Superior Vena Cava Resection and Reconstruction

Kenneth A. Kesler MD
Indiana University Department of Surgery

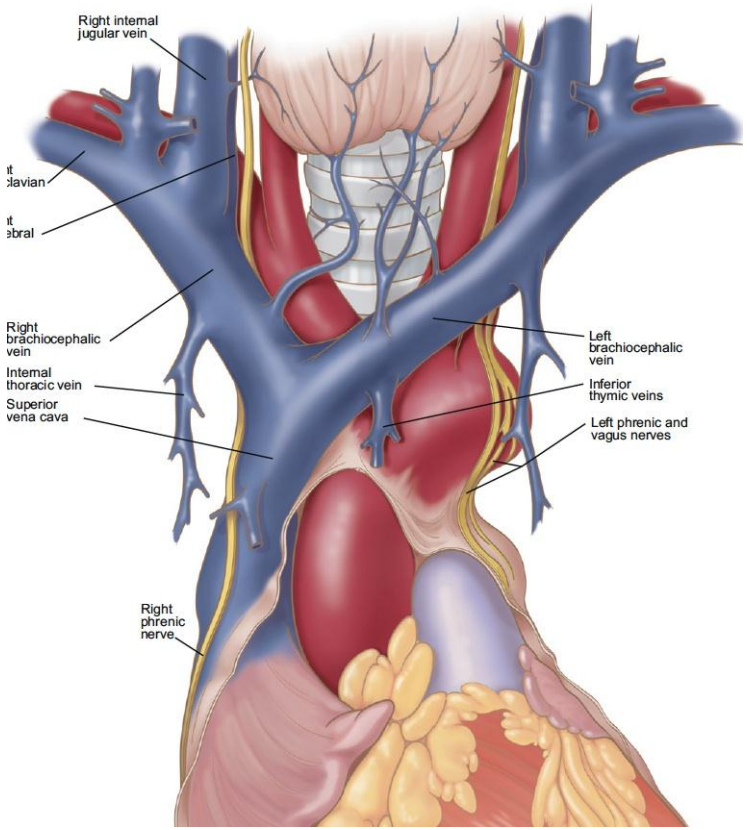
AATS 2013

Indiana University Health

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

No Disclosures

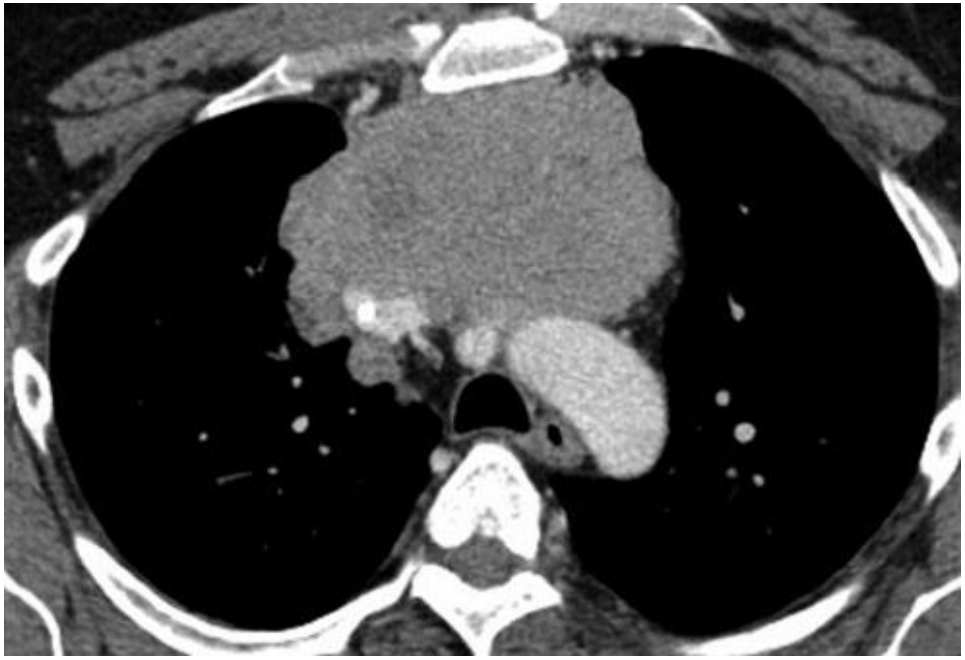
SVC RESECTION & RECONSTRUCTION
INTRODUCTION



