I have no relevant financial relationships to disclose at this time.
### Our Approach

- **Infrarenal IVC resection without replacement** if vein chronically occluded
- **Replacement of para- and supra-renal IVC** with low threshold to re-implant renal veins
- **In situ reconstruction of retrohepatic IVC** probably has broader applicability, versatility and similar efficacy as ex situ technique*  

*Ex situ technique if combination of complex IVC, hepatic and/or portal vein reconstruction

### Exposure is Everything

#### Choice of incision

- Size of tumor
- IVC segment to be isolated
- Body habitus
- Costal flare

#### 3rd arm or self-retaining retractor

### Lower IVC and Common Iliac Vein Exposure

- Often requires mobilization of the distal aorta and common iliac arteries
- There may be one or more lumbar vein branches to ligate
- Beware of lateral and middle sacral veins

### 60 y/o man with large retroperitoneal sarcoma invading infrarenal IVC and aorta

- Aorta and caval replacement with intraoperative radiation
- Patient IVC graft, but occluded aortic graft at 17 yrs

### Right Medial Visceral Rotation to Expose Suprarenal IVC

#### Anterior approach

- Ligate and divide caudate lobe veins

#### Retrohepatic

- Divide ligaments to fully mobilize liver

### Retrohepatic IVC Replacement Using Total Vascular Isolation of Liver

- Secure place for suprahepatic clamp
- Test clamp of the suprahepatic IVC to determine level of hemodynamic support
- Transfer clamp to graft after washout of acid metabolites from liver
- Graft cut to length after max. inhalation/exhalation
Invasive Renal Cell Cancer with Retrohepatic IVC and Left Renal Vein Tumor Thrombus

- IVC resection and LRV reimplantation because of tumor invasion
- Venous stent for stenosis at upper anastomosis

56 y/o woman with retrohepatic IVC leiomyosarcoma and hepatic vein thrombus

- Significant liver congestion
- Tumor extends into right hepatic vein
- Bland thrombus in left renal vein and lower IVC

Operation under cardiopulmonary bypass, hypothermia and low flow

- Hepatic vein thrombectomy under direct vision
- Reimplantation of left / middle and right hepatic veins as 2 cuffs
- Graft from right atrium to renal vein-caval confluence

Mayo Clinic Experience*

1990-2013
2305 patients with retroperitoneal malignancy

- 102 patients
  - Circumferential resection / Graft replacement
  - >190 patients
  - Patch / primary closure / no reconstruction

Follow-up (months)
- Mean: 54
- Median: 39
- Imaging: 88%

Outcomes of 102 Patients With IVC Graft Replacement

- Multiple segments 59
- Isolated segment 43
- Mortality 2
- Any morbidity 58
- Major adverse event 15
- Graft Occlusion 6
  - Early (1)
  - Late (5)
- Graft infection 2

Renal and hepatic vein reconstruction in 64 pts.
Mendes, et al. VAM June 2014

Life Table Analysis

- 1° patency
- Overall survival
- Cancer-free*

<table>
<thead>
<tr>
<th>Years</th>
<th>Life Table Analysis</th>
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<tbody>
<tr>
<td>0</td>
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<tr>
<td>2</td>
<td>92%</td>
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<tr>
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<tr>
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<td>24%</td>
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</table>

*Local progression free survival 66% at 5 yrs.
### Contemporary Results

<table>
<thead>
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<th>Year</th>
<th>n</th>
<th>Type</th>
<th>Location</th>
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<td>nr sh sh</td>
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<tr>
<td>Bower** 2014</td>
<td>102</td>
<td>Secondary PVL</td>
<td>nr sh sh</td>
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<td>102 2 (2)</td>
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</tbody>
</table>

*IR= infrarenal  SR= suprarenal  SH= suprahepatic  **Multiple segments in remainder

### Summary

- Primary and secondary malignancies of the inferior vena cava can be safely resected in select patients
- Keys to success are patient selection, a multidisciplinary team, and meticulous operative preparation and execution
- Externally-supported PTFE works well