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Short outcome comparison of elderly patients versus nonelderly patients treated with transjugular intrahepatic portosystemic stent shunt

A propensity score matched cohort study

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Abstract

A transjugular intrahepatic portosystemic stent shunt (TIPSS) has been widely used to treat portal hypertension and its complications. However, no established guidelines mentioned whether age was a risk factor for the treatment of TIPSS.

The aim is to determine whether age is a risk factor for poor outcomes following TIPSS.

The retrospective cohort study included 134 patients who received TIPSS treatment from 2003 to 2016. The adverse events after the TIPSS treatment were compared after propensity score matching to reduce the effect of selection bias. Multivariate logistic regression was conducted to confirm the potential confounders for rebleeding (RB) and ascites after TIPSS therapy.

After excluding 10 patients, 124 patients were analyzed. Among them, 37 patients were included in the elderly group. In the propensity score matched cohort (32 pairs), there was no significant difference between the elderly group and the nonelderly group in terms of the event after TIPSS therapy (All $P > .05$). Multivariate logistic regression analysis revealed that hypertension (OR 13.246, 95% CI: [1.29, 136.073]; $P = .03$) was an independent risk factor for RB. In addition, smoking (OR 4.48, 95% CI: [1.43, 14.033]; $P = .01$) and preascites (OR 6.7, 95% CI: [2.04, 22.005]; $P = .002$) were independent risk factors for ascites after TIPSS treatment.

Age is not an independent risk factor for poor outcomes following the treatment of TIPSS. Smoking and preascites are independent risk factors for patients' ascites, and hypertension is an independent risk factor for patients' RB after TIPSS therapy.

Abbreviations: AAD = against advice discharge, ALT = glutamic-pyruvic transaminase, APTT = activated partial thromboplastin time, AST = aspartate transaminase, BRTO = balloon-occluded retrograde transvenous obliteration, BUN = blood urea nitrogen, CHD = coronary heart disease, CIs = confidence intervals, DBIL = direct bilirubin, HCC = hepatocellular carcinoma, HD = hospital deaths, HGB = hemoglobin, HM = hepatic myelopathy, HV = hepatic vein, IBIL = indirect bilirubin, IH = intraperitoneal hemorrhage, INR = international normalized ratio, LFI = liver function injury, PE = pleural effusion, PHS = postoperative hospital stay, PLT = platelet, Pre-HE = pre hepatic encephalopathy, PSE = partial splenic embolization, PT = prothrombin time, PTVE = percutaneous transhepatic variceal embolization, PVCT = portal vein cavernous transformation, PVT = hepatic vein thrombosis, RB = re-bleeding, RHD = right heart dysfunction, Scr = serum creatinine, SD = stent dysfunction, TBIL = total bilirubin, TIPSS = transjugular intrahepatic portosystemic stent shunt, TLS = total length of stay, TP = total protein, VOD = hepatic veno-occlusive disease.

Keywords: age TIPSS, propensity score matching

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FW and BL collected data and followed the patients. YL and WM carried out the statistical analysis. YL, FW, and CQ participated in the design of the review. All authors read and approved the final manuscript.

The authors have no conflicts of interest to disclose.

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1. Introduction

Portal hypertension[1] is an increase in the porto-systemic pressure gradient in any portion of the portal venous system. Portal hypertension[2] results from a combination of both an increased resistance to and increased flow of portal blood that could be caused by prehepatic abnormalities (e.g., portal vein thrombosis), posthepatic abnormalities (e.g., Budd-Chiari syndrome), intrahepatic noncirrhotic causes (e.g., schistosomiasis), and cirrhosis. Many complications result from portal hypertension, such as refractory ascites, recurrent variceal bleeding, and portal vein thrombosis.

A transjugular intrahepatic portosystemic stent shunt (TIPSS) is a nonsurgical method of portal decompression that is currently used to treat major complications of portal hypertension[3] and has been proven to be an effective procedure for the treatment of portal hypertension and its complications during the last 25 years.[4,5]

The aging process is deleterious for fitness[6] and is the main risk factor for prevalent diseases in developed countries, including cancer, cardiovascular disease, and neurodegeneration.

