

Transjugular intrahepatic porto-systemic shunt in the elderly: Palliation for complications of portal hypertension

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refractory ascites alone ($n = 9$), hepatic hydrothorax alone ($n = 2$), refractory ascites and hydrothorax ($n = 1$), gastrointestinal bleeding alone ($n = 8$), gastrointestinal bleeding and ascites ($n = 3$).

RESULTS: Of these 23 attempted TIPS procedure patients, 21 patients had technically successful TIPS procedures. A total of 29 out of 32 TIPS procedures including revisions were successful in 21 patients with a mean age of 72.1 years (range 65-82 years). Three of the procedures were unsuccessful attempts at TIPS and 8 procedures were unsuccessful revisions of our existing TIPS. Sixteen of 21 patients who underwent successful TIPS (excluding 5 patients lost to follow-up) were followed for a mean of 14.7 mo. Ascites and/or hydrothorax was controlled following technically successful procedures in 12 of 13 patients. Bleeding was controlled following technically successful procedures in 10 out of 11 patients.

CONCLUSION: We have demonstrated that TIPS is an effective procedure to control refractory complications of portal hypertension in elderly patients.

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Abstract

AIM: To present a dedicated series of transjugular intrahepatic porto-systemic shunts (TIPS) in the elderly since data is sparse on this population group.

METHODS: A retrospective review was performed of patients at least 65 years of age who underwent TIPS at our institutions between 1997 and 2010. Twenty-five patients were referred for TIPS. We deemed that 2 patients were not considered appropriate candidates due to their markedly advanced liver disease. Of the 23 patients suitable for TIPS, the indications for TIPS placement was portal hypertension complicated by

Key words: Transjugular intrahepatic porto-systemic shunt; Portal hypertension; Elderly; Ascites; Cirrhosis

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INTRODUCTION

Transjugular intrahepatic porto-systemic shunt (TIPS) is a proven therapy for the treatment of complications of portal hypertension in adults with cirrhosis. However, there is limited data on the use of this modality in the elderly.

Cirrhosis is the 10th leading cause of death in the United States^[1]. Variceal bleeding is the most dreaded complication of chronic liver disease with a 30 d mortality of 20%. Standard therapies including endoscopic variceal sclerotherapy/ligation/banding and pharmacological management have proved useful in controlling bleeding for up to 90% of patients. Ascites is the most common of the major complications of cirrhosis. Medical treatment for symptomatic ascites includes sodium restriction, diuretics and/or paracentesis. Definitive long term treatment of refractory ascites and or variceal bleeding involves usually either liver transplantation or use of a portosystemic shunt. TIPS is a relatively new technique whereby a portosystemic shunt is created entirely within the liver. TIPS has been performed primarily in young to middle aged adults and to a lesser extent in children. The experience of TIPS in the elderly has been limited to a case report^[2]. Consequently, the technical and physiological limitations as well as the clinical results are not well described. Although the methods used to perform TIPS in the elderly is similar to that in younger adults, special consideration in the elderly include the presence of comorbidities leading to reduced overall life expectancy. In addition, a lesser potential for hepatocellular regeneration seems to exist in the elderly, which may ironically lead to longer shunt patency^[3]. In this article we report the results of TIPS placement in a group of elderly patients with severe portal hypertension, not responsive to medical management.

MATERIALS AND METHODS

All patients were referred to our institutions and were deemed appropriate candidates for TIPS due to a significant complication of portal hypertension, including refractory ascites, hydrothorax and/or, bleeding not responsive to medical management. Relative contraindications included severe pulmonary hypertension or limited cardiopulmonary reserve. Between 1997 and 2010, a total of 25 patients were greater than 65 years of age were referred for a possible TIPS procedure of which 23 were deemed suitable for TIPS. In these patients, the indication for TIPS was refractory ascites alone ($n = 9$), hepatic hydrothorax alone ($n = 2$), refractory ascites and hydrothorax ($n = 1$), gastrointestinal bleeding alone ($n = 8$), gastrointestinal bleeding and ascites ($n = 3$). Model for end-stage liver disease (MELD) score was calculated for each patient^[4]. MELD score is calculated by the United Network for Organ Sharing modification of the original

formula: MELD score = $9.6 \times \log_e$ (creatinine mg/dL) + $3.8 \times \log_e$ (bilirubin mg/dL) + $11.2 \times \log_e$ (INR) + 6.4. Meld and Child Pugh score for each individual patient are shown in Table 1. Technical details are shown in Table 2. Comorbidities are shown in Table 3.

