North American Practice-Based Recommendations for TIPS in Portal Hypertension

**General Considerations**

**Pre-TIPS**
- **Team-based approach** (incl. GI/hepatology and IR) is needed for assessing candidacy, planning, & management
- **There is no absolute MELD cut-off**: MELD score > MELD-Na or CTP for predicting 90-day post-TIPS mortality
- Check multiphasic cross sectional imaging (CT/MRI) & echocardiography
- Preprocedural liver transplant (LT) evaluation should not delay TIPS

**Absolute Contraindications**
- Severe congestive HF or severe untreated valvular heart disease (ACC/AHA stage C or D)
- Moderate-severe pulmonary HTN despite medical optimization
- Uncontrolled systemic infection
- Refractory overt hepatic encephalopathy (HE)
- Unrelieved biliary obstruction
- Lesions or tumors in liver parenchyma precluding TIPS creation

**Procedural**
- Expanded polytetrafluoroethylene (ePTFE)-covered stent grafts have ↑ patency, ↑ ascites control, and ↓ rebleeding
- **Controlled-expansion stent** allows for incremental & reliable expansion for tailoring amount of shunting
- Correcting INR or plt to threshold not recommended
- Periprocedural antibiotic use depends on patient risk factors
- Use free hepatic vein or IVC pressure rather than RA pressure for calculating portosystemic gradient (PSG) pre and post TIPS placement
- **If potential LT candidate**, ensure TIPS does not extend into RA & leaves segment of unstented main portal vein

**Post-TIPS**
- Monitor overnight after TIPS creation
- **US findings suggestive of TIPS dysfunction**: 
  - Change in intrahepatic portal vein flow direction
  - Abnormal flow velocities in TIPS
  - Persistent or recurrent ascites
  - Low spec (33-95%) and high false positive (50%)
- Checking TIPS venography + intervention is based on indication
  - **Varices**: if US with TIPS dysfunction or persistent/recurrence of portal hypertensive complications → obtain TIPS venography and manometry +/- intervention
  - **Ascites**: if ascites controlled → no TIPS venography
  - **Thrombus**: routine TIPS venography within 1-2 mo.

## Considerations by Indication

### Ascites/Hepatohydrothorax
- **TIPS > serial large volume paracentesis (LVP) for refractory ascites and transplant free survival (TFS)**
- **Consider TIPS in patients w/:**
  - Refractory Ascites
  - >3 LVP in 1 year
  - Hepatohydrothorax on max medical therapy, requiring frequent thoracentesis, or are symptomatic (hypoxia, resting dyspnea)
- ↑ bili, ↑ MELD, CTP C, and advanced age are associated w/ post-TIPS complications, but there is no specific MELD or age cut offs
- **Procedural considerations:**
  - **Staged approach**: start with small diameter (8 mm) TIPS w/ diuretics, followed by progressive dilation at 6 wk intervals

### Variceal Bleeding
- **Recommended for acute variceal bleeding:**
  - CTP C or CTP B w/ active bleeding at endoscopy *(Pre-emptive TIPS w/in 72 hrs of admission)*
  - Rebleeding during admission following successful endoscopic ligation *(Rescue TIPS)*
  - Profuse bleeding preventing endoscopic band ligation or persistent bleeding despite endoscopic ligation *(Salvage TIPS)*
- **Recommended for bleeding gastric fundal varices:**
  - TIPS ± variceal obliteration (VO) if no expertise in endoscopic cyanoacrylate glue injection, or if hemostasis not achieved w/ glue
  - TIPS ± VO for 2’ ppx or rebleeding after endoscopic therapy
- **Procedure considerations to decrease rebleeding risk:**
  - Obtaining PSG < 12 mm Hg or relative reduction of PSG by >50-60% from pre-TIPS gradient
  - Concurrent embolization at time of TIPS creation
  - Following TIPS for variceal hemorrhage, check US w/ doppler 1-6 mo after initially, then q 6-12 mo.
  - Get TIPS venogram if suspecting stenosis or occlusion, or if patient rebleeds after TIPS

