

Supplementary File

The present electronic supplementary material was prepared for the manuscript “**Unlocking the Potential of TIPS Placement as a Bridge to Elective and Emergency Surgery in Cirrhotic Patients: A Meta-Analysis and Future Directions for Endovascular Resuscitation in Acute Care Surgery**”. For questions about the information herein contained, please get in touch with the corresponding author:

Ramiro Manzano-Nunez MD

e-mail address: ramiro.manzano@autonoma.cat

Universitat Autònoma de Barcelona

Barcelona, Spain

This supplement contains the following items:

1. Search Strategies

2. Risk of Bias within studies:

Figure S1. Risk of bias assessment of case series and comparative studies according to MINORS

Figure S2. Critical appraisal of case reports according to the Joanna Briggs Institute Critical appraisal tool for case reports

3. Table S1 Study’s objectives/case characteristics as reported in each manuscript

4. Table S2 – Patients’ features demonstrating portal hypertension and history of liver-related events (LREs)

1. Search strategies:

1. Scopus (results= 321 documents):

(TITLE-ABS-KEY ({transjugular intrahepatic portosystemic shunt}) OR TITLE-ABS-KEY (tipss) OR TITLE-ABS-KEY ({percutaneous intrahepatic portosystemic shunt}) AND TITLE-ABS-KEY ({extrahepatic surgery}) OR TITLE-ABS-KEY ({major surgery}) OR TITLE-ABS-KEY ("preoperative") OR TITLE-ABS-KEY ("perioperative") OR TITLE-ABS-KEY ({abdominal surgery}))

2. MEDLINE (results=243 documents):

1. Exp Portosystemic Shunt, Transjugular Intrahepatic/
2. Percutaneousous transhepatic intrahepatic portosystemic shunt.mp.
3. Percutaneous portosystemic shunt*.mp.
4. Transjugular intrahepatic Portosystemic Shunt*.mp.
5. Percutaneous Intrahepatic Portosystemic Shunt*.mp.
6. Intrahepatic Portosystemic Shunt*.mp.
7. TIPSS.mp.
8. Prophylactic TIPS.mp.

9. Preoperative transjugular intrahepatic portosystemic shunt*.mp.
10. Perioperative transjugular intrahepatic portosystemic shunt*.mp.
11. Pre-surgical.mp.
12. Abdominal surgery.mp.
13. Exp General surgery/
14. Major surgery.mp.
15. Extrahepatic surgery.mp.
16. Exp Perioperative Care/
17. Exp Perioperative Period
18. Perioperative.mp.
19. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
20. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
21. 19 and 20

2. Risk of Bias Within studies:

Figure S1. Risk of bias assessment of case series and comparative studies according to MINORS

									In the case of comparative studies				
	Comparative study?	A clearly stated aim	Inclusion of consecutive patients	Prospective collection of data	Endpoint appropriate to the study aim	Unbiased evaluation of endpoints	Follow-up appropriate to the major endpoint	Loss to follow-up not exceeding 5%	A control group having the gold standard intervention	Contemporary groups	Baseline equivalence of groups	Prospective calculation of the sample size	Statistical analyses adapted to the study design
Azoulay 2001	No	Green	Yellow	Red	Yellow	Red	Yellow	Green					
Fagan 2004	No	Yellow	Yellow	Red	Yellow	Red	Yellow	Yellow					
Gil 2004	No	Green	Red	Red	Yellow	Red	Yellow	Yellow					
Vinet 2006	Yes	Green	Green	Red	Green	Red	Green	Green	Green	Green	Green	Red	Yellow
Kim 2009	No	Green	Green	Red	Green	Red	Green	Green					
Schlenker 2009	No	Green	Yellow	Red	Yellow	Red	Yellow	Green					
Telem 2010	No	Yellow	Yellow	Red	Yellow	Red	Green	Green					
Schmitz 2019	No	Green	Yellow	Red	Green	Yellow	Green	Green					
Tabchouri 2019	Yes	Green	Green	Red	Green	Red	Green	Green	Green	Green	Green	Red	Green
Goel 2020	No	Green	Yellow	Red	Yellow	Red	Green	Green					
Aryan 2022	Yes	Green	Green	Red	Green	Red	Green	Green	Green	Green	Green	Red	Yellow
Chang 2022	Yes	Green	Green	Red	Green	Yellow	Green	Green	Green	Green	Green	Red	Green

Figure S2. Critical appraisal of case reports according to the Joanna Briggs Institute’s Critical appraisal tool for case reports

