



## Short Report

# Transjugular intrahepatic portosystemic shunt placement increases feasibility of colorectal surgery in cirrhotic patients with severe portal hypertension



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## ABSTRACT

**Background:** Colorectal resection in cirrhotic patients is associated with high mortality and morbidity related to portal hypertension and liver insufficiency.

**Methods:** This retrospective study evaluated the clinical outcomes of cirrhotic patients who underwent transjugular intrahepatic porto-systemic shunt (TIPS) placement before colorectal resection for cancer. Main outcomes measures were postoperative morbidity and mortality rates.

**Results:** TIPS placement was successful in all eight patients and significantly decreased the mean hepatic venous pressure gradient from  $15.5 \pm 2.9$  to  $7.5 \pm 1.9$  mmHg ( $p = 0.02$ ). Surgical procedures included right colectomy ( $n = 3$ ), left colectomy ( $n = 2$ ), and proctectomy with total mesorectal excision ( $n = 3$ ). Postoperatively, two patients (25%) died of multiple organ failure. The overall postoperative morbidity rate was 75%, and major complications were seen in 25%.

**Conclusion:** Portal decompression via TIPS placement may enable selected cirrhotic patients with severe portal hypertension to undergo colorectal resection for cancer.

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## 1. Introduction

Despite improvements in surgical techniques and preoperative management, extra-hepatic abdominal surgery remains a major challenge in patients with cirrhosis [1–4]. The mortality rate of such patients undergoing elective abdominal extra-hepatic surgery ranges from 10% to 57% [5]. Moreover, irrespective of cirrhosis, colorectal surgery is considered a high-risk form of surgery in terms of morbidity and mortality [6]. Indeed, a recent French prospective multicentre study reported that colorectal resection was associated with a 3.4% mortality rate and a 35% morbidity rate [7]. Patient age above 70 years, neurological comorbidity, being underweight (body weight loss of >10% in the last 6 months), and emergency surgery comprise the four-item predictive score of postoperative mortality (the AFC score), which has been prospectively validated [8]. However, little is known about the risk of

colorectal surgery in cirrhotic patients, with the exception of two small single-centre studies that reported mortality rates from 24% to 26% [9,10].

Many predictive factors of postoperative mortality have been previously reported, including severe liver impairment and severe portal hypertension [11]. Severe portal hypertension may affect prognosis because it causes preoperative ascites and oesophageal varices, can contribute to excessive intraoperative bleeding and complex coagulopathy, and provokes new-onset or worsening postoperative ascites [3].

The use of surgical porto-systemic shunts has been proven to facilitate extra-hepatic abdominal surgery in cirrhotic patients, reducing the degree of portal hypertension [12]. Transjugular intrahepatic porto-systemic shunt (TIPS) placement represents an alternative option to the surgical shunt. Azoulay et al. [13] proposed this “two-step strategy” for extra-hepatic surgery, and it has also been demonstrated in extra-hepatic abdominal surgery [5,17]. However, few studies have reported the outcome of this strategy in colorectal surgery. The present study determined postoperative morbidity and mortality rates of colorectal surgery in cirrhotic patients undergoing neoadjuvant TIPS placement.

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## 2. Materials and methods

### 2.1. Study population

Between 2006 and 2012, a total of 8 consecutive cirrhotic patients underwent TIPS placement before elective colorectal resection for cancer. These patients were deemed inoperable because of underlying cirrhosis complicated by severe portal hypertension. This diagnosis was based on hepatic venous portal gradient measurement, a history of variceal bleeding, varices at risk of bleeding, and/or refractory ascites.

### 2.2. TIPS procedure

The same protocol was used for all patients. Under general anaesthesia, a 9F sheath was positioned through the right internal jugular vein. The right hepatic vein was catheterized, and a transhepatic puncture to the right portal vein was performed with a Rhor® needle. Portal venography was performed to evaluate the portal anatomy, and a portocaval pressure measurement was systematically performed before dilatation of the transhepatic track with an 8-mm balloon. A nitinol stent was placed from the hepatic vein to the portal vein. This endoprosthesis was completed by a covered stent through the transhepatic track to prevent TIPS thrombosis. The diameter of the prosthesis was 7–10 mm, and it had a mean length of 100 mm. Intrastent dilatation, selective embolization of splanchnic varices using coils or plugs (systematically carried out to prevent haemorrhage), and a final porto-caval pressure measurement were systematically performed. The functionality of the shunt was systematically checked 24 h after the procedure using Doppler ultrasonography (US). We did not perform anticoagulation measures after the procedure. Antibiotic prophylaxis agents were systematically administered within 24 h of the TIPS procedure. All patients were followed up by Doppler US after the TIPS procedure until the day before the colorectal surgery.