### Novel Indications
- **Cirrhosis and complete portal vein thrombosis?**
  - TIPS can be considered for LT listing
  - Noncirrhotic portal HTN and extrahepatic portal vein obstruction?
    - If fails AC and thrombectomy/thrombolysis, TIPS can be considered
    - Budd-Chiari syndrome?
    - If no improvement with medical therapy and are not candidates for percutaneous revascularization, can consider TIPS or DIPS
- **Pre-op TIPS for reduction of surgical complications or perioperative outcomes after nontransplant abdominal surgery?**
  - Insufficient evidence for TIPS
  - Hepatopulmonary Syndrome?
    - Not recommended
  - Hepatorenal Syndrome?
    - Not recommended
# Cardiopulmonary, Renal, and Neurologic Considerations

<table>
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<tr>
<th><strong>Cardiopulmonary</strong></th>
<th><strong>Renal</strong></th>
<th><strong>Neurologic</strong></th>
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<tr>
<td><strong>Concerns</strong></td>
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<tr>
<td>• Cardiac decompensation post-TIPS happens because of pre-TIPS subclinical cardiac dysfunction and post-TIPS worsening in hyperdynamic circulation from increased preload and CO w/ concomitant decreased SVR</td>
<td>• Unknown if TIPS causes AKI or benefits CKD</td>
<td>• Risk of overt HE after TIPS is 25-50%</td>
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<td>• Prior to TIPS, check cardiac echo, assessing for:</td>
<td>• Serum creatinine or GFR are best markers to assess kidney function pre or post-TIPS</td>
<td>• Consider evaluating for covert or minimal HE</td>
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<td>• LVEF, LV global longitudinal strain (normal: ≥18%)</td>
<td>• RVSP (normal up to &lt; 45 mm Hg), TAPSE (normal &gt; 1.6 cm)</td>
<td>• Risks factors for post-TIPS HE:</td>
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<tr>
<td>• Diastolic dysfunction</td>
<td>• Valves</td>
<td>• Prior HE</td>
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<tr>
<td>• RVSP (normal up to &lt; 45 mm Hg), TAPSE (normal &gt; 1.6 cm)</td>
<td>• Need cardiology referral if</td>
<td>• CTP C</td>
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<td>• Abnormal RVSP or TAPSE for R heart cath to evaluate for RV dysfunction or pulm HTN</td>
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<td>• MELD &gt; 18</td>
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<td>• Moderate to severe TR despite volume optimization</td>
<td>• Prior HE</td>
<td>• Older age</td>
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<td><strong>Avoid?</strong></td>
<td><strong>Avoid TIPS if:</strong></td>
<td><strong>Avoid TIPS in patients with cognitive impairment and poor social support</strong></td>
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<tr>
<td>• Avoid TIPS if:</td>
<td>• Grade III Diastolic dysfunction</td>
<td>• Avoid in overt HE</td>
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<td>• LVEF &lt; 50%</td>
<td>• Caution in Portopulmonary HTN (POPH)</td>
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<td><strong>Procedure</strong></td>
<td><strong>Pre-procedure</strong></td>
<td><strong>Post-procedure</strong></td>
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<td>• If systolic and/or diastolic function, or mild POPH getting TIPS, recommend 8-mm stent</td>
<td>• RRT is not a contraindication for TIPS</td>
<td>• Post-TIPS echo surveillance at 3 mo or earlier if systolic and/or diastolic dysfunction, pulm HTN, or moderate-severe valvular disease</td>
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<td>• Reduce renal complications post-TIPS?</td>
<td>• Albumin if concurrent LVP w/ &gt;5L</td>
<td>• If develops AKI post-TIPS, follow renal function closely within 1 wk of discharge after TIPS creation</td>
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<td>• Adequate hydration</td>
<td>• No role for medical ppx to prevent HE post-TIPS, if no prior hx of overt HE</td>
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<td>• Adequate hydration</td>
<td>• Judicious use of iodinated contrast</td>
<td>• Treat post-TIPS overt HE w/ lactulose and rifaximin</td>
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<td>• To limit post-TIPS HE, start with smaller diameter controlled-expansion stent</td>
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<td>• Consider TIPS stent diameter reduction if persistent or refractory HE post-TIPS</td>
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<td>• Consider embolization of spontaneous portosystemic shunts &gt;6mm to minimize post-TIPS HE or to treat refractory HE</td>
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*Cardiology referral if abnormal RVSP or TAPSE for R heart cath to evaluate for RV dysfunction or pulm HTN.*

*Reduce renal complications post-TIPS? Albumin if concurrent LVP w/ >5L Adequate hydration Judicious use of iodinated contrast*