Propensity score matching studies regarding TIPSS have been published. Gaba et al[7] proved that a covered stent-graft TIPSS

improved intermediate- to long-term survival without significantly increasing the short-term mortality of ascites patients. There were also propensity score matching studies concerning age and treatment efficiency. For example, Hu et al[8] proved that age alone was not a parameter for the treatment of advanced hepatocellular carcinoma (HCC) patients.

However, no research has been published regarding the effect of age on TIPSS treatment with the analysis method of propensity score matching, and no established guidelines mentioned whether age was a risk factor for poor outcomes following TIPSS treatment. In our research, we thus studied whether age was a factor that influenced the efficacy of TIPSS.

2. Methods

2.1. Patients

This retrospective cohort study included 134 patients with TIPSS at Shandong Provincial Hospital, Shandong, China from 2003 to 2016. Patients who met any of the following criteria were excluded: patients who underwent transarterial chemoembolization (TACE) therapy within 1 month; patients who were treated with emergency TIPSS; the TIPSS operation was not successful; and patients who were lost to follow-up. Based on these criteria, a total of 10 patients were excluded from the study. Of these, 4 patients underwent TACE therapy within a month, 1 patient experienced emergency TIPSS treatment, the TIPSS operation of 1 patient failed, and 4 patients did not participate in the follow-up process. Finally, a total of 124 patients were included in our study. Among them, 37 were elderly patients (age≥60 years), and 87 were nonelderly patients (age<60 years).

To reduce the effects of selection bias and potential confounders in our study, we performed a rigorous adjustment for differences in baseline characteristics by using propensity score matching.[9] We considered gender, hypertension, diabetes, coronary heart disease (CHD), smoking, drink, indication and etiology, prehepatic encephalopathy (pre-HE), preascites, splenectomy, Child–Pugh score, Child–Pugh classification, hemoglobin (HGB), platelet (PLT), total protein, albumin, glutamic-pyruvic transaminase (ALT), aspartate transaminase (AST), total bilirubin (TBIL), direct bilirubin (DBIL), indirect bilirubin (IBIL), serum creatinine (Scr), blood urea nitrogen (BUN), prothrombin time (PT), activated partial thromboplastin time (APTT), international normalized ratio (INR), and treatment. Thirty-two patient pairs were selected (Fig. 1). The study protocol was conducted in accordance with the Declaration of Helsinki and current ethical guidelines. Our study was approved by the Medical Ethics Committee of Shandong Provincial Hospital, and informed consent was obtained from all subjects.

2.2. TIPSS

A standard, widely used TIPSS procedure was performed beginning with right jugular vein access through which a 10-F sheath was advanced into the right atrium.[10] After pressure measurements were obtained, the 10-F sheath was advanced into the right or middle hepatic vein (HV). Next, a Roups-100 needle system was advanced into the HV over a guidewire, and the catheter-trocar apparatus was advanced toward the expected location of the right PV or the left PV if the middle HV was used. Next, a direct portal venogram and portal pressures were obtained. Then, the intrahepatic track was dilated with a balloon catheter, and the 10-F sheath system was advanced into the PV. A 7-mm/8-mm diameter Wallstent was inserted, and the stent was dilated with a balloon. Additional stents were inserted to produce a smooth track from the PV bifurcation to the right HV. The portosystemic gradient was measured, and if necessary, the shunt was dilated with a balloon until the gradient was <10 mm Hg. If necessary, additional stents were placed. If varices were still opacified, variceal embolization was performed through the catheter in the PV.