### 2.3. End points

The primary end-point was the 90-day postoperative mortality rate. Based on the study by Gil et al. [5], we selected a cut-off of 13 for the model for end-stage liver disease (MELD) score. Secondary end-points were the incidence of postoperative complications (liver failure, encephalopathy, infections, and anastomotic leakage) and the length of hospital stay.

### 2.4. Statistical analysis

Continuous variables were expressed as the mean  $\pm$  standard deviation (SD), or median and interquartile range with a skewed distribution. Categorical variables were expressed as percentages. Linear association was analysed using the chi-squared ( $\chi^2$ ) or Fisher's exact test. *p*-values less than 0.05 were considered significant. Neither univariate nor multivariate analysis was performed because of the small sample size.

## 3. Results

### 3.1. Population characteristics

The changes in clinical parameters before and after TIPS placement are summarized in Table 1. The TIPS procedure was uneventful in all patients. The hepatic venous pressure gradient decreased significantly from  $15.5 \pm 2.9$  to  $7.5 \pm 1.9$  mmHg ( $p = 0.01$ ). Embolization of oesophageal varices was performed in six patients. One patient experienced mild encephalopathy that responded to oral medications.

**Table 1**

Patient characteristics before and after Transjugular Intrahepatic Portosystemic Shunt placement.

	Before TIPS (%)	After TIPS (%)	<i>p</i> value
<i>N</i>		8	
Mean age (years)		58.7 $\pm$ 6.5	
Male patients <i>n</i> (%)		6 (80)	
Alcoholic cirrhosis <i>n</i> (%)		7 (88)	
ASA score			
2		3 (38)	
3		5 (62)	
Previous encephalopathy <i>n</i> (%)	0 (0)	0 (0)	
Esophageal varices <sup>a</sup> <i>n</i> (%)			
Grade 1	1 (13)	2 (13)	
Grade 2	3 (37)	3 (37)	
Grade 3	2 (25)	1 (25)	
Rupture	2 (25)	2 (25)	
Gastric varices <i>n</i> (%)	3 (38)	2 (25)	0.2
Ombilical vein permeation <i>n</i> (%)	3 (38)	3 (38)	0.9
Rectal varices <i>n</i> (%)	1 (13)	1 (13)	0.9
Preoperative ascites <i>n</i> (%)	7 (88)	3 (38)	0.04
Child–Pugh score <i>n</i> (%)			0.05
A	2 (25)	4 (50)	
B	2 (25)	2 (25)	
C	4 (50)	2 (25)	
MELD score <i>n</i> (%)			0.06
<13	5 (62)	6 (75)	
>13	3 (38)	2 (25)	

ASA, American Society of Anesthesiologists; MELD, Model for End-stage Liver Disease; TIPS, Transjugular Intrahepatic Portosystemic Shunt.

<sup>a</sup> Post-TIPS endoscopy was performed in only one patient.

All patients underwent colorectal surgery after TIPS placement with a delay ranging from 1 to 9 weeks. Among them, three patients with rectal cancer underwent surgery after neoadjuvant chemoradiotherapy. Surgical procedures included right colectomy ( $n = 2$ ), left colectomy ( $n = 3$ ), and proctectomy with total mesorectal excision ( $n = 3$ ) (Table 2). The mean operative time was  $125 \pm 27.3$  min (range, 90–170 min). Six patients (80%) required postoperative drainage. Six anastomoses (80%) were of the mechanical type.

### 3.2. Postoperative course

Operative mortality occurred in two patients, 30 and 60 days after the resection of right and left colon cancer, respectively. These two patients had the highest MELD score of the series before TIPS placement (14 and 15 points, respectively). Anastomoses were not diverted in these patients, and they required a second operation because of clinical anastomotic leakage on postoperative days 10 and 21, respectively. Diversions were achieved in both cases, with a Hartmann procedure or ileocolostomy. Both developed terminal liver failure and died of multiple organ failure.

The overall postoperative morbidity rate was 75%. According to Clavien–Dindo classification, 25% were major (Grade III and higher). The mean hospital stay was  $25 \pm 15$  days (range, 10–60 days; Table 2). Colorectal cancer staging showed that two patients were T2N0M0, three were T3N0, one was T3N0M0, one deceased patient was T3N2M0, and the second deceased patient was T4N0M0. All patients except one had node-negative colorectal cancer, but the mean number of lymph nodes was eight, suggesting that adequate surgery was performed. No serious haemorrhage during resection was encountered.