Bennett *Thorac Surg Clin* 2011

- Location + Thin Wall + Low Pressure = Easy Compression/Invasion by Tumors and Inflammatory Processes
- Begins at Innominate Vein Confluence and Ends at Superior Aspect of Right Atrium (Intrapericardial)
- Proximity of Right Phrenic N

SVC RESECTION & RECONSTRUCTION
INTRODUCTION



Stage IIIB Thymoma

- SVC Syndrome: 15,000 Cases/Year in U.S.
- Benign (20% – 30%)
  - CVP Catheters/Pacemakers
  - Granulomatous Disease
- Malignant (70% – 80%)
  - Lung Cancer 75%
  - Lymphoma 10%
  - Thymic Neoplasms
  - Germ Cell Tumors

SVC RESECTION & RECONSTRUCTION
REPLACEMENT CONDUITS

- Autologous Vein
  - Spiral Saphenous Vein
  - Superficial Femoral Vein
- Pericardium
  - Bovine
  - Autologous
- Prosthetic Vascular Grafts
  - PTFE (Externally-Stented or “Ribbed”)
  - Dacron
- Vascular Allografts
  - Descending Thoracic/Abdominal Aorta

SVC RESECTION & RECONSTRUCTION
PREOPERATIVE EVALUATION

- Define Tumor/Vein Anatomy: CT Venography/MRI
- Plan 2 to 3 cm Tumor Free Proximal and Distal "Target Areas" For Venous Clamping
- Choose Incision(s) to Optimize Tumor Dissection/Resection & Reconstruction of Great Veins
  - Median Sternotomy
  - "Clam Shell"
  - Median Sternotomy/Right Thoracotomy
  - Right Thoracotomy
  - "Trap Door"

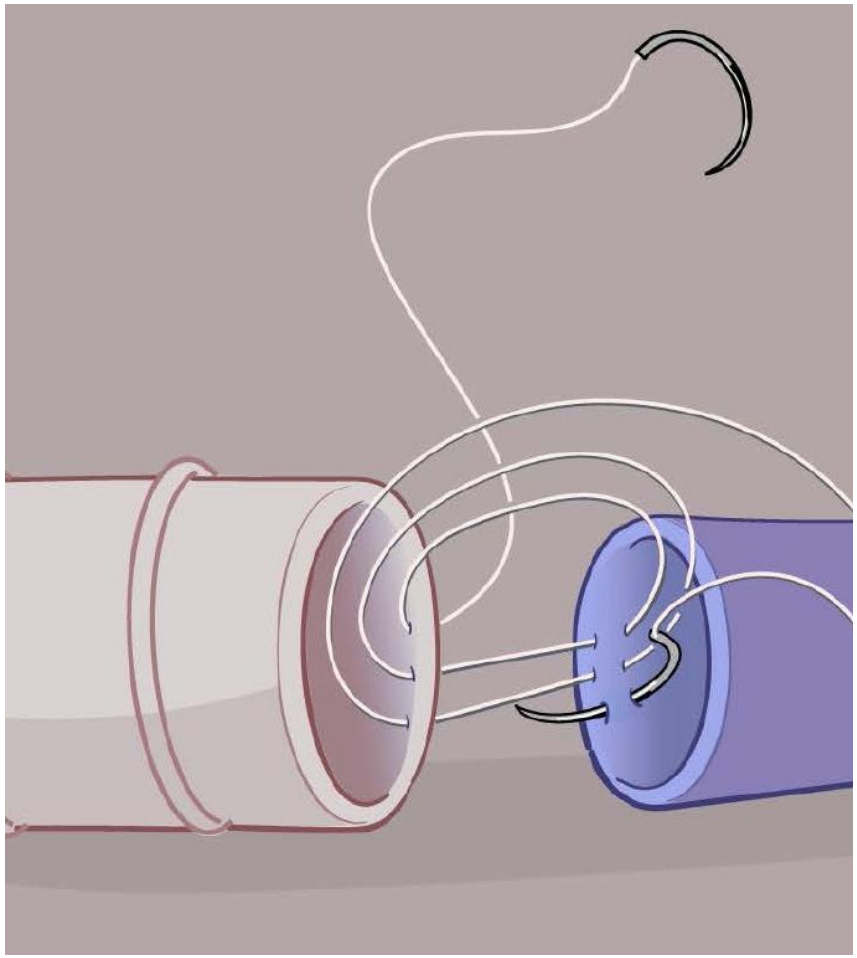
SVC RESECTION & RECONSTRUCTION
SURGICAL APPROACH

