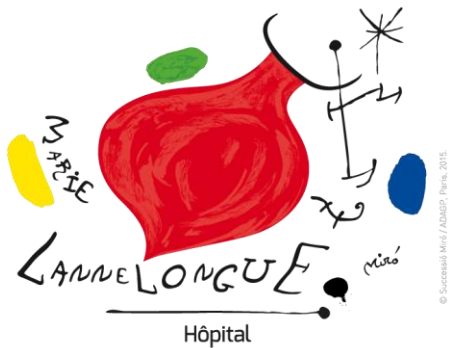
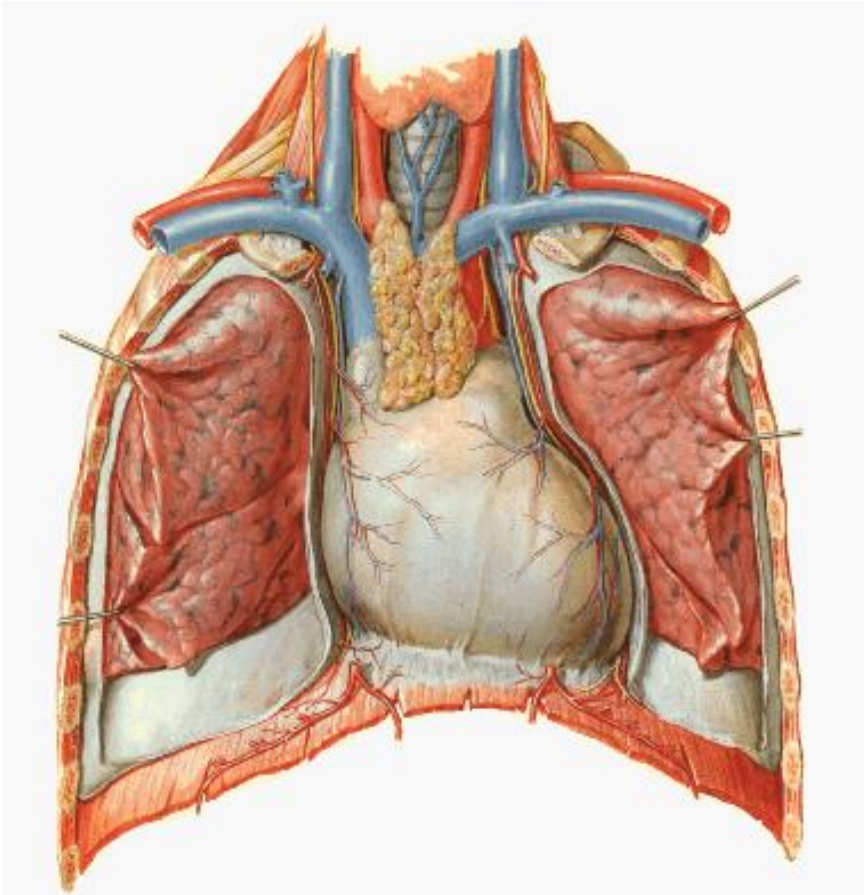


Superior vena cava surgery: techniques and results

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Thoracic Surgery, Marie Lannelongue Hospital
Institut d'Oncologie Thoracique
Université Paris-Saclay



Surgical Indications



- Lung Cancer (T4 extended surgery)
- Mediastinal Tumors (Thymoma)
- Benign (catheter, Fibrous mediastinitis)
- SVC disease