The JBI’s critical appraisal tools can be found on the JBI’s website (<https://jbi.global/critical-appraisal-tools>). The critical appraisal tool for case reports assesses the quality and relevance of case reports by evaluating six characteristics that the reporting of case reports should include (see figure). Each domain is scored as Yes (green), No (red), and Unclear (yellow). The results of the latter evaluation are represented in the following figure:

	Were patient’s demographic characteristics clearly described?	Was the patient’s history clearly described and presented as a timeline?	Was the current clinical condition of the patient on presentation clearly described?	Were diagnostic tests or assessment methods and the results clearly described?	Was the intervention(s) or treatment procedure(s) clearly described?	Was the post-intervention clinical condition clearly described?	Were adverse events (harms) or unanticipated events identified and described?	Does the case report provide takeaway lessons?
Moulin 1995	Green	Green	Yellow	Green	Yellow	Yellow	Yellow	Green
Amstrong 1998	Green	Green	Green	Green	Yellow	Yellow	Yellow	Green
Guglielmi 1999	Green	Green	Green	Green	Green	Green	Green	Green
Grubel 2002	Green	Green	Yellow	Green	Yellow	Yellow	Yellow	Green
Norton 2003	Green	Yellow	Yellow	Green	Green	Yellow	Yellow	Green
Catalano 2005	Green	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green
Semiz-Oysu 2007	Green	Green	Green	Green	Green	Green	Green	Green
Minicozzi 2010	Green	Green	Green	Green	Green	Green	Green	Green
Theruvath 2010	Green	Green	Green	Green	Green	Yellow	Yellow	Green
Beccq 2015	Green	Green	Green	Green	Yellow	Yellow	Yellow	Green
Liverani 2015	Green	Yellow	Yellow	Green	Green	Yellow	Yellow	Green
de Andres 2016	Green	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green
Jabbar 2016	Green	Green	Green	Green	Yellow	Green	Yellow	Green
Masood 2020	Green	Yellow	Yellow	Green	Green	Yellow	Yellow	Green
Kapeleris 2022	Green	Green	Yellow	Green	Yellow	Yellow	Yellow	Green

3. Table S1 Study’s objectives or case characteristics as reported in each manuscript

Author/y	Year	Objective/case characteristics
Moulin 1995	1995	"In the present report, we describe a patient in whom TIPS allowed palliative laser resection of an adenocarcinoma of the esophagus covering esophageal varices"
Amstrong 1998	1998	"We report a case of perforated diverticular diseases of the sigmoid colon, with intra-abdominal abscess, in a patient with severe portal hypertension and varices. Three-dimensional reconstruction of theabdominopelvic computed tomography angiographic scan illustrated the need for preoperative portal system decompression with TIPS before sigmoid diverticular disease resection"
Guglielmi 1999	1999	"We report herein a cirrhotic patient with early gastric cancer, presenting with gastroesophageal varices and severe hypertensive gastropathy, who underwent TIPS to reduce portal hypertension and was subsequently treated with endoscopy mucosal resection"
Azoulay 2001	2001	"The present study reports our experience with seven consecutive cirrhotic patients deemed inoperable because of complicated severe portal hypertension who were prepared for major abdominal surgery by TIPS"
Grubel 2002	2002	"We observed two patients with Child-Pugh class C cirrhosis and severe portal hypertension; one had been diagnosed with sigmoid colon cancer requiring"