- Double Lumen Endotracheal Tube
- CVP in Femoral Vein
- Prophylactic Perioperative Antibiotics
- Antimicrobial Barrier Drape
- Cardiopulmonary Bypass “Standby”

SVC RESECTION & RECONSTRUCTION
SURGICAL APPROACH

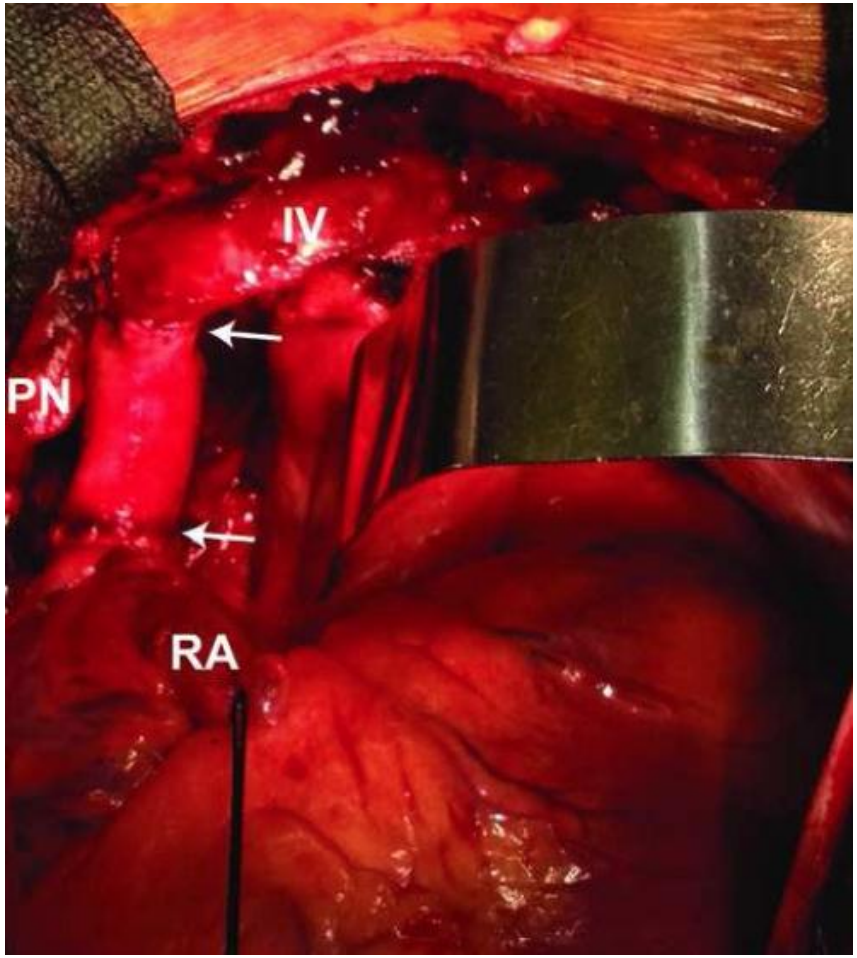
- Elevate HOB
- Intravenous Heparin (75 to 100 Units/Kg)
  - No Reversal
- Minimize Time of SVC Occlusion (< 45 Mins)
  - If Possible Reserve SVC Occlusion/Resection/Reconstruction as Last Step in Tumor Removal

