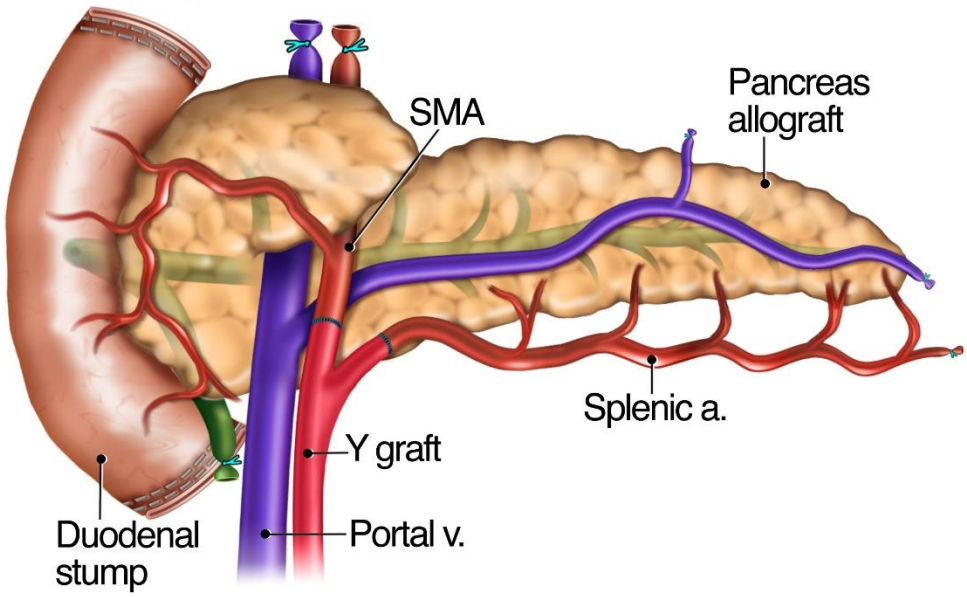
PANCREAS TRANSPLANT ULTRASOUND PROTOCOL (UPANCTX)

PATIENT PREP: No Prep

GENERAL INFORMATION

- A pancreatic transplant is usually placed in the RLQ unless the patient has had a previous renal transplant that is located in the RLQ.
- Pancreatic transplants are often done simultaneously with a renal transplant, in these cases the kidney will be placed in the LLQ and the pancreas in the RLQ.
- They are being done less often due to islet cell transplantation techniques.
- If placed in the retroperitoneum with portosystemic drainage, imaging by ultrasound is challenging and MRI may be more successful.
- 10%-20% overall complication rate.
- Technical failure rates- Thrombosis (50%), pancreatitis (20%), infection (18%), fistulas (6.5%), hemorrhage (2%).

Figure 1 – Anatomy as surgically removed from donor:



- Donor pancreas is removed en block with the duodenum and spleen.
- Stumps of the SMA, splenic artery, splenic vein and portal vein are preserved.
- Donor iliac vessels are recovered for reconstruction of Y graft.

SURGICAL ATTACHMENTS:

- Duodenal stump can be attached:
  To bowel – Enteric exocrine drainage, current and most common method
  To bladder – Vesical exocrine drainage, previous method
- Arterial and venous drainage is to the iliac vessels similar to a renal transplant. Less commonly, they can be attached directly to the portal system in the retroperitoneum with portosystemic drainage. This is the case in Combined Liver/ Pancreas transplantation. See more info below.
- The SMA/SMV supply the **head** of pancreas
- Splenic Artery/Vein supply the **body and tail** of pancreas

TYPICAL ORIENTATION

IF DUODENUM IS ATTACHED TO BOWEL –
Tail - Superior or medial
Head- Inferior or lateral

IF DUODENUM IS ATTACHED TO BLADDER –
Tail - Superior or lateral
Head- Inferior or medial

Include description in the report of how the anatomy was connected, especially if done unconventionally.