TIPS placement technique

Anesthesiology consultation was utilized to provide sedation. We started the procedure with catheterization of the hepatic vein with a balloon occlusion catheter. The hepatic vein was then occluded with the balloon and carbon dioxide was injected into the hepatic vein. As the carbon dioxide preferentially opacified the portal vein, the portal vein was able to be targeted. In four patients a computerized tomography guided percutaneous metallic marker was inserted just anterior to the right portal vein to assist targeting. A curved cannula was advanced over a guidewire from the right internal jugular vein into a hepatic vein. A sheathed needle was then advanced through the liver parenchyma into the right branch of the portal vein. The resultant portal vein tract was then dilated and catheterized. The shunt tract was dilated with an angioplasty balloon ranging from 8 mm to 10 mm, and a self-expanding metallic stent with a maximal diameter of 10 mm to 12 mm *vs* a covered stent with a maximal diameter of 10 mm was utilized. A self expanding metallic stent, WALLSTENT (Boston Scientific Natick, MA) or covered stent VIATORR (WL Gore and Associates, Elkton, MD) was deployed across the tract to support the shunt channel. Four patients underwent CT localization of the portal vein using a technique developed by Fontaine *et al*^[5]. (Patients No. 6, No. 7, No. 8, No. 23). Due to advances in technology the last 17 patients received covered stents (VIATORR). Finally, portal venography and pressure measurements were performed to assess the extent of portal decompression.

Follow-up assessments were performed by examination by the gastroenterologist in addition to ultrasonography. Ultrasonography was routinely performed, after TIPS placement, at 3 mo, and then at 6 mo intervals following TIPS placement (when patients were compliant). Ultrasonographic evaluation included assessment of patency, measurement of maximum peak systolic velocity, direction of flow in the vein, and the presence of ascites/hydrothorax. Transjugular portal venography followed by shunt revision was performed in patients with recurrent symptoms or when ultrasonography demonstrated shunt dysfunction.

RESULTS

Technical results

A total of 29 out of 32 TIPS procedures including revisions were successful in 21 patients with a mean age of 72.1 (range 65-82) years old. Three of the procedures were unsuccessful attempts at TIPS and 8 procedures were successful revisions of our existing TIPS. Sixteen of 21 patients who underwent successful TIPS (exclud-