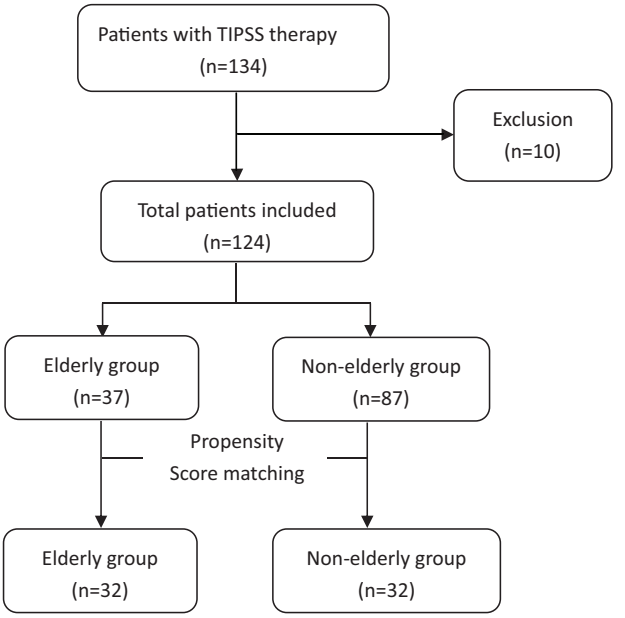

Figure 1. Flowchart of patient selection.

2.3. Data collection and follow-up

The following demographic, laboratory and clinical information was collected from medical chart review: age, gender, hypertension, diabetes, CHD, smoking, drink, indication and etiology, pre-HE, preascites, splenectomy, Child–Pugh score, Child–Pugh classification, HGB, PLT, TP, albumin, ALT, AST, TBIL, DBIL, IBIL, Scr, BUN, PT, APTT, INT, and treatment.

The outcome was treatment-related adverse events within 1 year after TIPSS therapy. Adverse events included fever, vomit, bellyache, diarrhea, HE, ascites, pleural effusion (PE), liver function injury (LFI), hepatic myelopathy (HM), stent dysfunction (SD), intraperitoneal hemorrhage (IH), right heart dysfunction (RHD), and rebleeding (RB). We also calculated the total length of stay (TLS) of patients, the postoperative hospital stay (PHS) of patients, the number of patients who were against advice discharge (AAD), and patients who experienced hospital deaths (HD). All patients were followed up for 1 year.

2.4. Propensity score analysis

The propensity scores were estimated regarding all categorical variables presented in the baseline characteristics with a parsimonious logistic regression model.[9] We used a nearest-neighbor matching algorithm without replacement. One-to-one caliper matching was performed within 25% of the standard deviation of log-trans-formed propensity scores. The value of the caliper was 0.5. In the propensity-score-matched cohort, the 2 groups were compared in terms of their baseline characteristics.

The balance of the matched cohort was evaluated using a standardized mean difference and a hypothetical test. Multinomial logistic regression was used to examine the potential confounders of RB and ascites after TIPSS treatment. Odds ratios with 95% confidence intervals (CIs) were calculated.

2.5. Statistical methods

In all study subjects, continuous variables were compared parametrically using Student *t* test or were compared nonparametrically using the Mann–Whitney *U* test. Categorical variables were compared using the χ^2 test or Fisher exact test as appropriate.

Statistical results are presented as the mean ± standard deviation and the number of patients (%). Two-sided test *P* values <.05 were defined as significant. Statistical analyses were conducted using the IBM SPSS statistical package 22.0 (IBM, Armonk, NY) with 3 plug-ins (SPSS R-plug-in, R and psmatching).

3. Results

3.1. Patient characteristics before propensity score matching

One hundred twenty-four patients treated with TIPSS were included in this study. Thirty-seven patients were older than the other 87 patients.

The baseline characteristics of the elderly group and the nonelderly group are summarized in Table 1. There were no significant differences between the groups with respect to gender, hypertension, diabetes, CHD, smoking, indication and etiology, pre-HE, preascites, splenectomy, Child–Pugh score, Child–Pugh classification, HGB, PLT, TP, albumin, ALT, AST, TBIL, DBIL, IBIL, Scr, BUN, PT, APTT, INT, or treatment. However, the number of patients who drank (*P*=.012) were significantly different between the elderly and nonelderly groups.

3.2. Patient characteristics after propensity score matching

In the propensity score matched cohort, there were no significant differences between the elderly group and the nonelderly group regarding gender, hypertension, diabetes, CHD, smoking, drink, indication and etiology, pre-HE, preascites, splenectomy, Child–Pugh score, Child–Pugh classification, HGB, PLT, TP, albumin, ALT, AST, TBIL, DBIL, IBIL, Scr, BUN, PT, APTT, INT, or treatment. The results are shown in Table 2.