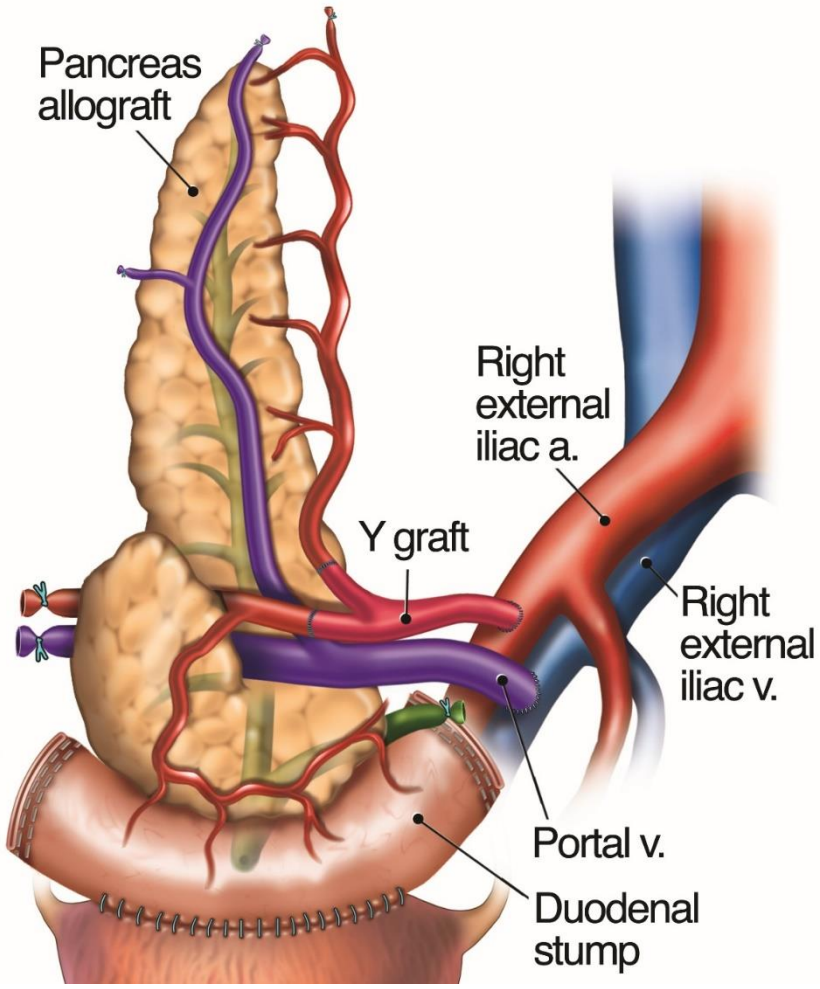


Figure 2 – Anatomy as typically surgically attached to recipient. Note that orientation can differ, the tail often settles into a medial instead of superior location.

IMAGES TO OBTAIN

2D IMAGING

1. **Parenchyma** - Evaluate echo texture and document all parts of organ - head, body, and tail
2. **Pancreatic duct** - Normal is < 3 mm
3. **Fluid collections** - Evaluate for collections around the transplant and surgical incision

COLOR DOPPLER

1. **Perfusion -** Document perfusion of the head, body, and tail with color flow set on a low scale. Use MFI imaging when available.
2. **Venous anastomosis** color image
3. **Arterial anastomosis** color image
4. **Y Graft** - color image of Y graft splitting to SMA and splenic artery
5. **Splenic Vein** - Evaluate for patency as far into the body and tail as visible with color doppler. Partial thrombosis may be seen and should be documented further with spectral doppler.

SPECTRAL DOPPLER

1. **Intra-pancreatic vasculature** –
    a. Arterial waveforms in the head, body, and tailelocity is not needed.
    b. Venous waveforms in the head, body, and tail. Velocity is not needed.
2. **Y graft anastomosis at Iliac-** Arterial waveform with angle corrected velocity. Peak velocity should be <250cm/s.
3. **SMA beyond Y graft -** Arterial waveform with angle corrected velocity.
4. **Splenic artery beyond Y graft -** Arterial waveform with angle corrected velocity.
5. **Splenic vein -** waveform to be obtained as distal as possible. If thrombus is seen- evaluate before, at and after the thrombus.
6. **Portal vein anastomosis -** Document patency with spectral doppler. Velocity should be between 15cm/s -100cm/s
7. **Iliac artery -** Arterial waveform with angle corrected velocity, sampled superior to anastomosis
8. **Iliac vein -**Waveform with peak velocities sampled superior to area of anastomosis.