Operative Strategy

- Cross Clamping Strategy

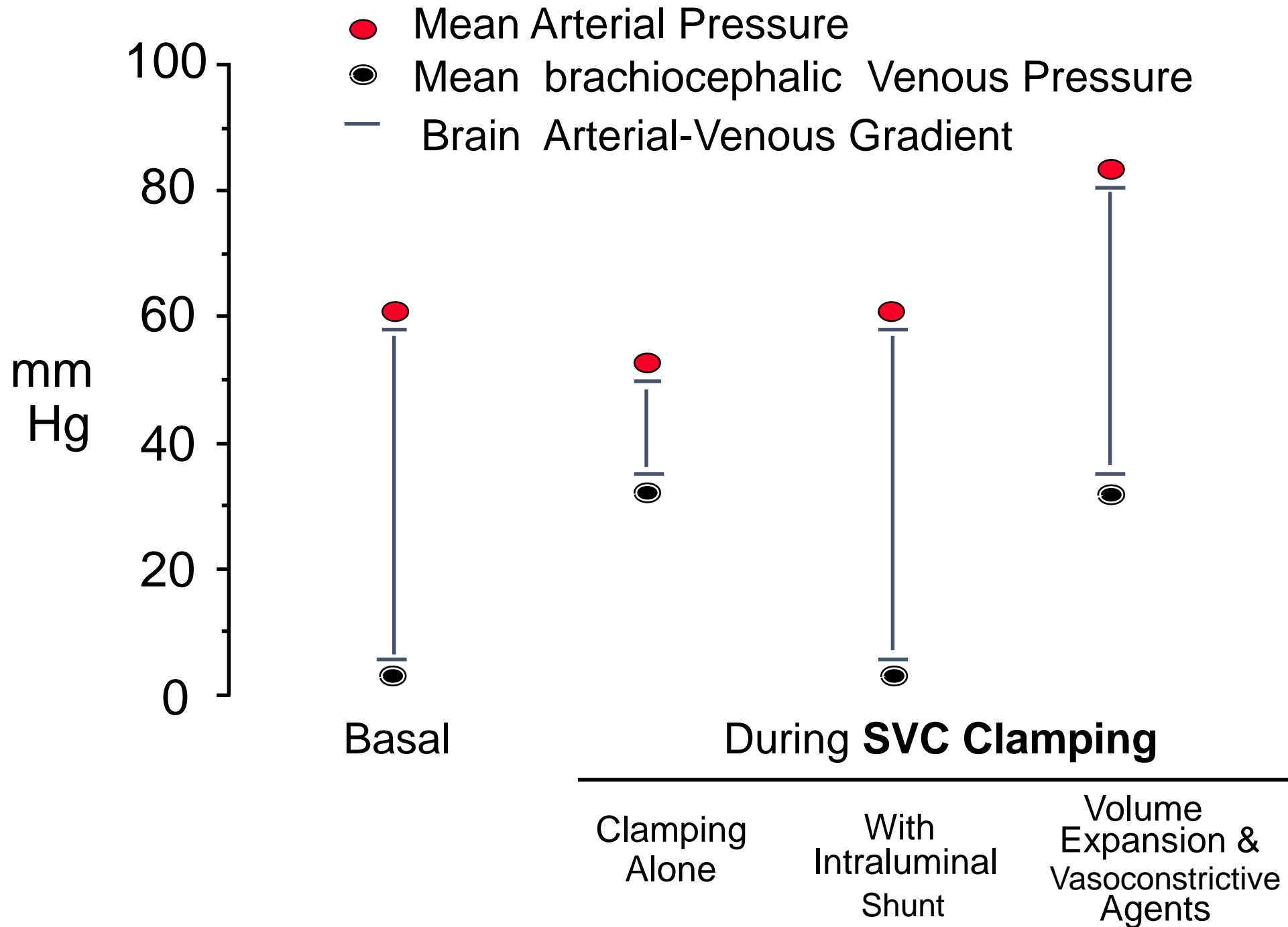
- No need for CPB
- As short as possible clamping time (< 60 min. *Masuda H Ann Thrac Surg 1989*)
- Collaterals evaluation

- Vascular conduit

- PTFE (anticoagulation) Ringed/Usual Innominate vein/SVC trunk
- Bovine pericardium

- Deairing

- Surgical Approach



Cross-clamping Technique

Vasoconstrictive agents – Fluid expansion (IVC IV lines)

