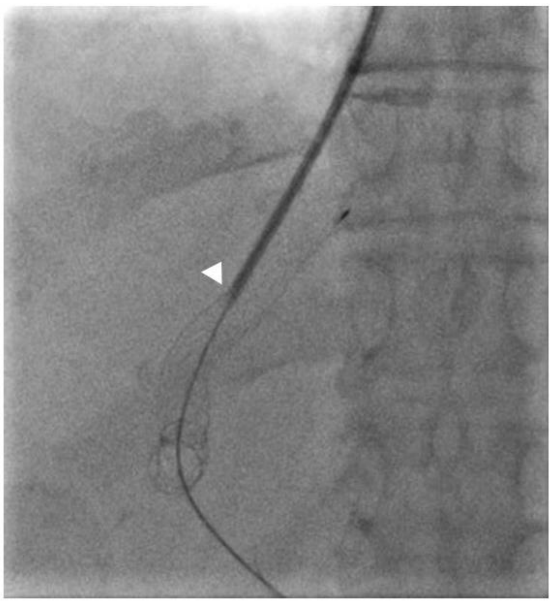
A. CT scan (coronary plain) before revision showing a cap-like thrombosis (white arrow) on top of the apparently occluded stent. Asterix indicates the inferior caval vein.



B. Angiography of the inferior caval vein at revision showing the protrusion of the stent into the inferior vaval vein, the cap-like thrombosis (arrow), and the inferior caval vein (asterix).

Figure 2

A. Introduction of the needle set (arrow) and opacification of the right hepatic vein.



B. Lateral puncture of the Viatorr-stent (arrow head) and placement of a stiff Terumo guidewire into the portal vein.

Figure 3

After dilation of the wall of the Viatorr-stent with a 6 mm balloon catheter, a pigtail catheter was advanced and a portography performed. In agreement with the CT imaging, the portal vein was patent and the stent-shunt was not opacified (not demonstrated). Direct injection of contrast dye into the stent lumen, however, revealed patency of the stent until its proximal end which was occluded by the cap-like thrombosis (figure 4a). Further dilation of the wall of the Viatorr stent using a 10 mm balloon allowed placement of a second Viatorr-stent in a y-like fashion. The final angiography showed good function of the novel shunt (figure 4b) and a drop of the pressure gradient from 17 mmHg to 11 mmHg. After the intervention, the patient received low molecular weight heparin for 2 weeks followed by a long-term treatment with 100 mg of acetylicsalicylic acid. In addition, a prophylactic antibiotic treatment for 5 days after the TIPS revision was applied. During the clinical follow-up of 3 months, ascites disappeared and creatinine improved to 0.67 mg/dl.

A. Direct injection of contrast dye into the lumen of the primary Viatorr stent showing the cap-like thrombosis at the upper end (black arrow) and patency of the rest of the stent lumen. As mentioned above (figure 1b), the right portal branch is occupied by the stent.

B. Final angiography demonstrating a patent y-shunt with perfect placement at both endings of the new Viatorr stent (white arrows). Thrombosis (black arrow).

Figure 4

CONCLUSIONS

This case demonstrates that protrusion of the stent into the inferior caval vein may cause thrombosis leading to shunt occlusion and bearing a potential risk of lung embolization. TIPS revision may increase the danger of lung embolization and should be performed only delayed and after anticoagulation. To restore secondary shunt patency, angioplasty or stent-in-stent placement are the techniques of choice. Both options require catheterization of the stent which was not successfully achieved in our patient, including a short attempt with the TIPS-puncture needle. A percutaneous transhepatic puncture of the stent in combination with a transjugular approach (25) was disregarded because of the considerable bleeding risk in a patient with refractory ascites. In view of the unfavourable geometry and the assumption that proximal stent elongation may even aggravate the underlying problem, further and more intense attempts to catheterize the stent lumen were waved. Removal of the Viatorr stent and implantation of a new stent was shortly discussed. This was seen as an option to prevent growth of the thrombosis and to establish an optimal TIPS. However, this procedure would also require stent catheterization. It may be difficult to perform, and its technical success was not predictable. Thus, a parallel TIPS seemed to be the sole option (26-28) which was, however, compromised by the very small right portal vein branch which was already occupied by the former stent. In this situation, we decided for an y-type of stenting. Lateral puncture of the Viatorr stent was performed, a guide wire advanced, and the rings of the Viatorr stent dilated. Finally, placement of a new Viatorr stent was achieved easily. This procedure avoided additional parenchymal damage, the risk of a new puncture of the portal vein, and the injury of

the small portal vein branch. After the procedure, anticoagulation was continued over 3 months and prophylactic antibiotic treatment was applied. The latter was given to reduce the risk of TIPSitis within the cavity between the new Viatorr stent and the thrombosis.

CLINICAL SIGNIFICANCE

Our case demonstrates the feasibility of y-type of stenting in a patient where stent-in-stent revision failed. Compared with parallel stenting, y-type of stenting may be preferable. It may have a lower technical risk since it does not afford portal vein puncture. In addition, the in-stenting of the distal/portal part of the primary stent may be an advantage especially in patients with small portal vein branches.

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

The authors declare that they have no competing interests.

The authors declare that they received no funding of the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

Contributions of author´s:
FB: intervention, writing; MR: intervention, writing, PR: writing. All authors read and approved the final manuscript.