### 3.3. Long-term follow-up

TIPS patency was monitored postoperatively and found to be complicated by partial thrombosis, which was responsive to anti-coagulant treatment in two patients: one at 6 months and the other

**Table 2**  
Postoperative outcomes of the cirrhotic 8 patients undergoing colorectal surgery.

PT	Age	MELD	Clavien	Child–Pugh	Weeks between TIPS and surgery	Type of colorectal resection	Neoadjuvant Radio-chemotherapy	Type of surgery	Diverting loop	Medical complications	Surgical complications	Death	Follow-up (months)
1	73	7	1	C10	5	Sigmoidectomy	No	Laparotomy	No	None	None	No	13
2	57	14	5	C10	2	Right colectomy	No	Laparoscopy	No	None BP, MOF	Anastomotic leakage, ileus	Yes (POD 21)	1
3	61	15	5	B9	1	Left colectomy	No	Laparotomy	No	HE, MOF, haemorrhage, venous thrombosis	Anastomotic leakage, ileus	Yes (POD 64)	2
4	59	8	1	C10	5	Right colectomy	No	Laparotomy	No	None	None	No	68
5	55	9	3	A5	9	Proctectomy with TME	Yes	Laparotomy	Yes	None	Intra-abdominal abscess, ileus	No	40
6	57	8	2	A6	8	Proctectomy with TME	Yes	Laparotomy	Yes	Ascites, pneumonia	None	No	38
7	58	12	2	B7	9	Proctectomy with TME	Yes	Laparotomy	Yes	Ascites	Ileus	Yes (cancer recurrence)	12
8	54	10	4	A5	5	Right colectomy	No	Laparotomy	No	Liver failure, Ascites	Ileus	No	17

MELD, model for end-stage liver disease; TME, Total Mesorectal Excision; POD, Post-Operative Day; HE, hepatic encephalopathy; TIPS, Transjugular Intrahepatic Portosystemic Shunt; MOF, multiorgan failure; BP, bacterial peritonitis.

20 months after the TIPS procedure. All stoma closures were performed after a mean follow-up time of 3 months. The postoperative courses of these were uneventful. Five patients (67.5%) were alive without recurrence of primary disease after a mean follow-up of time of  $31.6 \pm 15.2$  months (range, 13–68 months). One patient died 12 months after colorectal surgery, following cancer recurrence.

**4. Discussion**

The present study suggests that portal decompression by TIPS placement before colonic and rectal resection for cancer in cirrhotic patients with severe portal hypertension is worthwhile. Moreover, to our knowledge, this is the first report to show the benefit of rectal resection in such cases. This “two-step strategy” enables colorectal resection with total mesorectal excision to be performed in these patients, and is associated with an acceptable mortality and morbidity rate. As shown in the literature, the available series are quite small, and only 21 cases (excluding cases report) have been published to date. With the exception of two cases of colonic surgery that reported no mortality [5,14], the mortality rate of patients with cirrhosis complicated by severe portal hypertension undergoing elective resection after preoperative TIPS placement ranges from 16% to 40%. Our intraoperative and postoperative complication rates are therefore consistent with previously published studies [9,10].

Preoperative preparation before major abdominal surgery in cirrhotic patients is crucial to minimize morbidity and mortality rates [4,15,16]. Portal decompression via TIPS placement may reduce the risk of intraoperative bleeding and perioperative complications in patients with cirrhosis undergoing surgery, but experience is limited and controversial. Although Azoulay et al. [13] previously reported that preoperative TIPS reduces the varices around the tumoural area and achieves portal decompression, thus reducing the risk of intraoperative bleeding, Vinet et al. observed no improvement in postoperative outcomes [14]. In the present study, preoperative TIPS placement significantly decreased the hepatic venous pressure gradient with no per-procedure mortality. In our study, three patients with rectal cancer underwent surgery after chemo-radiotherapy and were alive after a mean follow-up time of 26 months. Moreover, the 3 patients who needed neoadjuvant chemotherapy before surgery had refractory ascites. All of them underwent successful TIPS placement with complete ascites regression, and neoadjuvant chemoradiotherapy was feasible.

Two patients with the highest MELD scores of the series died after colorectal resection without diverting loops. This suggests that patients with MELD scores above 13 should not undergo direct anastomosis without diverting loops. Moreover, we also recommend that such patients receive close follow-up in the intensive care unit during the first postoperative days.

Despite preoperative TIPS placement, we report an overall morbidity rate of 75%, which is markedly higher than the 48% [10] and 51% [16] previously reported. This difference could be explained by the fact that only major complications were considered in these previous studies. By contrast, like Meunier et al. [9], we reported all complications including minor ones. In our study, 62.5% of patients were alive without recurrence after 3 years.