Clamping time as short as possible

Anticoagulation - Héparine

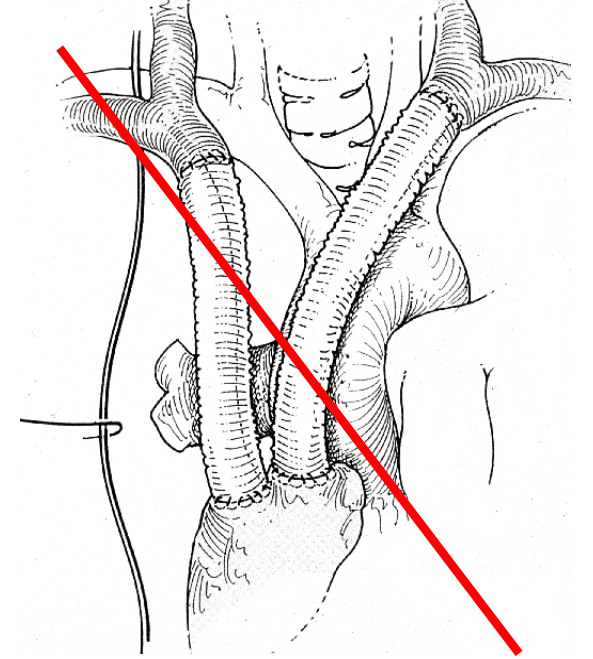
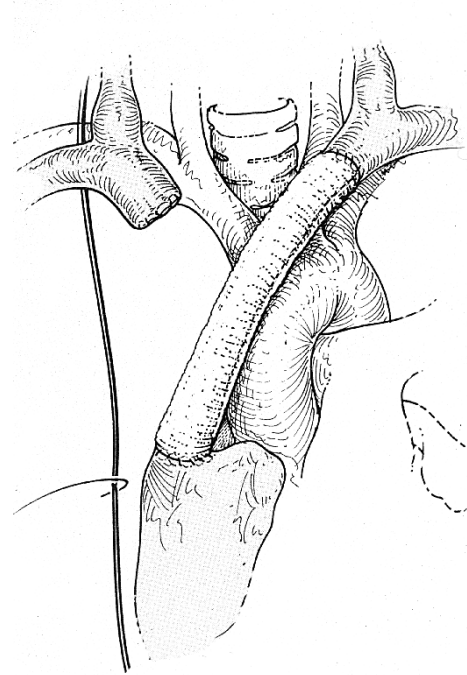
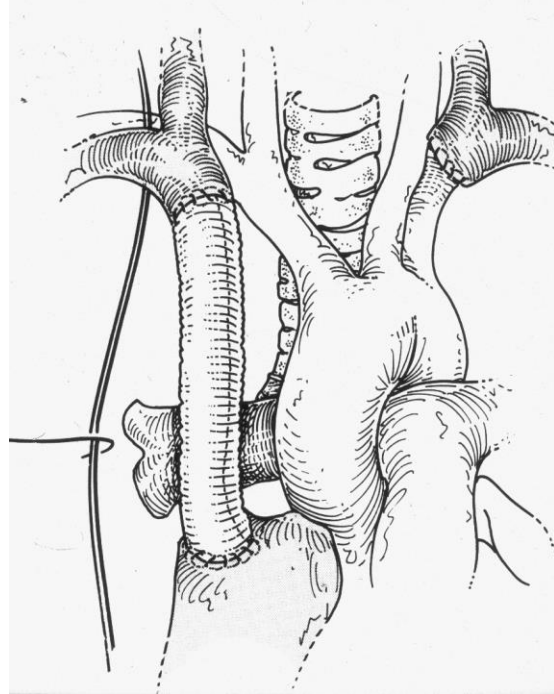
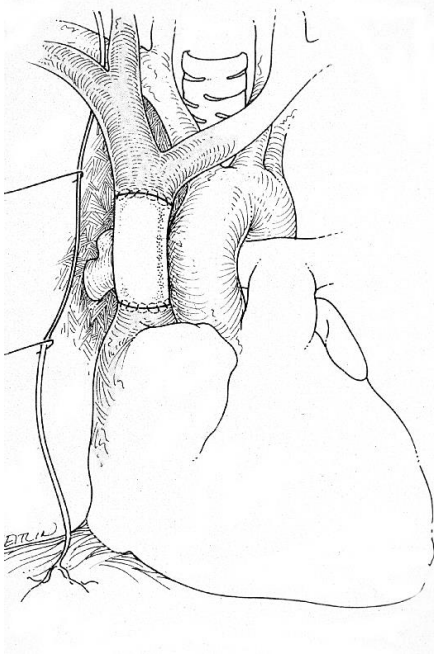
Before clamping-0.5 mg/kg iv