		sigmoidectomy, the other, with renal cell carcinoma requiring nephrectomy. To limit their operative risk of bleeding from abdominal and retroperitoneal varices, transjugular intrahepatic portosystemic shunts (TIPS) were placed preoperatively to decompress the portal system and reduce blood flow through portosystemic collaterals."
Norton 2003	2003	"We describe a case in which curative gastric resection was performed for carcinoma of the stomach after a preoperative TIPS and embolization of a large gastric varix in a patient with portal hypertension"
Fagan 2004	2004	"Here, we describe the combined use of TIPS and urgent umbilical hernia repair in 3 patients with refractory ascites. Two patients who presented with frank rupture of an umbilical hernia and leaking ascites were managed initially by TIPS followed by hernia repair. A third patient presenting with ascites and gangrenous intact skin overlying an umbilical hernia (indicating impending rupture) required emergent umbilical hernia repair followed by a TIPS procedure postoperatively."
Gil 2004	2004	"The present study reports our experience with three cirrhotic patients with abdominal tumours deemed inoperable because of their portal hypertension who were prepared for major abdominal surgery by TIPS."
Catalano 2005	2005	"We report the case of a 63-year-old male patient referred to our institution for recalcitrant epigastric pain in the setting of CTP A6 alcoholic liver cirrhosis. Endoscopy revealed the presence of a 3-cm ulcer located in the gastric antrum in association with Grade 2 distal esophageal varices with no red cherry spot marks. Histology of the bioptic sample was consistent with gastric adenocarcinoma. The patient was referred to preoperative TIPSS to reduce the surgical morbidity and allow for safe nodal dissection"
Semiz-Oysu 2007	2006	"We performed TIPS procedure in two patients prior to cardiac surgery with the use of cardiopulmonary bypass in order to reduce the increased risks associated with portal hypertension."
Vinet 2006	2006	"In the present study, using retrospective design, we evaluated the postoperative morbidity and mortality rates after major abdominal surgery in cirrhotic patients with or without preoperative TIPS placement"
Kim 2009	2009	The aim of this study is to assess the outcomes in consecutive cirrhotic patients who had achieved portal decompression via a TIPS before major abdominal or thoracic surgery
Schlenker 2009	2009	"Placement of TIPS also has been reported for a small number of patients with cirrhosis and portal hypertension undergoing abdominal surgery to prevent complications. We have had success with the use of TIPS for this indication and report our experience"
Minicozzi 2010	2010	"This case shows that the use of minimally invasive procedures is effective and can improve the results of complex operations even in patients with severe cirrhosis". 70-year-old male affected by alcoholic cirrhosis underwent neoadjuvant transjugular intrahepatic portosystemic shunt before surgery
Telem 2010	2010	"This study represents our institutional experience with the management and outcome after umbilical herniorrhaphy in one of the larger series of patients with advanced cirrhosis and refractory ascites. The purpose of our hospital-based study was to assess variables influencing short and long-term outcome after herniorrhaphy"
Theruvath 2010	2010	"This report presents a case with neoadjuvant TIPS placement in a patient with Child-Turcotte-Pugh Class B cirrhosis and portal hypertension closely followed by surgical resection of an insulinoma and synchronous sigmoid adenocarcinoma"
Becq 2015	2015	"We report the case of a 67-year-old cirrhotic patient who presented with GAVE related GIB, unresponsive to multiple endoscopic treatments. The patient had a good liver function (model for end-stage disease 10). After a multidisciplinary meeting, a transjugular intrahepatic portosystemic shunt

		(TIPS) procedure was performed, in order to treat the cirrhosis associated ascites. The outcome was successful. An antrectomy was then performed, with no recurrence of (gastrointestinal bleeding) GIB and no transfusion need during three months of follow up. In this case, the TIPS procedure achieved a complete ascites regression, allowing a safer surgical treatment of the GAVE-related GIB."
Liverani 2015	2015	"We retained preoperative the trans-jugular porto-systemic shunt in the patients with elevated portal pressure and gastric cancer to perform a gastrectomy more safely and to decrease morbidity and mortality of these cases."
de Andres 2016	2016	"We present the case of a patient with achalasia and gastroesophageal varices due to alcoholic cirrhosis in whom a TIPS was inserted preoperatively and varices were embolized, with subsequent laparoscopic fundoplication and Heller myotomy."
Jabbar 2016	2016	We report on a patient undergoing portal decompression via TIPS prior to a whipple resection
Schmitz 2019	2019	"The goal of this study was to determine the percentage of patients who underwent abdominal operation following preoperative TIPS creation and to understand the relationship between preoperative TIPS and perioperative outcomes"
Tabchouri 2019	2019	"The aim of this study was to compare the morbidity and mortality following elective extrahepatic abdominal surgery between cirrhotic patients with preoperative TIPS placement (in a bridge to surgery setting) and cirrhotic patients without TIPS"
Goel 2020	2020	"We describe our experience of TIPS to facilitate nonhepatic surgery in the setting of patients with liver cirrhosis and established portal hypertension"
Masood 2020	2020	"We report a caso of a patient with early-stage colon cancer and large caput medusae, who underwent Transjugular Intra-hepatic Postosystemic Shunt (TIPS) in order to decompress the periumbilical veins to allow for surgical resection of the colon cancer"
Aryan 2022	2022	"We investigated the utility of perioperative TIPS in patients with cirrhosis undergoing abdominal surgery by analyzing postoperative complications when compared to cirrhotics undergoing abdominal surgery without TIPS"
Chang 2022	2022	"This retrospective study aimed to investigate the impact of preoperative TIPS placement on ACLF development and mortality in patients with liver cirrhosis undergoing surgery"
Kapeleris 2022	2022	"We present two patients who underwent TIPSS as a bridge procedure and their outcomes"

4. Table S2 – Patients’ features demonstrating portal hypertension and history of liver-related events (LREs)

Author/y	Year	Study type	HVPG pre-TIPS (mmHg)	HVPG post-TIPS (mmHg)	Presence/history of esophageal varices before TIPS?	History of previous LRE/decompensated cirrhosis?
Moulin 1995	1995	CR	25	8	Yes: Grade 3	Yes, variceal bleeding
Amstrong 1998	1998	CR	NR	NR	Yes: "large portal venous varices"	Yes, Child-C cirrhosis
Guglielmi 1999	1999	CR	32	22	Yes, not graded.	Yes, ascites