SVC RESECTION & RECONSTRUCTION
IU TECHNIQUES



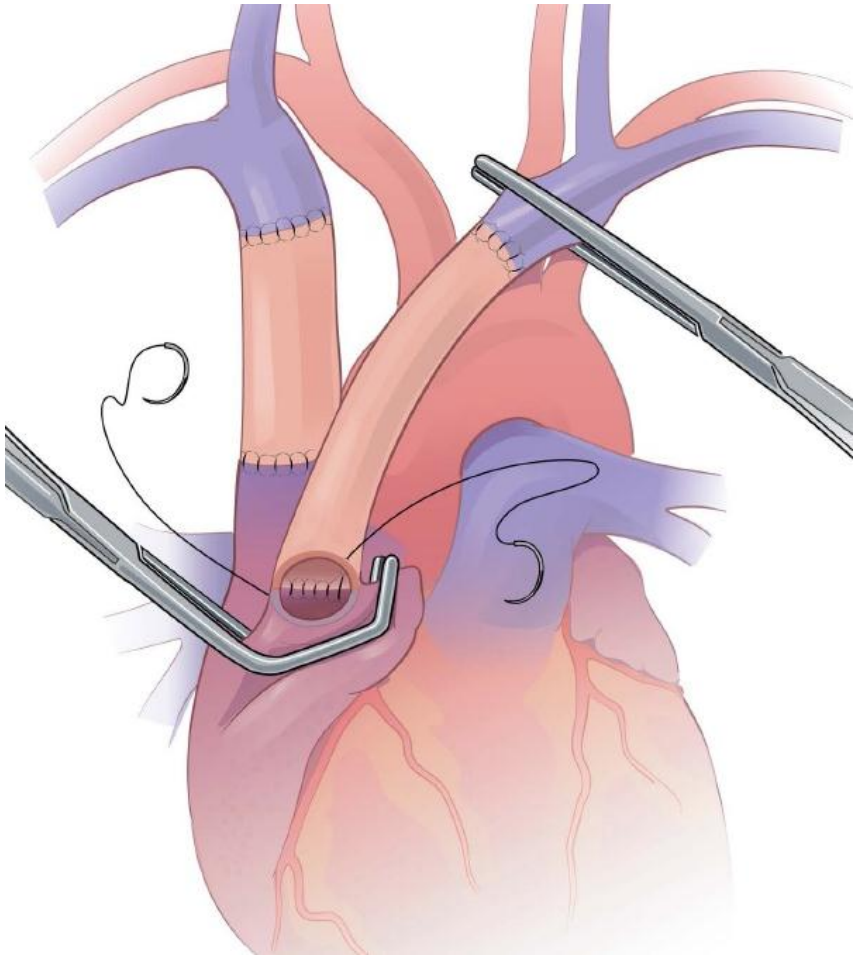
- "Proximal" Anastomosis First & "Distal" Anastomosis Last
- Running Vertical Mattress Suture
- 5-0 PTFE Suture When Using ePTFE Grafts
- Graft Length Critical For Patency
- No Graft Clamping

SVC RESECTION & RECONSTRUCTION
RECONSTRUCTION TECHNIQUES



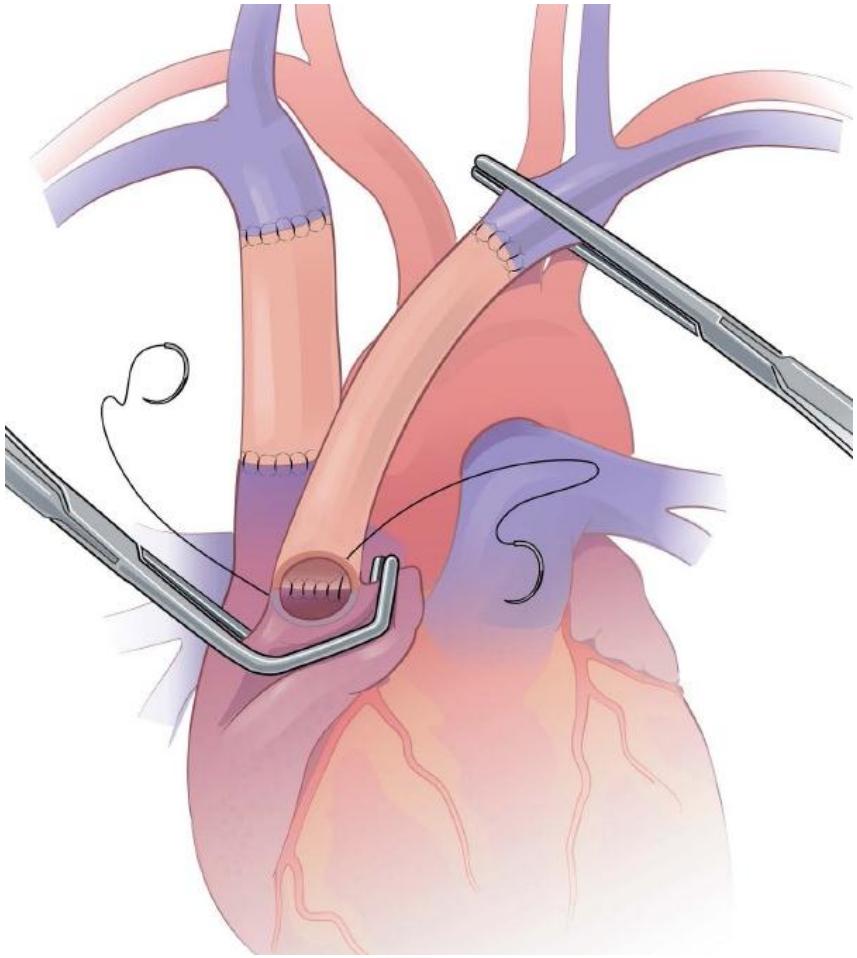
- SVC Only ⟶
  "Straightforward"
- Innominate Vein
  - "Double-Vein"
  - "Y" Graft
  - "Single-Vein"