Table 1 Patient characteristics and clinical results

Patient	Sex, age (yr)	Underlying condition	Indication for TIPS	Previous treatment	Child pugh score	MELD score	Survival post shunt	Complications and follow-up
1	F (76)	Hepatitis B	Hydrothorax, refractory ascites	Numerous thoracenteses, furosemide	B (9)	9	25 mo, expired	transient encephalopathy (grade 1 to 2) 1 episode < 30 d, 6 episodes over 24 mo, pulm, edema x 1
2	M (78)	Celiac sprue	Refractory ascites	Numerous paracenteses, spironolactone	C (10)	7	41 mo, expired	Encephalopathy (grade 1 to 2) > 30 d 6 episodes over 40 mo
3	M (71)	Cryptogenic cirrhosis	Refractory ascites	Numerous paracenteses, spironolactone	B (8)	16	8 mo, expired	None
4	F (80)	Cryptogenic cirrhosis	Hepatic hydrothorax	Numerous thoracenteses, spironolactone	C (11)	11	3.5 mo, expired	Encephalopathy transient grade 1 (2 episodes at 30 d and 3 mo)
5	M (69)	Sclerosing cholangitis	Refractory ascites	Numerous paracenteses, spironolactone	C (12)	17	3 mo, expired post attempted shunt	None
6	M (65)	Alcoholic cirrhosis	Hepatic hydrothorax	Numerous thoracenteses, spironolactone, lasix	B (9)	15	19 mo liver transplant, still alive	Encephalopathy transient grade 1 (1 episode > 30 d and < 3 mo)
7	M (71)	Alcoholic cirrhosis	Refractory ascites	Numerous paracenteses, spironolactone, lasix	C (10)	13	3 mo, expired	Encephalopathy transient grade 1 (3 episodes > 30 d)
8	F (70)	Hepatitis C	Refractory ascites, skin breakdown	Numerous paracenteses, spironolactone, lasix	B (8)	9	2nd TIPS placed at 21 mo due to occlusion of 1st TIPS expired 47 mo post initial TIPS	None
9	F (66)	Hepatitis C	Acute bleeding		B (7)	9	Lost to fu pt in Spain	None
10	F (72)	Cryptogenic	Acute bleeding, refractory ascites	Paracentesis, propranolol, lactulose, protonix	B (9)	12	10 mo lost to fu	None
11	F (72)	Hepatitis C	Acute bleeding	Sclerotherapy, spleno-renal shunt x 2, numerous paracentesis, lasix, spironolactone	B (8)	9	Liver transplant 18 mo after TIPS, still alive	None
12	F (67)	Hepatitis B portal vein thrombosis	Acute bleeding	Octreotide, protonix	C (10)	10	Liver transplant 16 mo after TIPS, still alive	None
13	M (74)	Hepatitis C (end stage liver disease)	Refractory ascites	Aldactone, lasix, lactulose, protonix	B (8)	15	2 wk, expired	Transient encephalopathy grade 1 (< 2 wk)
14	F (68)	Hepatitis C	Acute bleeding	Midodrine	B (7)	24	2 mo, expired	Recurrent GI bleed 3 wk required revision
15	M (69)	Cryptogenic	Acute bleeding	4 unsuccessful banding, lasix, spironolactone, lactulose, paracentesis	C (10)	21	Revision required 48 h after liver transplant 11 mo after revision, still alive	Continued bleed after 1st TIPS, stopped after revision
16	F (73)	NASH cirrhosis	Acute bleeding	Octreotide, protonix, spironolactone, lasix	B (9)	11	25 mo, still alive	Minimal ascites
17	M (71)	Cryptogenic	Acute bleeding	Band ligation-not successful	B (8)	16	Lost to fu	None
18	M (82)	Cryptogenic	Refractory ascites, acute bleeding	Numerous paracentesis, lasix, amiloride	B (9)	16	2 wk expired (AV block-DNR/DNI)	None
19	M (73)	Hepatitis C	Refractory ascites	Numerous paracenteses, Spironolactone, lasix s/p kidney and liver tx	B (9)	14	1 mo lost to fu	None
20	F (78)	Hepatitis C	Acute bleeding, refractory ascites		B (8)	18	5 d, expired	Post-procedural bleeding, encephalopathy (< 30 d), ascites
21	M (71)	Cirrhosis	Acute bleeding		B (8)	11	Status unknown, discharged to rehabilitation hospital	None
22	M (66)	Alcoholic cirrhosis, s/p liver transplant, portal vein thrombosis	Refractory ascites	Lasix	B (9)	8	Unknown	Failed attempted TIPS
23	M (76)	Alcoholic cirrhosis	Refractory ascites	Numerous paracenteses (once a week)	B(8)	12	15 mo, still alive	None

