·专　论　Special comment·

门静脉高压介入性精准分流

马婧嶔，　罗剑钧，　颜志平

【摘要】 门静脉高压是门静脉压力梯度(portal pressure gradient，PPG)病理性升高，常导致严重并发症。介入性分流如经颈静脉肝内门体分流术已逐渐成为重要治疗手段，但患者术后血流动力学变化不确定，需要精准分流以实现个体化治疗。精准分流旨在平衡分流量与肝组织血液灌注，在缓解症状的同时最小化并发症。介入性分流术后血流动力学目标确定受多种因素影响，合理的术后血流动力学目标(合理 PPG)应综合考虑术式差异与个体差异。精准分流初步临床实践强调对术前门静脉压力的准确测量以及对术后血流动力学状态的有效监测。未来研究应进一步完善介入性分流技术，以实现更为个体化和精准的治疗。

【关键词】 介入性分流；经颈静脉肝内门体分流术；精准分流；门静脉高压；门静脉压力梯度

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Interventional precision shunting for portal hypertension

MA Jingqin, LUO Jianjun, YAN Zhiping. Department of Interventional Radiology, Affiliated Zhongshan Hospital of Fudan University; National Clinical Research Center for Interventional Medicine; Shanghai Institution of Medical Imaging, Shanghai 200032, China

Corresponding author: YAN Zhiping, E-mail: yan.zhiping@zs-hospital.sh.cn

【Abstract】 Portal hypertension is a pathological elevation of portal pressure gradient (PPG), often leading to severe complications. Interventional shunting such as transjugular intrahepatic portosystemic shunt (TIPS) has gradually become an important means of treatment, but the postoperative hemodynamic changes are uncertain, therefore, individualized treatment scheme with precision shunting is needed. The purpose of precision shunting is to balance the amount of shunting blood with the amount of blood perfusion in the liver tissue, which can minimize the incidence of complications while relieving symptoms. The determination of hemodynamic goals after interventional shunting is influenced by various factors, and the procedural differences and individual variances should be taken into consideration when making reasonable postoperative hemodynamic targets (optimal PPG). The preliminary results of clinical practice of precision shunting indicates that accurate measurement of preoperative portal pressure and effective monitoring of postoperative hemodynamic status should be emphasized. Future studies should further improve the interventional shunting technique to achieve a more individualized precision treatment.

【Key words】 interventional shunting; transjugular intrahepatic portosystemic shunt; precision shunting; portal hypertension; portal pressure gradient

门静脉高压是由多种因素造成的门静脉压力梯度(portal pressure gradient，PPG)，即门静脉与下腔静脉压力差升高，约 90％由肝硬化所致门静脉血液回流阻力增高引起。门静脉高压可引发包括食管胃静脉曲张破裂出血、腹水和肝性脑病等在内多种严重并发症。食管胃静脉曲张破裂出血是肝硬化门静脉高压患者最主要死因，急性破裂出血后 6 周死亡率高达 15％～25％，50％～75％患者在 1～2 年

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作者单位：200032　上海　复旦大学附属中山医院介入治疗科、国家放射与治疗临床研究中心、上海市影像医学研究所

通信作者：颜志平　E-mail：yan.zhiping@zs-hospital.sh.cn

内会发生再出血[1]。自 1969 年起，Rösch 等率先开展系列非手术建立门体分流道的动物和临床研究[2-5]以来，以经颈静脉肝内门体分流术（transjugular intrahepatic portosystemic shunt，TIPS）为代表的介入性分流经过 50 余年发展，已成为治疗门静脉高压相关不良事件的重要手段[6-7]。随着专用覆膜支架替代传统支架、普遍构建较小直径（8 mm）分流道以及可控直径覆膜支架的应用，介入性分流技术成功率和分流道稳定性得到了极大提升，但仍不理想。介入性分流后血流动力学变化的不确定性促使我们需要进行基于“危险分层、个体化治疗”的介入性精准分流，以更好地满足患者特定需求和病情变化。

1　介入性精准分流概念

介入性精准分流是指采用各种微创技术在门静脉系统与体静脉之间建立低阻力通道，分流多余的门静脉血液、将门静脉压力降至合理水平，既能缓解门静脉高压所带来的严重并发症，又能维持肝内必要的门静脉血流灌注。一般来说，分流量越大，PPG 下降越多，曲张静脉再出血及腹水发生率就越低。然而肝组织血供主要来自门静脉，过大的分流量可能会导致门静脉血流灌注减少，从而损害肝功能。此外过多含氮物质未经肝脏代谢直接进入体循环，增加了肝性脑病发生率[8-9]。因此，介入性精准分流需要仔细平衡分流量和肝组织血液灌注，以在最大程度地缓解症状的同时最小化潜在不良作用。