SVC RESECTION & RECONSTRUCTION
"DOUBLE-VEIN" RECONSTRUCTION



- Right Innominate Vein "Orthotopic" & Left Innominate Vein "Heterotopic"
  - Right Atrial Appendage
  - Right Atrial Body
- Left Graft Measured with Sternotomy Retractor out
- Excise Atrial Trabeculae

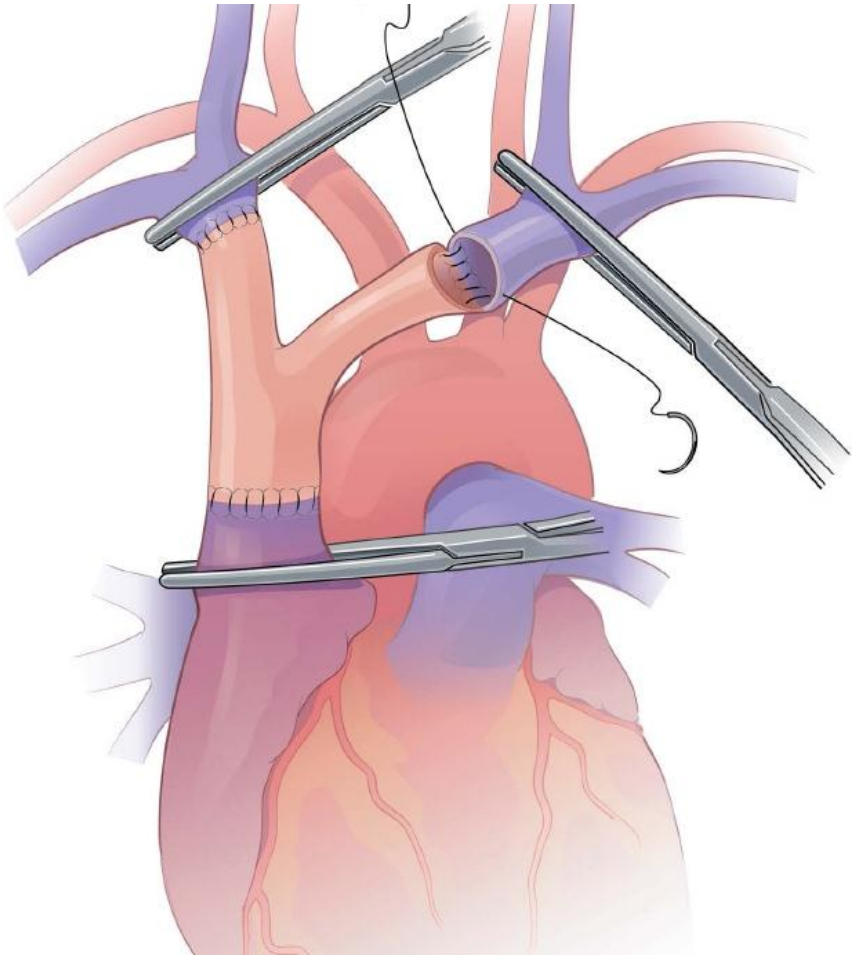
SVC RESECTION & RECONSTRUCTION
"DOUBLE-VEIN" RECONSTRUCTION