One limitation of the current study is the small number of patients reported. Nevertheless, this series represents the largest reported experience to date of patients with preoperative TIPS undergoing colorectal resection for cancer in the published literature [5,11,13,14,17].

In conclusion, portal decompression via TIPS placement may allow cirrhotic patients with severe portal hypertension to undergo colorectal resection for cancer with acceptable rates of short-term morbidity and mortality. Currently, oncologists may contraindicate chemotherapy treatment for patients with poor liver function, but

we suggest that preoperative TIPS placement is necessary to allow preoperative chemo-radiotherapy to be mandatory in rectal cancer. However, even if TIPS placement is feasible, patients with a high MELD score should undergo protective anastomosis during colorectal resection because of the high mortality rate observed in this study caused by anastomotic leakage.

#### Conflict of interest

None declared.

#### References

- [1] Csikesz N, Nguyen L, Yseng J, et al. Nationwide volume and mortality after elective surgery in cirrhotic patient. *Journal of the American College of Surgeons* 2008;208:96–103.
- [2] Paugam-Burtz C. Cirrhose et risque opératoire. *La Presse Médicale* 2011;40:17–23.
- [3] Garrison R, Cryer H, Howard D, et al. Clarification of risk factors for abdominal operations in patients with hepatic cirrhosis. *Annals of Surgery* 1984;199:648–54.
- [4] Rice H, O'Keefe G, Helton W, et al. Morbid prognostic features in patients with chronic liver failure undergoing nonhepatic surgery. *Archives of Surgery* 1997;132:880–5.
- [5] Gil A, Regueira-Martinez F, Hernandez-Lizoain JL, et al. The role of transjugular intrahepatic portosystemic shunt prior to abdominal tumoral surgery in cirrhotic patients with portal hypertension. *European Journal of Surgical Oncology* 2004;30:46–52.
- [6] Nguyen G, Correia A, Thuluvath P. The impact of cirrhosis and portal hypertension on mortality following colorectal surgery: a nationwide population based study. *Diseases of the Colon and Rectum* 2009;52:1367–74.
- [7] Alves A, Panis Y, Mathieu P, et al. Postoperative mortality and morbidity in French patients undergoing colorectal surgery: results of a prospective multicenter study. *Archives of Surgery* 2005;140:278–83.
- [8] Alves A, Panis Y, Manton G, et al. The AFC score: validation of a 4-item predicting score of postoperative mortality after colorectal resection for cancer or diverticulitis: results of a prospective multicenter study in 1049 patients. *Annals of Surgery* 2007;246:91–6.
- [9] Meunier K, Mucci S, Quentin V, et al. Colorectal surgery in cirrhotic patients: assessment of operative morbidity and mortality. *Diseases of the Colon and Rectum* 2008;51:1225–31.
- [10] Metcalf A, Dozois R, Wolff B, et al. The surgical risk of colectomy in patients with cirrhosis. *Diseases of the Colon and Rectum* 1987;30:529–31.
- [11] Schlenker C, Johnson S, Trotter JF. Preoperative transjugular intrahepatic portosystemic shunt (TIPS) for cirrhotic patients undergoing abdominal and pelvic surgeries. *Surgical Endoscopy* 2009;23:1594–8.
- [12] Schwartz SI. Biliary tract surgery and cirrhosis: a critical combination. *Surgery* 1981;90:577–83.
- [13] Azoulay D, Buabse F, Damiano I, et al. Neoadjuvant transjugular intrahepatic portosystemic shunt: a solution for extrahepatic abdominal operation in cirrhotic patients with severe portal hypertension. *Journal of the American College of Surgeons* 2001;193:46–51.
- [14] Vinet E, Perreault P, Bouchard L, et al. Transjugular intrahepatic portosystemic shunt before abdominal surgery in cirrhotic patients: a retrospective, comparative study. *Canadian Journal of Gastroenterology* 2006;20:401–4.
- [15] Mansour A, Watson W, Shayani V, et al. Abdominal operations in patients with cirrhosis: still a major surgical challenge. *Surgery* 1997;122:730–6.
- [16] Wong R, Rappaport W, Witte C, et al. Risk of nonshunt abdominal operation in the patient with cirrhosis. *Journal of the American College of Surgeons* 1994;179:412–6.
- [17] Kim JJ, Dasika NL, Yu E, et al. Cirrhotic patients with a transjugular intrahepatic portosystemic shunt undergoing major extrahepatic surgery. *Journal of Clinical Gastroenterology* 2009;43:574–9.