2　TIPS 是最常用介入性分流术

介入性分流涵盖多种分流途径，包括肝内门静脉与肝静脉之间分流（如 TIPS）、肝内门静脉与肝段下腔静脉之间分流[如直接肝内门体静脉分流术（direct intrahepatic portocaval shunt，DIPS）]、门静脉侧支与肝静脉之间分流（分流道部分在肝外）以及其他潜在的分流途径（如利用自发性分流道进行分流和介入性脾-肾分流等）。目前，TIPS（包括改良或辅助 TIPS）是最主要、最常用分流途径。TIPS 通过在肝内门静脉与肝静脉间构建一低压快速分流道，引导部分门静脉血流直接通过肝静脉进入体循环，缓解门静脉系统高压力、高流量的血流动力学状态。2003～2013 年美国 TIPS 手术量增长 19.4%，占总门体分流手术量 86%[10]。多项国内外指南[11-15]均推荐 TIPS 作为挽救内科治疗失败患者急性曲张静脉破裂出血一线治疗方案，也是预防高危患者食管胃曲张静脉再出血、治疗胃曲张静脉破裂出血和顽固性腹水的安全有效手段。

3　分流道理想状态

介入性精准分流后理想的血流动力学状态是将 PPG 降至合理水平，这既能有效缓解临床症状，又能最大限度保持肝脏血流灌注。因此，理想的分流道应在确保仅分流多余门静脉系统血流的同时具备良好的通畅性和稳定性。分流道通畅性对于维持分流功能至关重要，而分流道稳定性则有助于减少术后并发症发生。

4　介入性精准分流关键是分流道直径

介入性分流后血流动力学变化受多种因素影响，包括肝硬化病因、病理学分期、肝脏储备功能、肝脏体积、曲张静脉严重程度，门静脉直径、压力、流速，分流途径，分流道角度、长度、直径等[16]。其中分流道直径是最关键、最直接的影响因素。理论上，直径较大的分流道可有更好的通畅性和降压效果，但这也可能导致分流后肝功能损害和肝性脑病发生率升高。目前直径 6～10 mm 分流道均有报道。国外肝硬化患者肝硬化病因、适应证及肝脏体积等与国内不同，多采用直径 10 mm 或 8～10 mm 可控直径支架。我国由于多数肝硬化患者有乙型肝炎病史，肝脏体积较小，更倾向于采用 6～8 mm 小直径分流道[17-18]。现有研究表明，8 mm 分流道与10 mm分流道相比具有相似的通畅率及再出血率，而术后肝性脑病发生率及总生存期（OS）则有显著获益[19-20]。对于肝脏体积较小患者，采用 6 mm 分流道可进一步降低显性肝性脑病发生率，且不影响支架通畅率或再出血率[18]。尽管亚扩张的分流道可能在术后 6 个月内被动扩张至标准直径[21]，但对于老年患者或有肝性脑病史患者，这种允许门静脉压力逐渐降低的技术仍值得考虑[22]。最新可控直径支架在一定程度上解决了亚扩张后分流道被动扩张问题，减少了患者因术后肝性脑病和心力衰竭再次住院情况[23-24]。

5　合理的术后血流动力学目标（合理 PPG）

术后 PPG 是评价介入性分流后血流动力学改变的常用指标。尽管目前认为术后 PPG 应控制在

5～12 mmHg(1 mmHg = 0.133 kPa)或较术前下降 50%～60%[25-27],但其合理性值得进一步探讨。首先,大多数关于血流动力学目标的研究是在覆膜支架广泛应用前进行,并未得到充分更新。裸支架直径往往会随着时间推移而缩小,这导致术后 PPG 逐渐升高,可能需要更低(过度)PPG(<12 mmHg)以维持降压效果。覆膜支架良好的长期通畅性能够对抗裸支架分流直径逐渐减小,允许较高的术后 PPG(<14 mmHg)以维持肝脏血供,减少相关并发症[28]。

其次,PPG 测量方法和时间点也会对血流动力学目标造成影响。PPG 是指门静脉和下腔静脉(而非右心房)之间压力梯度,由于右心房压力始终低于下腔静脉压力,门静脉-右心房压力梯度可能会高估 PPG,导致支架扩张过度[29]。TIPS 术后即刻 PPG 可能受多种因素影响,如分流后因回心血量增加所致的血流动力学异常、门静脉高压出血引起的血流动力学不稳定、血管活性药物使用、全身麻醉及深度镇静等。术后延迟 2～4 d 行 PPG 可能比即刻 PPG 能更有效地预测术后 1 年内静脉曲张再出血[26]。