Azoulay 2001	2001	CS	18 (5)*	9 (5)*	Yes, in all. Grade 2 in 3/7, grade 3 in 3/7. Not graded in 1	Yes, history of variceal bleeding in 5/7 patients and a history of ascites in 3.
Grubel 2002	2002	CR	Case 1: 17 Case 2: 26	Case 1: 8 Case 2: 14	Case 1: history of variceal bleeding, Case 2: history of variceal bleeding	Yes. Case 1: ascites and variceal bleeding. Case 2: ascites, variceal bleeding, and HE.
Norton 2003	2003	CR	16	12	Yes, presented with bleeding esophageal varices	Yes, variceal bleeding.
Fagan 2004	2004	CS	NR	NR	NR	Yes, ascites in all 3 patients
Gil 2004	2004	CS	Case 1: 22 Case 2: 20, Case 3: 28	Case 1: 7 Case 2: 7, Case 3: 7	Yes: grade 3 in two cases. Grade 2 in one case.	Yes, variceal bleeding in 1 patient.
Catalano 2005	2005	CR	20	5	Yes: grade 2	NR
Semiz-Oysu 2007	2006	CR	Case 1: 19, Case 2: 20	Case 1: 5, Case 2: 10	Case 1: grade 3, Case 2: grade 2	Yes, ascites in 1 patient.
Vinet 2006	2006	Comparative study	21.4 (3.9)	8.4 (3.4)	Yes, history of variceal bleeding in 5 patients.	Yes. History of ascites in 7/18. Previous HE=3/18.
Kim 2009	2009	CS	19.6 (5.5)	8.7 (2.9)	NR	Yes, previous HE in 42%, history of ascites in 71%
Schlenker 2009	2009	CS	Case 1: 12, Case 2: unknown, Case 3: 12, Case 4: 9, Case 5: 22, Case 6: unknown, Case 7: 21	Case 1: 4, Case 2: unknown, Case 3: 8, Case 4: 7, Case 5: 10, Case 6: 3, Case 7: 8	Yes, present in 3/7 patients. History of variceal bleeding in 2/7 patients.	Yes, previous LRE in 6/7 patients.
Minicozzi 2010	2010	CR	31	19	Yes, not graded	NR
Telem 2010	2010	CS	NR	NR	NR	Yes, previous LRE in 4/6 patients.

Theruvath 2010	2010	CR	27	10	Yes, not graded	Yes, ascites
Becq 2015	2015	CR	NR	NR	NR	Yes, ascites and variceal bleeding
Liverani 2015	2015	CR	NR	NR	Yes, history of variceal bleeding	Yes, variceal bleeding
de Andres 2016	2016	CR	NR	NR	Yes, not graded.	Yes, ascites
Jabbar 2016	2016	CR	NR	NR	Grade B esophageal varices	NR
Schmitz 2019	2019	CS	14.3 (4.6)*	4.9 (1.7)*	Yes, present in 18/21 (85.7%)	Yes, History of variceal bleeding: 5 (23%), History of ascites: 13 (61%), History of HE: 7 (33%)
Tabchouri 2019	2019	Comparative study	13.8 (6-23)**	5.4 (1-11)**	Yes: Grade 1 in 8 (14%), Grade 2 in 19 (33%), Grade 3 in 21 (37%)	Yes, ascites in 20 (30%).
Goel 2020	2020	CS	NR	Post TIPS gradient: 5 (1-13)**	NR	Yes, ascites or variceal bleeding in 4/21.
Masood 2020	2020	CR	11 mmHg	NR	Yes	NR
Aryan 2022	2022	Comparative study	16.3 (4.6)*	5.3 (2.3)*	Yes, previous variceal bleeding in 8 (29%)	Yes. Ascites in 26 (93%), variceal bleeding in 8 (29%), HE in 13 (46%)
Chang 2022	2022	Comparative study	NR	NR	Grade 1: 11 (24%), Grade 2: 13 (29%), Grade 3: 11 (24%)	Yes. History of ascites: 35 (77%). History of variceal bleeding: 18 (40%). History of HE: 8 (17%)
Kapeleris 2022	2022	CR	Case 1: 33, Case 2: 22	Case 1: 7, Case 2: 19	Yes	Yes, ascites in 1 patient.

CS: Case series, CR: Case report, HE: hepatic encephalopathy, *mean and SD, **median and range, NR: not reported