- Advantages
  - Cases w/ Patent SVC, Complete Brachiocephalic Occlusion Avoided During Reconstruction
  - More Complete Brachiocephalic Venous Drainage vs "Single-Vein"
  - Symptoms due to Occlusion of One Graft may be Mitigated
- Disadvantage
  - Conduits in Anterior Mediastinum More Susceptible to Kinking Cardiac/Lung Motion

SVC RESECTION & RECONSTRUCTION

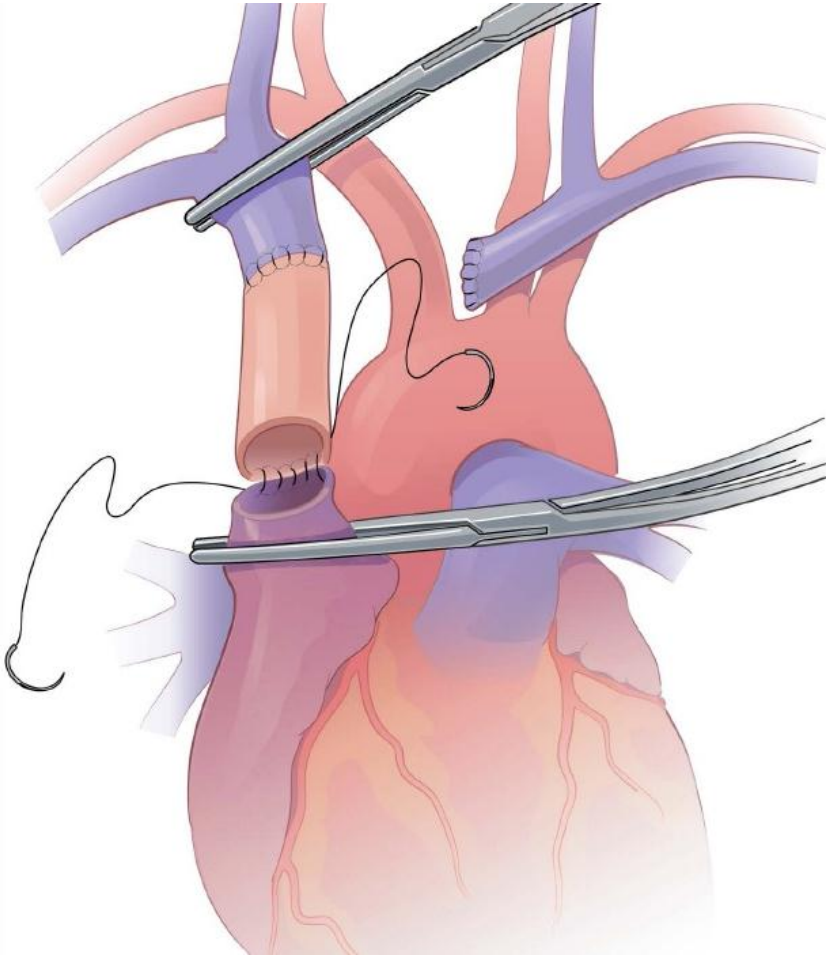
"Y" GRAFT RECONSTRUCTION



- More Complete Brachiocephalic Venous Drainage vs "Single-Vein"
- Symptoms due to Occlusion of One Arm may be Mitigated
- Avoid "Graft-to-Graft" Anastomosis
- Aortoiliac "Y" Allografts may Improve Patency?