Table 2 Technical details and results

Patient	Procedure time (min)	Success	No. of stents	Stent type (mm)	Balloon size (mm)	Portosystemic gradient (mmHg)	Revision dates
1	195	No	N/A	N/A	N/A	N/A	
1	150	Yes	2	10 × 68	10	6-9	
2	160	Yes	2	10 × 68	8	8	
Revision 2	165	Yes	1	12 × 90	10	5	Revision 3 wk
Revision 2	105	Yes	1	12 × 90	10	10-12	Revision 8 mo
Revision 2	90	Yes	1	12 × 90	10	6-8	Revision 32 mo
3	140	Yes	1	12 × 90	10	3-4	
4	65	Yes	1	10 × 94	8	3-5	
5	127	No	N/A	N/A	N/A	N/A	
6	165	Yes	1	10 × 60 ¹	8	12	
7	235	Yes	1	10 × 70 ¹	8	13	
8	135	Yes	2	8 × 60 ¹	8	12	
Revision 8	120	Yes	2	8 × 6 ¹	8	10	New Parallel TIPS 21 mo
9	15	Yes	1	8 × 70 ¹	8	5	
10	Unavailable	Yes	1	10 × 80 ¹	10	7	
Revision 10	50	Yes	1	Unavailable	Unavailable	Unavailable	Revision 10 mo
11	50	Yes	2	10 × 80 ¹	10	10	
12	70	Yes	1	10 × 80 ¹	10	4	
13	150	Yes	1	10 × 80 ¹	10	3	
14	35	Yes	1	10 × 60 ¹	10	6	
Revision 14	Unavailable	Yes	1	Unavailable	Unavailable	Unavailable	Revision 3 wk
15	35	Yes	1	10 × 70 ¹	10	13	
Revision 15	18	Yes	1	Unavailable	Unavailable	Unavailable	Revision 48 h
16	55	Yes	1	10 × 80 ¹	10	2	
17	65	Yes	1	10 × 80 ¹	10	8	
18	30	Yes	1	10 × 80 ¹	10	4	
19	85	Yes	2	10 × 60 ¹	10	4	
Revision 19	Unavailable	Yes	1	12 × 60 ¹	10	Unavailable	Unavailable
20	Unavailable	Yes	1	10 × 80 ¹	8	4	
21	Unavailable	Yes	1	8 × 80 ¹	8	2	
22	Unavailable	No	N/A	N/A	N/A	N/A	
23	135	Yes	1	10 × 70 ¹	8	8	

¹Denotes Viatorr (W.L Gore, Elkton, MD) covered stent use.

ing 5 patients lost to follow-up) were followed for a mean of 14.7 mo. Ascites and/or hydrothorax was controlled following technically successful procedures in 12 out of 13 patients. Bleeding was controlled following technically successful procedures in 10 out of 11 patients. Two patients in whom TIPS could not be placed had portal vein thrombosis; thus, the portal vein could not be successfully catheterized. Only 4 patients were candidates for orthotopic liver transplantation. The mean duration of the procedures was 101 min (range 15-235 min). The created shunt size was 8-10 mm in diameter in all patients. Four patients received WALLSTENT bare metal stents, 17 patients received the VIATORR covered stents (Tables 1 and 2).

Clinical results

Complications: All complications were clinical complications. There were no technical complications. Within 30 d after TIPS placement, 4 patients (Patient No. 1, No. 4, No. 13 and No. 20) experienced mild transient grade I - II encephalopathy. In 3 out of 4 of these patients, this was controlled with medical therapy. One (patient No. 20) out of this 4 died due to failure to cure within 5 d as a result of continued gastrointestinal bleeding. One

patient experienced pulmonary edema, which was readily controlled with diuretics. Early death (< 3 mo) occurred in 2 patients at 2 wk and 1 patient at 2 mo following TIPS for an early death rate of 14% (3 of 21). Of these early deaths the average MELD score was 18.3. This is compared to 12.0 for the average MELD score of the rest of the patients who underwent successful TIPS. Technical issues corrected by successful revisions (also not considered complications) of TIPS within 30 d included 2 patients (Patient No. 14, No. 15) for continued gastrointestinal bleeding and 2 for recurrent ascites (Patient No. 2, No. 19). Failure to cure (inability to durably control bleeding), which is not considered a complication occurred in 1 patient [1 of 11 (9%)] who died (Patient No. 20 at 5 d).

Follow-up

Of the 21 patients who underwent successful TIPS placement, 10 were followed until their death and 6 patients are still alive for an overall mean follow-up of 14.7 mo. In addition, 3 patients were lost to follow-up immediately after the procedure, whereas 1 patient was lost to follow-up at 1 mo and 1 patient was lost to follow-up at 10 mo.