3.3. Comparison of therapy-related events

In our research, we included the therapy-related events as follows: fever, vomit, bellyache, diarrhea, hepatic encephalopathy, ascites, PE, liver function injury (LFI), hepatic myelopathy (HM), stent dysfunction (SD), intraperitoneal hemorrhage (IH), right heart dysfunction (RHD), rebleeding (RB), TLS, PHS, AAD, and HD. There were no significant differences between the elderly group and the nonelderly group. The results are shown in Table 3.

3.4. Multivariate analysis for the association of confounding factors with RB

Multivariate logistic regression was performed to examine associations with patients' RB after TIPSS (Table 4). The analysis

Table 1

Comparison of baseline characteristics between the elderly (n=37) and nonelderly (n=87) groups before propensity score match.

Variables	Elderly group	Nonelderly group	*P* value
Gender, male	23 (62.6%)	64 (73.6%)	.204
Hypertension	2 (5.4%)	6 (6.9%)	.757
Diabetes	4 (10.8%)	12 (13.8%)	.65
CHD	1 (2.7%)	2 (2.3%)	.893
Smoking	12 (32.4%)	30 (34.5%)	.825
Drink	7 (18.9%)	37 (42.5%)	.012
Indication and etiology	–	–	.068
Recurrent hemorrhage	20 (54.1%)	59 (67.8%)	–
Refractory ascites	4 (10.8%)	8 (9.25)	–
Budd-Chiari	2 (5.4%)	2 (2.3%)	–
Rebleed after surgery	2 (5.4%)	1 (1.1%)	–
PVT	9 (24.3%)	8 (9.2%)	–
PVCT	0	6 (6.9%)	–
VOD	0	3 (3.4%)	–
HE	1 (2.7%)	0	.124
Ascites	27 (73.0%)	59 (67.8%)	.569
PE	6 (16.2%)	19 (21.8%)	.612
Splenectomy	12 (32.4%)	23 (26.4%)	.224
Child–Pugh score	6.54 ± 1.48	6.28 ± 1.05	.262
Child–Pugh classification	–	–	.284
A	21 (56.8%)	54 (62.1%)	–
B	15 (40.5%)	33 (37.9%)	–
C	1 (2.7%)	0	–
HGB			.068
Normal	5 (13.5%)	12 (13.8%)	–
>90 g	18 (48.6%)	21 (24.1%)	–
60–90 g	11 (29.7%)	42 (48.3%)	–
30–60 g	2 (5.4%)	11 (12.6%)	–
<30 g	1 (2.7%)	1 (1.1%)	–
WBC	4.65 ± 3.36	4.57 ± 5.12	.927
PLT	–	–	.859
Normal	12 (32.4%)	25 (28.7%)	–
$>300\times10^9$	1 (2.7%)	6 (6.9%)	–
$>50\times10^9$	19 (51.4%)	41 (47.1%)	–
$30–50\times10^9$	3 (8.1%)	10 (11.5%)	–
$<30\times10^9$	2 (5.4%)	5 (5.7%)	–
TP	58.88 ± 9.62	60.23 ± 8.00	.834
Albumin	30.89 ± 5.72	32.37 ± 4.99	.152
ALT	26.27 ± 14.56	27.26 ± 18.20	.77
AST	38.76 ± 18.83	36.94 ± 27.39	.687
TBIL	27.68 ± 19.33	26.34 ± 16.24	.691
DBIL	8.12 ± 8.04	8.14 ± 10.70	.989
IBIL	19.55 ± 11.86	19.15 ± 11.54	.861
SCR	–	–	.436
Normal	33 (89.2%)	83 (95.4%)	–
<=178 μmol/L	3 (8.1%)	3 (3.4%)	–
178–445 μmol/L	1 (2.7%)	1 (1.1%)	–
>445 μmol/L	0	0	–
BUN	6.97 ± 4.66	6.12 ± 3.60	.277
PT	14.58 ± 1.91	15.01 ± 1.75	.222
APTT	35.59 ± 7.33	34.88 ± 8.19	.651
INR	1.23 ± 0.16	1.27 ± 0.15	.236
Treatment	–	–	.768
Tipss	12 (32.4%)	27 (31.0%)	–
Tipss+PTVE	24 (64.9%)	51 (58.6%)	–
Tipss+PSE	0	1 (1.1%)	–
Tipss+PTVE+PSE	0	1 (1.1%)	–
Tipss+thrombolysis	0	3 (3.4%)	–
Tipss+PTVE+thrombolysis	1 (2.7%)	2 (2.3%)	–
Tipss+PTVE+BRTO	0	2 (2.3%)	–