最后,术后合理 PPG 决策还应充分考虑个体差异,如年龄、肝功能、肝/脾组织硬度或体积、心功能及营养不良/肌肉萎缩等[30]。不同肝功能分级患者对术后 PPG 耐受性不同,合理 PPG 应根据 Child-Pugh 分级进行调整,以实现在降低压力和减少相关不良事件之间达到平衡。对于 Child-Pugh 分级 C 级患者,术后 PPG<14 mmHg 可能更为合理[31]。分流前 PPG 与白蛋白之比,对 TIPS 术后 6 个月内肝硬化腹水具有一定预测作用[32]。

6　TIPS 精准分流初步临床实践

门静脉高压介入性精准分流的前提是精准测定压力。肝静脉压力梯度(hepatic venous pressure radient,HVPG)虽然是目前较常用的术前门静脉压力测量方法,但肝内静脉-静脉分流(intrahepatic veno-venous shunt,IHVS)有会削弱其准确反映 PPG 的能力[33]。此外,在非窦性肝硬化患者中,HVPG 与实际门静脉压力之间相关性和一致性较低。对于上述两种类型患者,应该使用细针穿刺肝内门静脉进行压力测定。PPG 应选择门静脉-下腔静脉而非门静脉-右心房之间的压力梯度,门静脉-下腔静脉对曲张静脉再出血的预测能力更佳[29]。

7　结语

介入性分流是治疗门静脉高压相关不良事件的重要手段,已逐步替代外科性分流成为有效降低门静脉压力最直接方法。介入性精准分流终极目标是仅分流多余门静脉血流,将门静脉压力降至合理水平,这既能缓解临床症状,又能维持肝脏灌注。这一目标的实现需要后续更深入研究以及更先进的分流器械,以便临床根据个体化制定的合理术后血流动力学目标精确控制分流道。

[参 考 文 献]

[1] Garcia-Tsao G, Abraldes JG, Berzigotti A, et al. Portal hypertensive bleeding in cirrhosis: risk stratification, diagnosis, and management: 2016 practice guidance by the American Association for the Study of Liver Diseases[J]. Hepatology, 2017, 65: 310-335.

[2] Palmaz JC, Sibbitt RR, Reuter SR, et al. Expandable intrahepatic portacaval shunt stents: early experience in the dog[J]. AJR Am J Roentgenol, 1985, 145: 821-825.

[3] Colapinto RF, Stronell RD, Gildiner M, et al. Formation of intrahepatic portosystemic shunts using a balloon dilatation catheter: preliminary clinical experience[J]. AJR Am J Roentgenol, 1983, 140: 709-714.

[4] Burgener FA, Gutierrez OH. Nonsurgical production of intrahepatic portosystemic venous shunts in portal hypertension with the double lumen balloon catheter (author's transl)[J]. Rofo, 1979, 130: 686-688.

[5] Rösch J, Hanafee W, Snow H, et al. Transjugular intrahepatic portacaval shunt. An experimental work[J]. Am J Surg, 1971, 121: 588-592.

[6] 颜志平, 罗剑钧. 重视经门脉系统的介入诊治[J]. 介入放射学杂志, 2009, 18: 561-562.

[7] 马婧嶔, 罗剑钧. "TIPS 先行"的临床实践与探索[J]. 肝脏, 2019, 24: 1097-1099.

[8] Ma L, Ma J, Zhang W, et al. Acute hepatic ischemia after transjugular intrahepatic portosystemic shunt creation despite preserved arterial perfusion[J]. J Vasc Interv Radiol, 2021, 32: 1510-1512.

[9] Kloster ML, Ren A, Shah KY, et al. High incidence of hepatic encephalopathy after viatorr controlled expansion transjugular intrahepatic portosystemic shunt creation[J]. Dig Dis Sci, 2021, 66: 4058-4062.

[10] Perry BC, Kwan SW. Portosystemic shunts: stable utilization and improved outcomes, two decades after the transjugular intrahepatic portosystemic shunt[J]. J Am Coll Radiol, 2015, 12: 1427-1433.

[11] Pericleous M, Sarnowski A, Moore A, et al. The clinical management of abdominal ascites, spontaneous bacterial peritonitis and hepatorenal syndrome: a review of current guidelines and recommendations[J]. Eur J Gastroenterol Hepatol, 2016, 28: e10-e18.

[12] European Association for the Study of the Liver. EASL clinical practice guidelines for the management of patients with decompensated cirrhosis[J]. J Hepatol,2018,69:406-460.

[13] Chinese College of Interventionalists. CCI clinical practice guidelines:management of TIPS for portal hypertension (2019 edition)[J]. Zhonghua Gan Zang Bing Za Zhi, 2019, 27: 582-593.