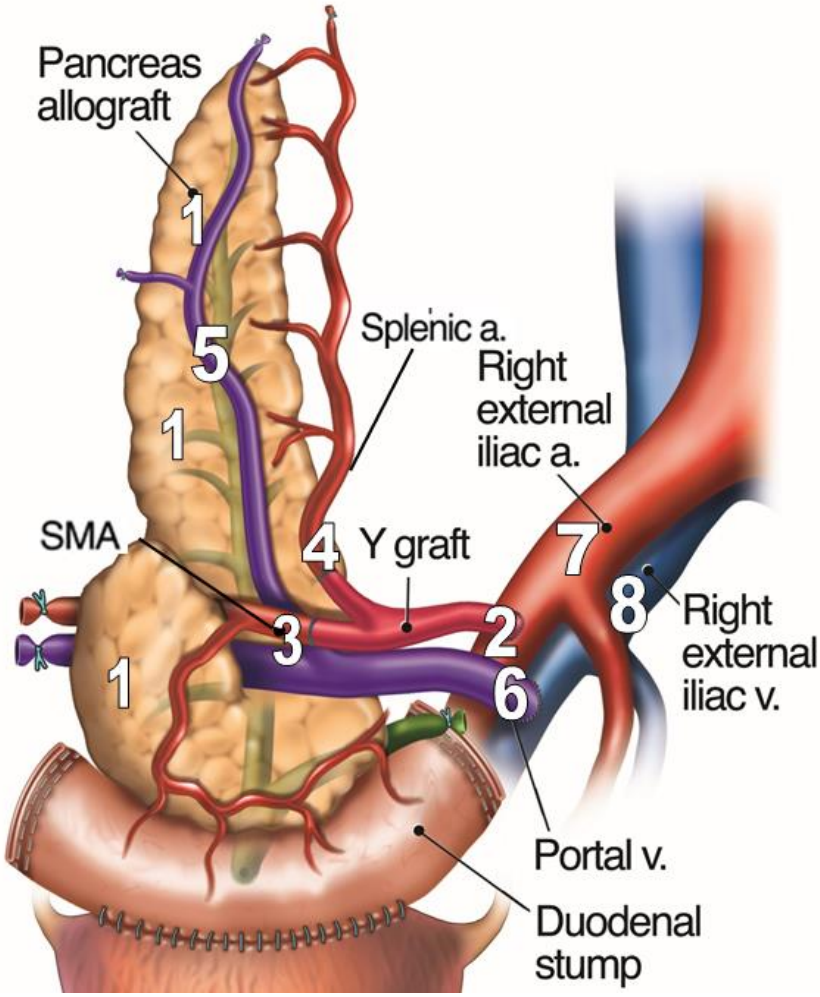


Figure 3 -Spectral doppler protocol locations. Note that the orientation of organ may differ.

COMBINED LIVER/PANCREAS TRANSPLANTS (CLPT)

INDICATIONS: These are done in very few circumstances, some of these are:

1. Lifesaving method in the treatment of otherwise non-respectable upper abdominal malignancies, however the outcome tends to be poor, due to recurrence of tumors.
2. More ideal indication is in cases of liver disease and insulin-dependent diabetes mellites.

GENERAL NOTES:

- Recipient has organ removal of the liver and pancreas and usually spleen.
- Placement of transplants, including the pancreas are in the orthotic location, so the vasculature differs from a pancreas transplant placed in lower quadrants.

PANCREAS TRANSPLANT VASCULATURE:

VENOUS:

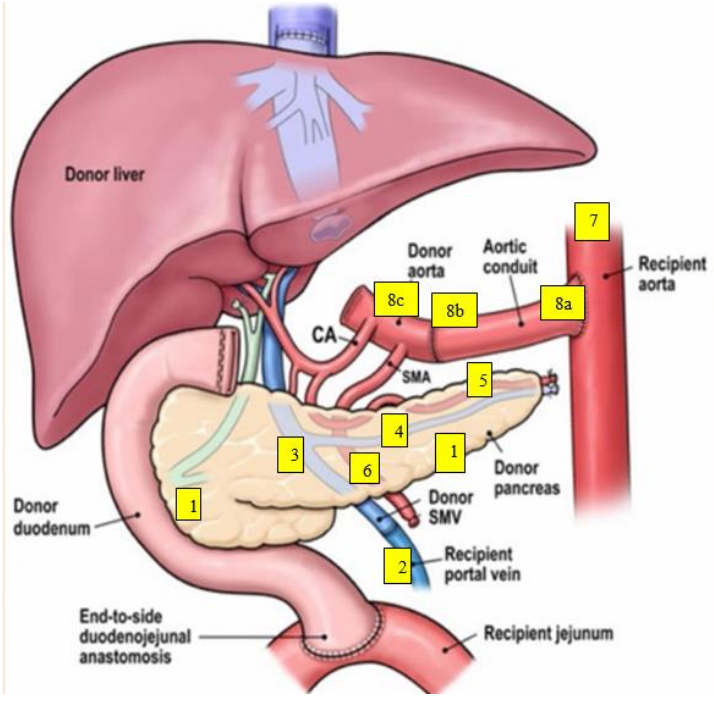
- The entire venous system is connected to the recipient's portal vein by the donor SMV.

ARTERIAL:

- There is no Y graft, instead there is an **Aortic conduit** – the is a conduit created from the donor's thoracic aorta.
- The aortic conduit connects the section of the donor aorta with the SMA and celiac axis to the recipient aorta.
- The anastomosis of the conduit to the aorta is infrarenal.