Data are shown as the mean ± standard deviation or the number (%) of patients.
PVT = hepatic vein thrombosis, PVCT = portal vein cavernous transformation, VOD = hepatic veno-occlusive disease, PTVE = percutaneous transhepatic variceal embolization, PSE = partial splenic embolization, BRTO = balloon-occluded retrograde transvenous obliteration.

Table 2

Comparison of baseline characteristics between the elderly (n = 32) and nonelderly (n = 32) groups after propensity score match.

Variables	Elderly group	Nonelderly group	*P* value
Gender, male	20 (62.5%)	19 (59.4%)	.798
Hypertension	2 (6.2%)	2 (6.2%)	1
Diabetes	4 (12.5%)	4 (12.5%)	1
CHD	0	0	1
Smoking	11 (34.4%)	8 (25%)	.412
Drink	7 (21.9%)	9 (28.1%)	.567
Indication and etiology		0.564	–
Recurrent hemorrhage	18 (56.2%)	19 (59.4%)	–
Refractory ascites	3 (9.4%)	4 (12.5%)	–
Budd-Chiari	1 (3.1%)	2 (6.2%)	–
Rebleed after surgery	1 (3.1%)	0	–
PVT	9 (28.1%)	4 (12.5%)	–
PVCT	0	2 (6.2%)	–
VOD	0	1 (3.1%)	–
HE	0	0	1
Ascites	22 (68.8%)	25 (78.1%)	.396
PE	6 (18.8%)	6 (18.8%)	.601
Splenectomy	11 (34.4%)	9 (28.1%)	.542
Child–Pugh score	6.34 ± 1.23	6.56 ± 1.16	.468
Child–Pugh classification			.448
A	20 (62.5%)	17 (53.1%)	–
B	12 (37.5%)	15 (46.9%)	–
C	0	0	–
HGB			.646
Normal	5 (15.6%)	6 (18.8%)	–
>90 g	14 (43.8%)	11 (34.4%)	–
60–90 g	11 (34.4%)	12 (37.5%)	–
30–60 g	1 (3.1%)	3 (9.4%)	–
<30 g	1 (3.1%)	0	–
WBC	4.78 ± 3.59	5.07 ± 5.80	.807
PLT			.529
Normal	11 (34.4%)	8 (25%)	–
$>300 \times 10^9$	1 (3.1%)	5 (15.6%)	–
$>50 \times 10^9$	16 (50%)	15 (46.9%)	–
$30–50 \times 10^9$	2 (6.2%)	2 (6.2%)	–
$<30 \times 10^9$	2 (6.2%)	2 (6.2%)	–
TP	59.73 ± 9.62	61.27 ± 6.97	.467
Albumin	30.96 ± 5.72	32.52 ± 3.64	.197
ALT	26.19 ± 12.94	26.06 ± 17.35	.974
AST	38.88 ± 18.65	37.78 ± 20.52	.824
TBIL	27.12 ± 19.34	27.94 ± 18.48	.863
DBIL	7.78 ± 7.79	7.16 ± 5.35	.712
IBIL	19.31 ± 12.08	20.76 ± 13.50	.652
SCR			.602
Normal	31 (96.9%)	30 (93.8%)	–
<=178 μmol/L	1 (3.1%)	1 (3.1%)	–
178–445 μmol/L	0	1 (3.1%)	–
>445 μmol/L	0	0	–
BUN	6.25 ± 3.21	6.72 ± 3.49	.58
PT	14.60 ± 2.00	15.04 ± 1.83	.368
APTT	35.42 ± 7.45	33.71 ± 9.27	.42
INR	1.23 ± 0.17	1.27 ± 0.17	.308
Treatment			.357
Tipss	9 (28.1%)	9 (28.1%)	–
Tipss+PTVE	23 (71.9%)	19 (59.4%)	–
Tipss+PSE	0	1 (3.1%)	–
Tipss+PTVE+PSE	0	0	–
Tipss+thrombolysis	0	2 (6.2%)	–
Tipss+PTVE+thrombolysis	0	1 (3.1%)	–
Tipss+PTVE+BRTO	0	0	–