after: TCA=1.5 T

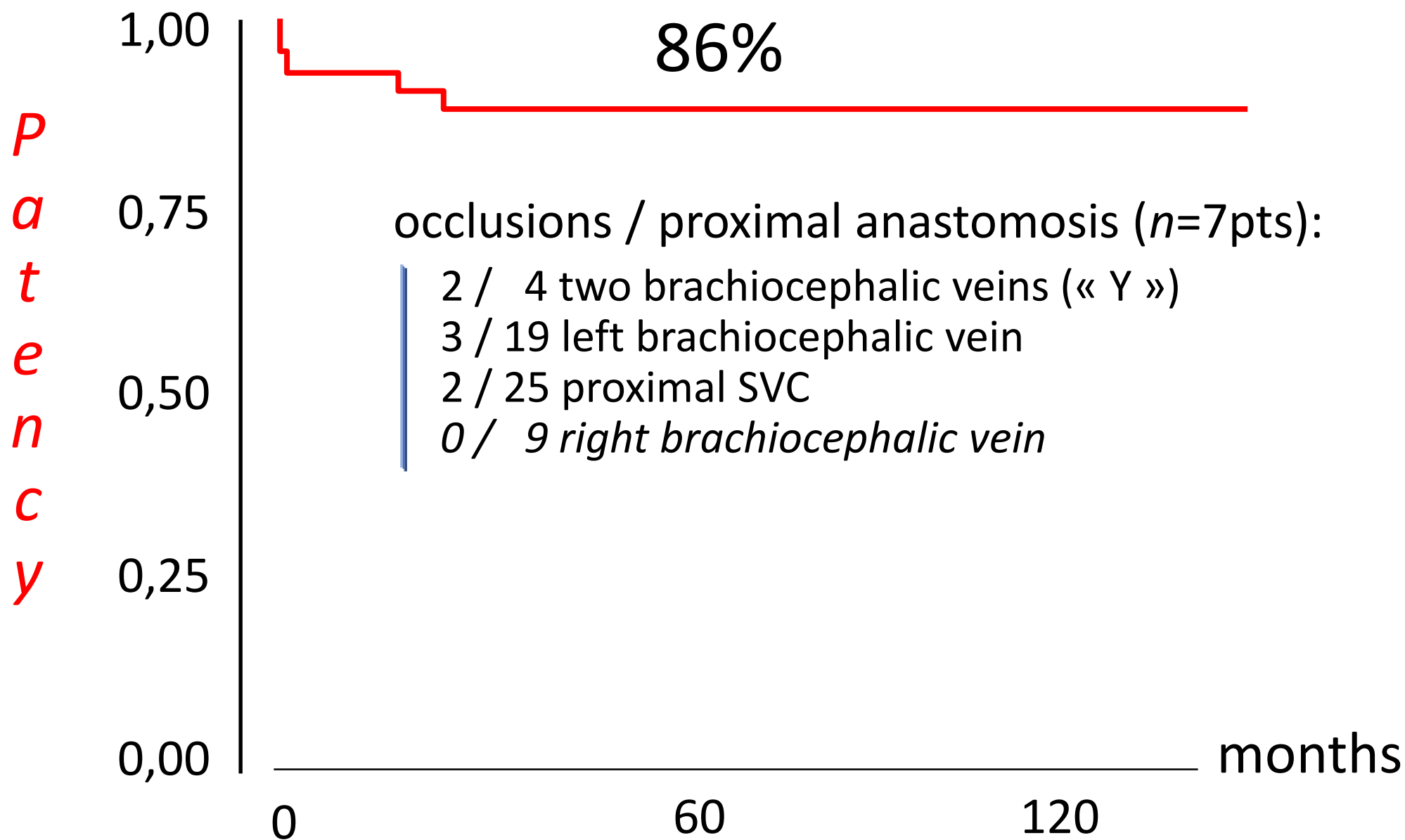
At discharge: VKA (INR 2-3)

Monitoring: Pressure, NIRS?