SPECTRAL DOPPLER

1. **Intra-pancreatic vasculature**-
    a. Arterial waveforms in the head, body, and tail. Velocity is not needed.
    b. Venous waveforms in the head, body, and tail. Velocity is not needed.
2. **Portal Vein of recipient**- Document peak velocity with angle correction, at anastomosis if visible.
3. **SMV of donor at head-** Document peak velocity with angle correction (supplies pancreatic head)
4. **Splenic Vein of donor in body and tail** - Document peak velocity with angle correction (supplies pancreatic body and tail)**-** Waveform should be obtained as distal as possible. If thrombus is seen- evaluate before, at and after the thrombus.



5. **Splenic Artery within body or tail**-Arterial waveform with angle corrected velocity. (Supplies pancreatic body/tail from donor celiac axis)
6. **SMA of donor at head** - Arterial waveform with angle corrected velocity. (Supplies pancreatic head from donor aorta/conduit)
7. **Recipient Aorta** superior to anastomosis - Arterial waveform with angle corrected velocity.
8. **Aortic conduit of donor**- Arterial waveform with angle corrected velocity:
    a. Prox at anastomosis to donor aorta
    b. Mid conduit (if seen)
    c. Distal Donor Aorta (if seen)

PANCREAS TRANSPLANT IMAGE LIST

IMAGE	MODE	# on figure
Panc TX orientation H/B/T	2D	
Panc Head w/ color & MFI for perfusion	Color/MFI	
Panc Body w/ color & MFI for perfusion	Color/MFI	
Panc Tail w/ color & MFI for perfusion	Color/MFI	
Eval for fluid collections under new incisions and around transplant	2D/Color	
Venous anastomosis to EIA w color	Color	
Arterial anastomosis to EIA w color	Color	
Y-Graft - *showing splitting of SMA & splenic artery*	Color	
Splenic vein -*Eval patency as far into body and tail as able*	Color	
Head Arterial & Venous Flow *no velocity needed*	Spectral	1
Body Arterial & Venous Flow *no velocity needed*	Spectral	1
Tail Arterial & Venous Flow *no velocity needed*	Spectral	1
Y-Graft anastomosis at EIA *velocity w angle correct*	Spectral cm/s	2
SMA beyond Y-Graft *velocity w angle correct*	Spectral cm/s	3
Splenic artery beyond Y-Graft *velo w angle correct*	Spectral cm/s	4
Splenic vein *as distal as possible, velo w angle correct*	Spectral cm/s	5
Splenic Vein if thrombus seen- eval before, at and after thrombus	*Spectral cm/s*	*5*
Portal vein anastomosis to EIA *velo w angle correct*	Spectral cm/s	6
External Iliac Artery (sup to anast) *velocity w angle correction*	Spectral cm/s	7
External Iliac Vein (sup to anast) *velocity w angle correction*	Spectral cm/s	8

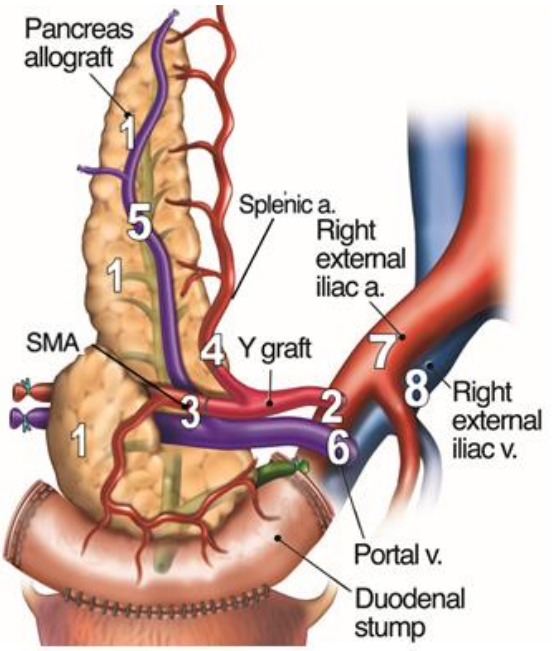


Figure 3 -Spectral doppler protocol locations. Note that the orientation of organ may differ.

PANCREAS TRANSPLANT PROTOCOL HISTORY

	Date	Changes made	By whom
Updated	09/2015		
Updated	10/2022	-Added Surgical info -Added MFI for perfusion when available -Added Splenic Vein with Spectral Doppler -Removed Y Graft mid, dist, prox requirements and will just be Y graft anastomosis, SMA and Splenic artery requirements -Added -include surgical orientation/attachments to history section of report	Protocol Meeting 9/22/2022 Manjiri Dighe, Shaun Bornemeier, Becky Marion, Katie Toth, Renee Betit Fitzgerald
Added	4/15/2024	Image Lists Combined Liver/Panc Tx info	Renee Betit Fitzgerald Ilona Kutek