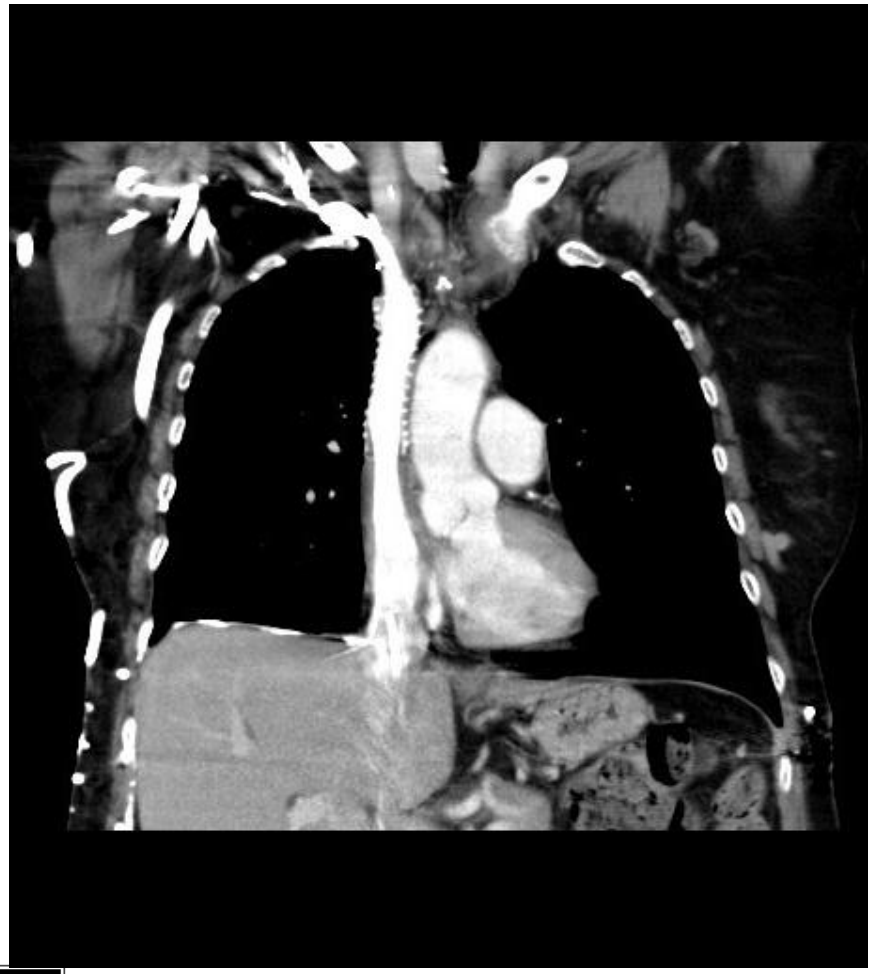
SVC RESECTION & RECONSTRUCTION

"SINGLE-VEIN" RECONSTRUCTION



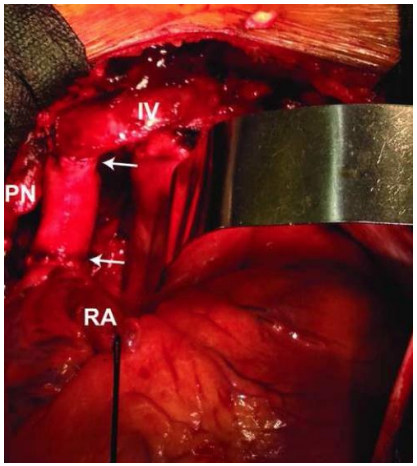
- "Simplest" Approach
- Occasionally the Only Option with Extensive Proximal Thrombosis
- Higher Blood Flow Through a Single Conduit
- Severe Upper Extremity Swelling Rare Where Ligation of Single Innominate Vein Performed

SVC RESECTION & RECONSTRUCTION
"SINGLE-VEIN" RECONSTRUCTION



- Right Innominate Vein to SVC
  - No Graft Angulation
  - Shorter Graft Length
  - Downward Blood Flow
  - Less Susceptible to Kinking
- Left Innominate Vein to SVC
  - Sternotomy Retractor Out to Determine Graft Length
  - Distal Anastomosis in RA Appendage/RA Body More Susceptible to Kinking?