Data are shown as the mean ± standard deviation or the number (%) of patients.

PVT = hepatic vein thrombosis, PVCT = portal vein cavernous transformation, VOD = hepatic veno-occlusive disease, PTVE = percutaneous transhepatic variceal embolization, PSE = partial splenic embolization, BRTO = balloon-occluded retrograde transvenous obliteration.

Table 3

Comparison of therapy-related events between the elderly and nonelderly groups.

Events	Elderly group (N = 32)	Nonelderly group (N = 32)	*P* value
Fever	11 (34.4%)	7 (21.9%)	.266
Vomit	5 (15.6%)	7 (21.9%)	.443
Bellyache	8 (25%)	6 (18.8%)	.59
Diarrhea	2 (6.1%)	0	.151
HE	4 (12.5%)	6 (18.8%)	.491
Ascites	15 (46.9%)	17 (53.1%)	.393
PE	5 (15.6%)	3 (9.4%)	.701
LFI	15 (46.9%)	13 (40.6%)	.738
HM	0	0	1
SD	3 (9.4%)	3 (9.4%)	1
IH	1 (3.1%)	0	.565
RHD	6 (18.8%)	3 (9.4%)	.542
RB	7 (21.9%)	3 (9.4%)	.27
TLS	17 ± 7.7	16.75 ± 9.0	.905
PHS	9.28 ± 5.1	8.63 ± 5.6	.625
AAD	1 (3.1%)	2 (6.1%)	.554
HD	1 (3.1%)	1 (3.1%)	1

AAD = against advice discharge, HD = hospital deaths, HE = hepatic encephalopathy, HM = hepatic myelopathy, IBIL = indirect bilirubin, IH = intraperitoneal hemorrhage, LFI = liver function injury, PE = pleural effusion, PHS = postoperative hospital stay, RB = re-bleeding, RHD = right heart dysfunction, SD = stent dysfunction, TLS = total length of stay.

revealed that hypertension (OR 13.246, 95% CI: [1.29, 136.073]; $P = .03$) was an independent risk factor for RB.

3.5. Multivariate analysis for the association of confounding factors with after-ascites

Multivariate logistic regression was performed to examine the associations with patients' ascites after TIPSS (Table 5). The analysis revealed that smoking (OR 4.48, 95% CI: [1.43, 14.033]; $P = .01$) and preascites (OR 6.7, 95% CI: [2.04, 22.005]; $P = .002$) were independent risk factors for ascites after TIPSS treatment.

4. Discussion

TIPSS has been widely used for the treatment of portal hypertension and its complications.

Many studies have confirmed the role of TIPSS for portal hypertension. For example, Bissonnette et al[11] thought that TIPSS was an excellent option to treat severe complications of idiopathic noncirrhotic portal hypertension. Gastroesophageal variceal bleeding is a severe complication of portal hypertension. RB is associated with significant morbidity and mortality;[12] thus, preventing variceal RB may be a substitute outcome of survival.[13] Despite recent advances in patient care, many patients with cirrhosis still suffer from refractory variceal bleeding. Several therapeutic alternatives have been proposed to further reduce mortality. TIPSS has been effectively proven to be the most promising approach[14] when it is placed early after acute variceal bleeding in patients with high portal pressure. Holster et al[15] thought covered TIPPS was superior to endoscopic variceal ligation with a β-blocker for reduction of variceal rebleeding.