Table 3 Comorbidities

Patient	
1	Hypothyroidism, diabetes mellitus, hypertension, chronic GI bleed, hypoxemia on home oxygen
2	Celiac sprue, recurrent chronic bleeding from esophageal varices
3	Congestive heart failure, s/p CABG, s/p mitral valve replacement, chronic atrial fibrillation, hypertension
4	Aortic stenosis
5	Noninsulin dependent diabetes mellitus, chronic renal failure, cholecystectomy, bilateral hernia repair
6	None
7	None
8	None
9	None
10	Status post lumpectomy, diabetes type 2, basal cell carcinoma of the skin, some masculinizing tumor of the ovary for which the patient has had a bilateral salpingo-oophorectomy, hypertension
11	Cholecystectomy, diabetes mellitus
12	Breast cancer in 1996 status post modified radical mastectomy, history of portal vein thrombosis in 2002 secondary to tamoxifen
13	Aortic stenosis; coronary artery disease, status post 3-vessel CABG; diabetes mellitus; and bilateral lower extremity cellulitis.
14	End-stage renal, diabetes, GERD, diverticulitis
15	Hypertension
16	Coronary artery disease (CAD), hyperlipidemia, Anemia
17	Peptic ulcer disease, obstructive sleep apnea, gastroesophageal reflux disease, myeloproliferative disorder, diabetes, aortic stenosis, status post aortic valve replacement in 1996, coronary artery disease
18	Severe aortic stenosis, chronic renal insufficiency, BPH, sinus bradycardia with mobitz type I AV block
19	Renal failure, status post transplant, cryoglobulinemia, BPH, hypothyroidism
20	Hypothyroid, coagulopathy
21	Prostate cancer, CHF, AFib, COPD, hypertension, CVA, respiratory failure, history of MRSA and VRE
22	Spontaneous bacterial peritonitis, status post liver transplant, hypertension, diabetes, portal vein thrombosis
23	CAD, hiatal hernia

Ascites, hepatic hydrothorax, and/or bleeding was controlled in 20 of 21 (95%) patients who underwent successful TIPS. Fifteen out of 21 patients maintained shunt integrity with no need for shunt revision. Patient No. 2 required repeat shunt revision for restenosis at 8 and 32 mo. All revisions in this patient were done with an uncovered stent since covered stents were not yet available. One patient (Patient No. 10) required a revision at 10 mo due to restenosis from a bile duct puncture. This was corrected with a covered stent. Patient No. 8 developed recurrent ascites at 20 mo due to an occluded shunt and therefore underwent a parallel TIPS creation with resolution of ascites. Patient No. 14 and 15 underwent successful shunt revision at 3 wk and 48 h respectively due to recurrent bleeding for patient No. 14 and persistent bleeding for patient No. 15. Patient No. 19 required shunt revision at 3 wk for recurrent ascites. One patient (No. 3) who developed recurrent ascites 5 mo post procedure was successfully treated using diuretic therapy without paracentesis. This patient's TIPS was patent. The patient (No. 5) in whom a shunt could not be placed due to chronic portal vein thrombosis developed renal and hepatic failure 6 wk post attempt and died 3 mo post attempted procedure.

Two patients (No. 1 and No. 2) developed chronic gastrointestinal bleeding later on in the course of their illness. Both of these patients had successful TIPS which were demonstrated to be patent on long-term follow up. Patient No. 1 had gastric vascular ectasias (watermelon stomach) and colonic angiodysplasia without variceal hemorrhage. This patient did have a total of six (3-5 d) admissions for grade II encephalopathy. Patient No. 2

was diagnosed with nonvariceal gastric bleeding. A total of 16 hospital admissions (between 3-5 d admissions) from 10/98 to 06/01 occurred. Of those admissions, 6 were secondary to grade II encephalopathy, 2 were secondary to concurrent grade II encephalopathy and anemia, and 4 were secondary to anemia alone.

Five patients (Patient No. 1, No. 2, No. 4, No. 6 and No. 7) experienced an episode of grade I to II encephalopathy beyond 30 d post procedure which required admission. All patients responded to oral lactulose therapy. The rest of the patients did not experience encephalopathy beyond 30 d.

Patient No. 4, No. 11, No. 12 and No. 15 received liver transplantation at 19, 18, 16, and 11 mo respectively. These patients continued to remain alive. Of patients who underwent successful TIPS who did not undergo liver transplant, average follow up was 14.7 mo. This includes patients who are either dead or currently alive and excludes the 5 patients who were lost to follow-up.

DISCUSSION

TIPS is an accepted treatment of portal hypertension related complications which are not amenable to medical management^[6]. TIPS has been successful in the young and middle aged adult population, as well as even the pediatric population^[7]. Published literature regarding TIPS and the elderly population is scarce. Our report suggests that TIPS may be performed safely and successfully in the elderly population.