SVC Reconstructions: Different options

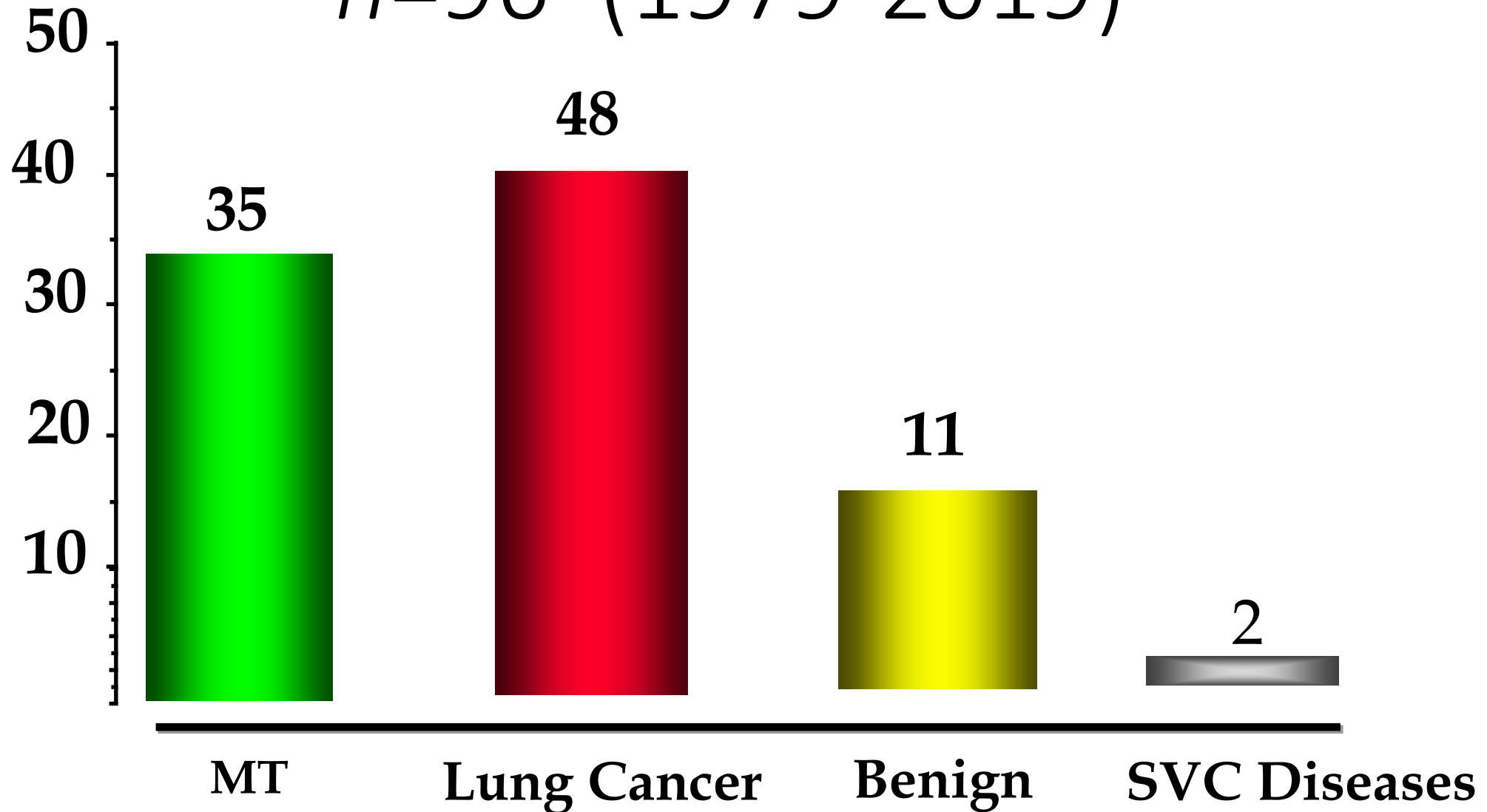


PTFE patency (n=94, Marie Lannelongue experience)