SVC RESECTION & RECONSTRUCTION
ANTICOAGULATION



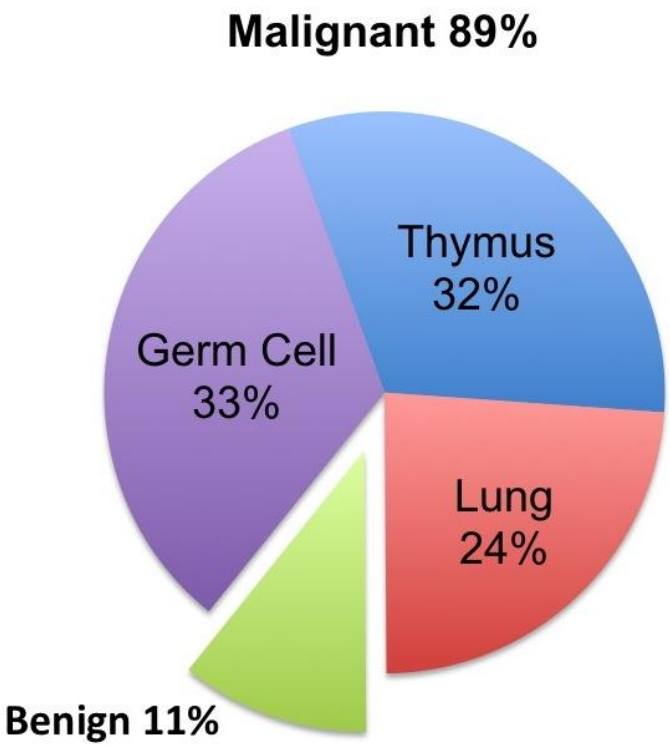
- No Consensus
- Suggest Anticoagulation Should be Tailored to Conduit Material & Length/Diameter
  - None or ASA for Allograft, Pericardial Graft, Short/Large Diameter Prosthetic Grafts
  - Short or Long-Term Warfarin for Long/Small Diameter Prosthetic Grafts

SVC RESECTION & RECONSTRUCTION

SUMMARY PUBLISHED RESULTS

	Journal	Year	Patient #'s	Patency	Months Follow-Up
Spiral Vein					
Doty	*JTCVS*	1990	9	78%	81
Bovine Pericardium					
Ciccone	*EJCTS*	2011	14	100%	46
PTFE					
Dartevelle	*JTCVS*	1991	22	90%	23
Shintani	*JTCVS*	2005	18	55%	33
Suzuki	*ATS*	2006	11	82%	67
Spaggiari	*ATS*	2007	13	66%	32
Lanuti	*ATS*	2009	12	91%	45
Leo	*EJCTS*	2010	27	96%	4
Okereke	*ATS*	2010	38	94%	24
Sekine	*ATS*	2010	20	70%	44
Odell	*STCVS*	2011	10	92%	17
			Total 171	Ave 81%	Ave 32
Allograft					
Gomez-Caro	*ATS*	2008	9	100%	18

SVC RESECTION & RECONSTRUCTION
IU DATA: PROSTHETIC GRAFTS



- 48 Patients Total
  - 29 Patients Reviewed
- Follow Up Interval
  - Range: 0.2 to 13 Years
  - Average: 4.5 Years
- Outcomes
  - Graft Infection/Death N=1
  - Overall Patency 86%
  - Pulmonary Embolism N=2
  - IR “Rescue” N=2

SVC RESECTION & RECONSTRUCTION
IU DATA: PROSTHETIC GRAFTS

TECHNIQUE	GRAFT (AVE DIA)	PATENCY %	PATIENT #'s	SWELLING	
SINGLE VEIN					
LEFT INNOMINATE TO SVC	ePTFE (14 mm)	80%	4/5	LEFT ARM HEAD RIGHT ARM	MILD (N=1)
RIGHT INNOMINATE TO SVC	ePTFE (15 mm)	100%	13*/13	LEFT ARM HEAD RIGHT ARM	MOD (N=1)
"Y" GRAFT	Bifurcated/PTFE (3) Bifurcated Dacron (1)	25%	1*/4	LEFT ARM HEAD RIGHT ARM	MILD-MOD (N=2) MILD-MOD (N=3) MILD-MOD (N=2)
SVC ONLY	ePTFE (16 mm)	100%	7/7	LEFT ARM HEAD RIGHT ARM	

SVC RESECTION & RECONSTRUCTION
CONCLUSIONS I

- SVC Resection & Reconstruction is a Surgical Challenge ⟶ Meticulous Approach Needed
- Morbidity/Mortality Acceptable in Select Patients
- Long-Term Prognosis Based on Underlying Pathology

SVC RESECTION & RECONSTRUCTION
CONCLUSIONS II

- Conduit Material
  - Excellent Patency Reported with Bovine Pericardium and Aortic Allografts → More Study Warranted
  - Good Patency Reported with ePTFE
  - Heparin Bonded PTFE Grafts Not Available in SVC Diameters

- Innominate Vein Reconstruction Technique Controversial
  - "Y", "Double-Vein", vs "Single-Vein"
  - Reversed Aortoilliac Allografts For "Y" Reconstruction Appear Promising

- Early IR "Rescue" Possible for Proximal Stenosis