Because liver transplantation is often not an option for elderly patients, TIPS can provide palliative relief in

this population who may otherwise require multiple hospitalizations and/or repeated paracenteses/thoracenteses or endoscopic therapy. Consensus opinion suggests that TIPS for ascites is indicated in appropriate patients if the frequency of paracentesis is greater than 3 times per month, the patient does not tolerate paracentesis, or if the paracentesis is contraindicated/ineffective^[8,9]. TIPS is also useful for hepatic hydrothorax^[9-12]. For portal hypertensive bleeding, polytetrafluoroethylene (PTFE)-covered stent TIPS is indicated after failure of endoscopic therapy and/or medical treatment. Additionally, early use of TIPS is now advocated to reduce treatment failure and mortality^[13].

It is imperative that appropriate evaluation is performed prior to consideration of the patient for TIPS. Unlike other age groups such as the pediatric and younger adult population, the justification of TIPS as a “bridge to transplantation” does not usually exist in the elderly. Therefore, based on prognostic criteria TIPS should not be performed in elderly patients with markedly advanced liver disease whose survival is limited.

The duration of 101 min was comparable to the TIPS procedure time reported for younger patients (60-120 min). There were no irreversible or catastrophic complications that were encountered during this small series. Complications in the younger adult population include shunt closure, hemorrhage, encephalopathy, portal vein occlusion, and liver failure. Our 30 d complications included 4 patients with mild reversible hepatic encephalopathy and 1 case of reversible pulmonary edema. Three out of 21 patients experienced early death (2 patients at 2 wk and one patient at 2 mo). It should be noted of these early death patients that the average MELD score was 18.3 (range 15-24) *vs* 12.0 in the rest of the patients who underwent successful TIPS creation. Of note the MELD score was calculated in retrospect in patients 1, 2, 3, 4, and 5 as MELD scores were not in use at that time period. Our failure to cure includes 1 case [Patient No. 20 (died at 5 d)] of recurrent gastrointestinal bleeding resulting in death.

Follow-up after 30 d did demonstrate 5 of our patients had transient grade I - II encephalopathy requiring 3-5 d admissions. It should be noted that our patients presenting with ascites were more likely to develop encephalopathy than our patients presenting with acute bleeding. In a recent large meta-analysis by Bai *et al*^[14], it was noted that higher Child Pugh scores result in a higher rate of encephalopathy post TIPS. The Child Pugh score is a reflection of the extent of liver disease and one of the major determinants of this score is the presence of ascites. It is therefore inherent that patients with ascites have higher Child Pugh scores which correlates with higher risk for hepatic encephalopathy. Encephalopathy is a common complication of TIPS placement and has a known incidence of 54.9%. This compares to an incidence of 38.1% in controls undergoing large volume paracentesis^[15]. Fortunately, as in our experience,

encephalopathy is usually responsive to medical therapy. Pre-existing hepatic encephalopathy is a relative contraindication to TIPS as it may precipitate uncontrollable encephalopathy. One of our patients had grade 1 pre-existing hepatic encephalopathy. One other point of discussion is that the elderly may be more prone to encephalopathy than younger patients. This was confirmed in the meta-analysis by Bai *et al*^[14]. It is speculated this may be due to lower cerebral reserve in the elderly with a higher susceptibility to the toxic effect of metabolites such as ammonia^[16].

Two patients (Patient No. 14 and No. 15) required shunt revision within 3 wk due to continued gastrointestinal bleeding. Two patients (Patient No. 2 and No. 19) required revision due to shunt closure that occurred within 3 wk with resulting recurrent ascites. Patient No. 2 who had an **uncovered TIPS required subsequent shunt revision** 2 additional times within the 41 mo after initial shunt placement. One other patient (Patient No. 10) had shunt restenosis at 10 mo requiring revision with a covered stent. Another patient (Patient No. 8) had shunt closure at 20 mo requiring a parallel TIPS. Shunt stenosis or obstruction occurs in 70% of patients at 1 year with uncovered TIPS^[17]. This event resulting in recurrent ascites or bleeding may be reduced with the placement of newly developed ePTFE-Covered stent grafts, as we used in our last 15 patients^[18]. Long term patency rates have dramatically improved with shunt patency's of 90%, 84%, and 74% at 1, 2 and 3 years respectively^[19]. In fact as of December 2004 covered stents have been FDA approved for TIPS^[15]. This may eventually result in a possible improvement in morbidity and mortality^[19,20].