However, the studies about the effect of age on the treatment of TIPSS were limited. And, different researchers had different conclusions about the role of age in the treatment of TIPSS. Garcia-Pagan et al[16] proved age was a risk factor for Budd–

Table 4

Multivariate analysis for the association of confounding factors with RB.

Factors	B	SE (b)	Wald χ^2	*P* value	ORs	95% CI	
Age	−0.619	0.648	0.913	.339	0.539	0.151	1.917
Gender	0.086	0.818	0.011	.916	1.09	0.219	5.417
Hypertension	2.584	1.188	4.727	.03	13.249	1.29	136.073
Smoking	−0.026	0.788	0.01	.973	0.974	0.208	4.56
Preascites	1.681	1.067	2.479	.115	5.37	0.663	43.511
After-fever	0.947	0.689	1.888	.169	2.578	0.668	9.953
After-diarrhea	2.103	1.349	2.43	.119	8.187	0.582	115.158
After-ascites	1.578	0.895	3.112	.078	4.847	0.839	27.99
After-HE	−1.658	1.252	1.755	.185	0.19	0.016	2.214

CIs = confidence intervals, HE = hepatic encephalopathy.

Table 5

Multivariate analysis for the association of confounding factors with after-ascites.

Factors	B	SE (b)	Wald χ^2	*P* value	ORs	95% CI	
Age	−0.385	0.505	0.579	.447	0.681	0.253	1.833
Gender	−0.707	0.609	1.348	.246	0.493	0.15	1.626
Hypertension	−0.015	0.919	0	.987	0.985	0.163	5.961
Smoking	1.5	0.583	6.626	.01	4.48	1.43	14.033
Preascites	1.902	0.607	9.828	.002	6.7	2.04	22.005
After-fever	0.067	0.553	0.015	.904	1.069	0.362	3.158
After-diarrhea	1.212	1.304	0.864	.353	3.362	0.261	43.332
After-HE	−0.256	0.672	0.145	.703	1.292	0.346	4.818

CIs = confidence intervals, HE = hepatic encephalopathy.

Chiari syndrome patients with TIPSS. Syed et al[17] thought TIPSS was an effective procedure to control refractory complications of portal hypertension in elderly patients. We found no significant differences between elderly patients and nonelderly patients receiving TIPSS treatment (all $P > .05$). Age should thus not be the limitation for the choice of patients for TIPSS treatment.

Unlike us, the patients in Garcia-Pagan study were included from 1997 to 2006 years, which were almost 10 years earlier than our patients. Syed et al only studied 23 patients, and there were not control group in their study. In our study, our valid 124 patients were included from 2003 to 2016 years. In recent 10 years, all aspects of technology and the operation level of doctors have developed rapidly. And we used propensity score matching to narrow the gap between elderly group and nonelderly group to make our conclusions more believable.

TACE has emerged as an effective treatment strategy for patients with HCC. Although TACE was an effective treatment strategy for HCC with TIPSS, Miura et al[18] proved that TACE might be associated with higher complication rates for patients who are treated with TIPSS. Thus, we excluded the patients treated with TACE.

There are limitations to the present study because of its retrospective design. More patients are needed to match more pairs and increase the credibility of the results.

We set 60 years old as the boundary between the elderly group and the nonelderly group because of the number of patients. There were only 5 patients over 70 years old in the original data, and only 16 patients of the source material were over 65 years old. The long-term overall survival and the cost of repeat TIPSS treatment should be researched in the future.

In conclusion, our propensity matching score study suggests that there is no significant difference in TIPSS between elderly and nonelderly patients. Age is not a risk factor for poor outcomes following TIPSS therapy. Hypertension can significantly affect patients' RB after TIPSS therapy and is an independent risk factor for patients' RB after TIPSS therapy. Additionally, smoking and ascites before TIPSS can significantly affect patients' ascites after TIPSS therapy; therefore, they both are independent risk factors for patients' ascites after TIPSS.

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