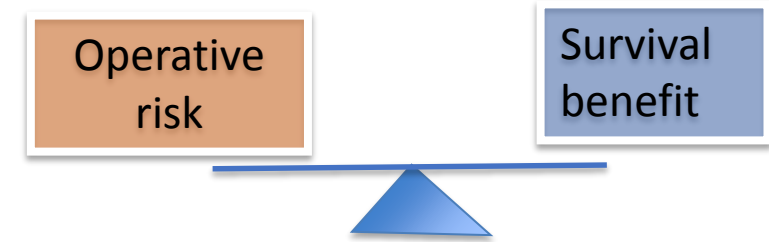
Marie Lannelongue Experience

$n=96$ (1979-2019)



Lung Cancer

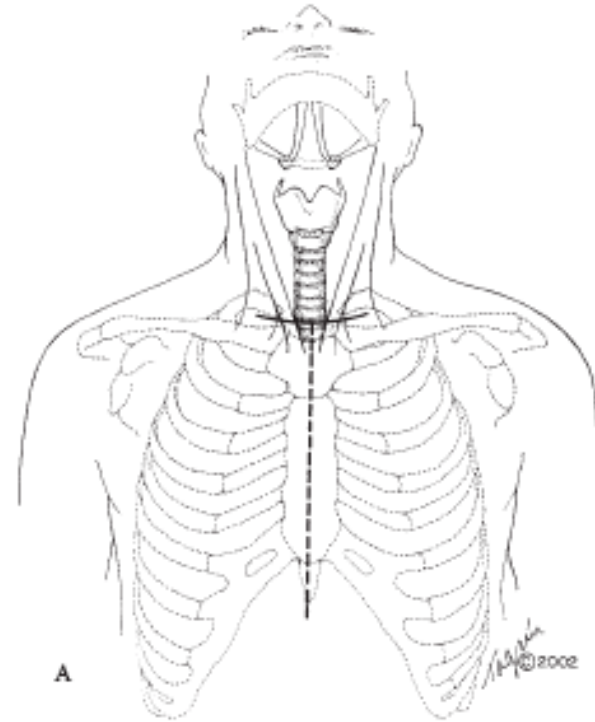
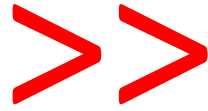
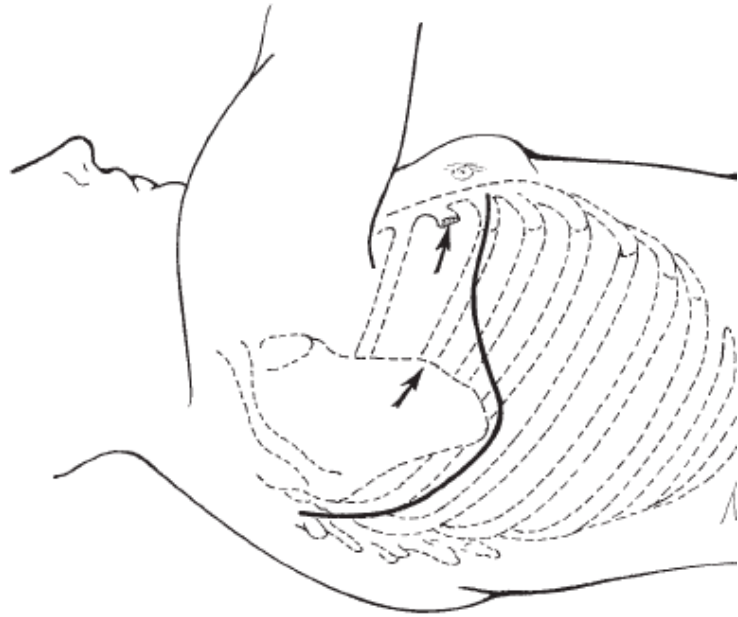
Indications for extended resections