Patients who are in advanced stages of cirrhosis [Child's class C (> 9) or MELD > 15] should also be cautiously approached due to the higher risk of hepatic failure and potential risk of uncontrollable encephalopathy^[21]. It has been suggested in the literature that the use of the MELD scoring system is a better predictor of mortality than the older Child's Pugh classification system^[21-25]. In conclusion, TIPS placement can be performed successfully in the elderly who are deemed unsuitable for liver transplantation. TIPS should be performed after careful consideration of alternatives and appropriate patient selection. This procedure appears to offer control of medically refractory ascites, hepatic hydrothorax, and portal hypertensive bleeding in the elderly population who are otherwise often excluded from receiving the TIPS procedure. However, there is a predisposition to hepatic encephalopathy, but this typically responds to medical therapy. The major limitation of our study is that it is retrospective over a 14-year period. Therefore, further study is encouraged.

COMMENTS

Background

Cirrhosis of the liver is the 10th leading cause of death in the United States. Portal hypertension is the major physiologic manifestation of cirrhosis. Tran-

sjugular intrahepatic porto-systemic shunt (TIPS) is a relatively new technique that has revolutionized the treatment of complications from portal hypertension due to cirrhosis. This includes variceal bleeding and massive ascites refractory to standard medical therapy. These patients are now typically offered TIPS and/or liver transplantation with TIPS often being a "bridge" to transplantation. Unfortunately the elderly population is only rarely offered liver transplantation due to age criteria and higher risk. The only potential option for these patients is therefore TIPS. Up until now, the published experience of TIPS in the elderly however is quite limited. This is despite the elderly representing a growing population with cirrhosis and having a mortality of 50% with 1 year of diagnosis.

Research frontiers

Important areas of research in the field are identifying appropriate criteria for offering TIPS to patients based on model for end-stage liver disease (MELD) score and child-Pugh Class and for knowing which risk factors result in complications such as hepatic encephalopathy. However, research in the elderly is limited.

Innovations and breakthroughs

A major innovation has been to risk stratify patients using MELD score. This has improved outcomes and reduced mortality. Another major advance has been the use of covered stents, which have improved patency rates. Portal vein localization techniques have also been helpful in improving technical success rates and reducing complications. In the present study we discussed and incorporated these advancements in the elderly population for TIPS.

Applications

This study shows that TIPS can be safely performed in the elderly with acceptable outcomes for palliation of complications of portal hypertension.

Terminology

TIPS: Is the acronym for transjugular intrahepatic portosystemic shunt. This is an artificially created connection within the liver between the inflow of the portal vein and outflow of the hepatic vein. It is useful in relieving complications of portal hypertension including (1) gastrointestinal bleeding due to varices; and (2) ascites/hepatic hydrothorax. It is typically performed by interventional radiologists using a percutaneous transjugular intrahepatic approach with image guidance. Covered stents: A type of artificial tube which is inserted into the communication between the portal vein and the hepatic vein. Previously bare metal stents were utilized in TIPS. Now a days covered stents are utilized which are lined with vascular graft material. This has resulted in significant improvement in patency for TIPS. MELD score: This is an acronym for model for end stage liver disease. It was initially developed to predict poor survival after TIPS. It was later found to be useful in determining the prognosis of chronic liver disease and in prioritizing patients needing a liver transplant. MELD score is calculated by the United Network for Organ Sharing modification of the original formula: $\text{MELD score} = 9.6 \times \log_e (\text{creatinine mg/dL}) + 3.8 \times \log_e (\text{bilirubin mg/dL}) + 11.2 \times \log_e (\text{INR}) + 6.4$. Child-Pugh score: sometimes called the Child-Turcotte-Pugh score is also used to assess the severity and prognosis of chronic liver disease typically cirrhosis. It has similar usefulness as the MELD score.

Peer review

The article describes the feasibility of application of TIPS in elderly cirrhotic people who are generally denied this kind of procedure. The message deserves reporting as the results, complications and follow up seem comparable to those reported in younger adult individuals with end stage cirrhosis. It is of educational value and of clinical relevance as it highlights another opportunity to prevent/treat some life-threatening complications of cirrhosis at an advanced age as well. Criteria for patient selection, the specific diseases requiring TIPS, the way of performing TIPS, and follow up were appropriately considered and described.

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