[14] Tripathi D, Stanley AJ, Hayes PC, et al. Transjugular intrahepatic portosystemic stent-shunt in the management of portal hypertension[J]. Gut,2020,69:1173-1192.

[15] 曹家伟,丁鹏绪,段　峰,等. 中国门静脉高压经颈静脉肝内门体分流术临床实践指南(2019 年版)[J]. 临床肝胆病杂志,2019,35:2694-2699.

[16] 任洪成,王　斌,邵长刚,等. 不同支架肝静脉端形态对经颈静脉肝内门体分流术后疗效的影响[J]. 介入放射学杂志,2023,32:1001-1005.

[17] Wang XZ,Liu GF,Wu JC,et al. Small-diameter transjugular intrahepatic portosystemic shunt versus endoscopic variceal ligation plus propranolol for variceal rebleeding in advanced cirrhosis[J]. Radiology,2023,308:e223201.

[18] Yan H, Xiang Z, Zhao C, et al. 6-mm shunt transjugular intrahepatic portosystemic shunt in patients with severe liver atrophy and variceal bleeding[J]. Eur Radiol, 2024, 34: 4697-4707.

[19] Wang Q,Lv Y,Bai M,et al. Eight millimetre covered TIPS does not compromise shunt function but reduces hepatic encephalopathy in preventing variceal rebleeding[J]. J Hepatol,2017,67:508-516.

[20] Trebicka J, Bastgen D, Byrtus J, et al. Smaller-diameter covered transjugular intrahepatic portosystemic shunt stents are associated with increased survival[J]. Clin Gastroenterol Hepatol,2019,17:2793. e1-2799. e1.

[21] Borghol S,Perarnau JM,Pucheux J,et al. Short-and long-term evolution of the endoluminal diameter of underdilated stents in transjugular intrahepatic portosystemic shunt[J]. Diagn Interv Imaging,2016,97:1103-1107.

[22] Liu J,Ma J,Zhou C,et al. Potential benefits of underdilation of 8-mm covered stent in transjugular intrahepatic portosystemic shunt creation[J]. Clin Transl Gastroenterol,2021,12:e00376.

[23] Miraglia R, Maruzzelli L, Di Piazza A, et al. Transjugular intrahepatic portosystemic shunt using the new gore viatorr controlled expansion endoprosthesis: prospective, single-center, preliminary experience[J]. Cardiovasc Intervent Radiol,2019,42:78-86.

[24] Praktiknjo M,Abu-Omar J,Chang J,et al. Controlled underdilation using novel VIATORR® controlled expansion stents improves survival after transjugular intrahepatic portosystemic shunt implantation[J]. JHEP Rep,2021,3:100264.

[25] de Franchis R, Bosch J, Garcia-Tsao G, et al. Baveno Ⅶ-renewing consensus in portal hypertension[J]. J Hepatol, 2022,76:959-974.

[26] Ma L, Ma J, Zhang W, et al. Predictive power of portal pressure gradient remeasured shortly after transjugular intrahepatic portosystemic shunt[J]. Hepatol Int, 2023, 17: 417-426.

[27] Biecker E,Roth F,Heller J,et al. Prognostic role of the initial portal pressure gradient reduction after TIPS in patients with cirrhosis[J]. Eur J Gastroenterol Hepatol,2007,19:846-852.

[28] Bosch J. Small diameter shunts should lead to safe expansion of the use of TIPS[J]. J Hepatol,2021,74:230-234.

[29] Ma L,Liu Y,Yan Z,et al. Comparing the predictive ability of portoatrial and portocaval gradient after transjugular intrahepatic portosystemic shunt creation for variceal rebleeding[J]. J Gastroenterol,2023,58:494-502.

[30] 曹俊杰,姚志超,刘占鳌,等. 个体化经颈静脉肝内门体分流术血流动力学模拟研究[J]. 介入放射学杂志,2023,32:17-21.

[31] Xia Y, Tie J, Wang G, et al. Individualized portal pressure gradient threshold based on liver function categories in preventing rebleeding after TIPS[J]. Hepatol Int, 2023, 17: 967-978.

[32] Zhao D,Zhang G,Wang M,et al. Portal pressure gradient and serum albumin:a simple combined parameter associated with the appearance of ascites in decompensated cirrhosis treated with transjugular intrahepatic portosystemic shunt[J]. Clin Mol Hepatol,2019,25:210-217.

[33] Ma J,Gong X,Luo J,et al. Impact of intrahepatic venovenous shunt on hepatic venous pressure gradient measurement[J]. J Vasc Interv Radiol,2020,31:2081-2088.

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