References

1. Haskal ZJ, Davis A, McAllister A, Furth EE. PTFE-encapsulated endovascular stent-graft for transjugular intrahepatic portosystemic shunts: experimental evaluation. Radiology 1997;doi.org/10.1148/radiology.205.3.9393521

2. Haskal ZJ. Improved patency of transjugular intrahepatic portosystemic shunts in humans: creation and revision with polytetrafluoroethylene (PTFE) stent-grafts. Radiology 1999; DOI.org/10.1148/radiology.213.3r99dc28759

3. Wang L, Xiao Z, Yue Z, et al. Efficacy of covered and bare stent in TIPS for cirrhotic portal hypertension: A single center randomized trial. Scientific reports 2016; DOI: 10.1038/srep21011

4. Rössle M, Siegerstetter V, Euringer W, et al. The use of a polytetrafluoroethylene-covered stent graft for transjugular intrahepatic portosystemic shunt (TIPS): Long-term follow-up of 100 patients. Acta Radiol 2006;47:660-666.

5. Bercu ZL, Fischman AM, Kim E, et al. TIPS for refractory ascites: a 6-year single-center experience with expanded polytetrafluoroethylene-covered stent-grafts. AJR 2015;204:654-661.

6. Bureau C, Garcia-Pagan JC, Layrargues GP, et al. Patency of stents covered with polytetrafluoroethylene in patients treated by transjugular intrahepatic portosystemic shunts: long-term results of a randomized multicentre study. Liver int 2007; DOI: 10.1111/j.1478-3231.2007.01522.x

7. Perarnau JM, Le Gauge A, Nicolas C, et al. Covered versus uncovered stents for transjugular intrahepatic portosystemic shunt: a randomized controlled trial. J Hepatol 2014:60:962-968.

8. LaBerge JM, Ferrel LD, Ring EJ, et al. Histopathologic study of stenotic and occluded transjugular intrahepatic portosystemic shunts. J Vasc interv Radiol 2993;4:779-786.

9. Jalan R, Harrison DJ, Redhead DN, et al. Transjugular intrahepatic portosystemic stent-shunt (TIPSS) occlusion and the role of biliary venous fistulae. J Hepatol1996;24:169-176.

10. Saxon RR, Mendel-HartvigJ, Corless CL, et al. Bile duct injury as a major cause of stenosis and occlusion in transjugular intrahepatic portosystemic shunts: comparative histopathological analysis in humans and swine. J Vasc Interv Radiol 1996;7:487-497.

11. Teng GJ, Bettmann MA, Hoopes PJ, et al. Transjugular intrahepatic portosystemic shunt: effect of bile leak on smooth muscle cell proliferation. Radiology 1998;208:799-805.

12. Krajina A, Lojik M, Chovanek V, Raupach J, Hulek P. Stent-grafts in TIPS. Abdom Imaging 2004;29:53-59.

13. Wittkugel O, Koops A, Habermann C, et al. Bile resistance of coated transjugular intrahepatic portosystemic shunt stents in a flow-model. Investigative Radiology 2004;39:717-722.

14. Clark TWI, Agarwal R, Haskal ZJ, Stavropoulos SW. The effect of initial shunt outflow position on patency of transjular intrahepatic portosystemic shunts. J Vasc Interv Radiol 2004;15:147-152.

15. Cura M, Cura A, Suri R, et al. Causes of TIPS dysfunction. AJR 2008; DOI: 10.2214/AJR.07.3534

16. Luo SH, Chu JG, Huang H, et al. Effect of initial stent position on patency of transjugular intrahepatic portosystemic shunt. World J Gastroenterol 2017;23:4779-4787.

17. Klasen-Sansone J, Bode J, Lanzman RS, et al. TIPS geometry infuences patency. Z Gastroenterol 2015;53:28-32. Doi.org/10.1055/s-0034-1385430

18. Wang X, Luo X, Zhao M, et al. Prognostic factors for acute transjugular intrahepatic portosystemic shunt occlusion using expanded polytetrafluoroethylene-covered stent. Dig Dis Sci 2022; 65:3032-3039.

19. Meyer C, Paar Perez AM, Chang J, et al. Cranial stent position is independently associated with the development of TIPS dysfunction. Scientific Reports 2022; doi.org/10.1038/s41598-022-07595-5

20. Yin K, Wang X, Zheng T. Computational hemodynamic analysis for optimal stent position in the transjugular intrahepatic portosystemic shunt procedure. J Biomechanics 2022;Doi.org/10.1016//j.jbiomech.2022.111303

21. Zhan PC, Li Z, Li X, et al. A nomogram to predict the risk of stent dysfunction after TIPS in patients with hepatitis B cirrhosis. Academic Radiology 2022;29:1532-1540.

22. Andring B, Kalva SP, Sutphin P, et al. Effect of technical parameters on transjugular intrahepatic portosystemic shunts utilizing stent grafts. World J Gastroenterol 2015;21:8110-8117.

23. Cho JK, Serna J, Clark TWI, et al. Impact of PTFE-covered stent position and extension on TIPS patency. Interventional Radiology 2020;45:3915-3922.

24. Rössle M. TIPS: 25 years later. J Hepatol 2013;59:1081-1093.

25. Ferral H, Banks B, Wholey M, et al. Techniques for transjugular intrahepatic portosystemic shunt revision. AJR 1998;171:1041-1047.

26. Haskal ZJ, Ring EJ, LaBerge JM, et al. Role of parallel transjugular intrahepatic portosystemic shunts in patients with persistent portal hypertension. Radiology 1992;185:813-817.

27. Dabos KJ, Stanley AJ, RedheaDN, et al. Efficacy of balloon angioplasty, restenting, and parallel shunt insertion for transjugular intrahepatic portosystemic stent-shunt (TIPSS). Minimal Invasive Therapy & Allied Technologies 1998;7:287-293.

28. Rössle M. Interventional treatment of Budd-Chiari syndrome. Diagnostics 2023; doi.org/10.3390/diagnostics13081458.