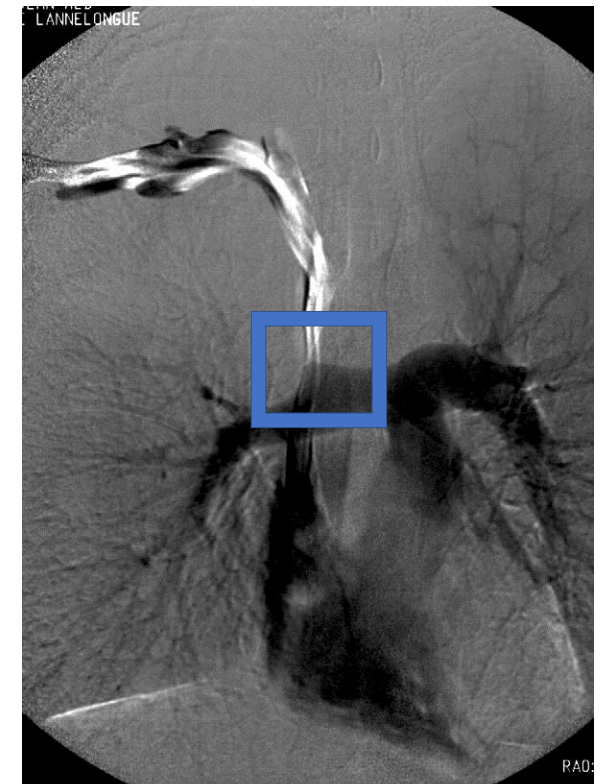
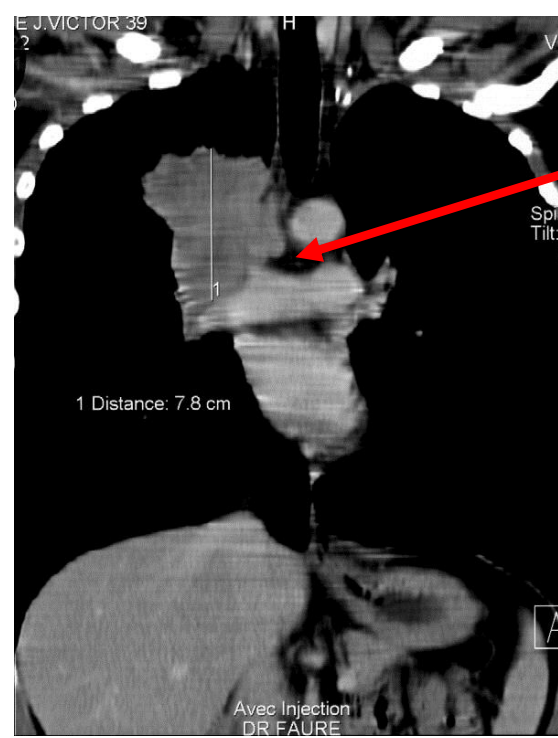
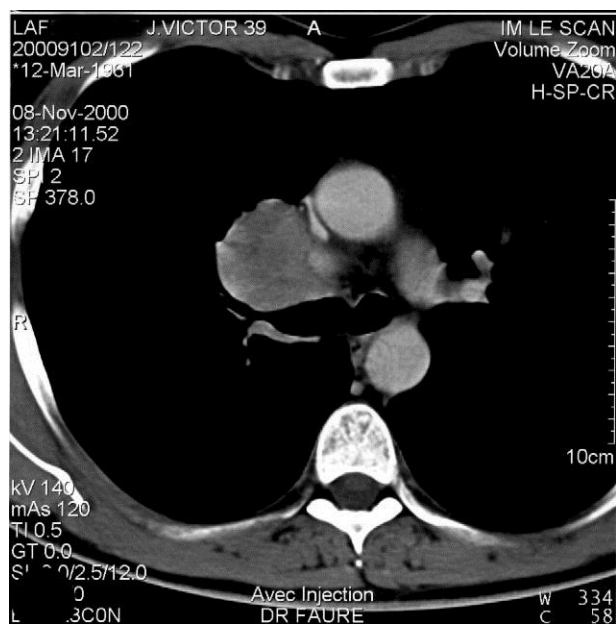
- **Rule out N2 disease**
- **Lung function tests** (PFTs, Exercise testing)
- **Don't forget pulmonary circulation+++**
 - Cardiac echography
- **Associated risk factors (vascular disease)**

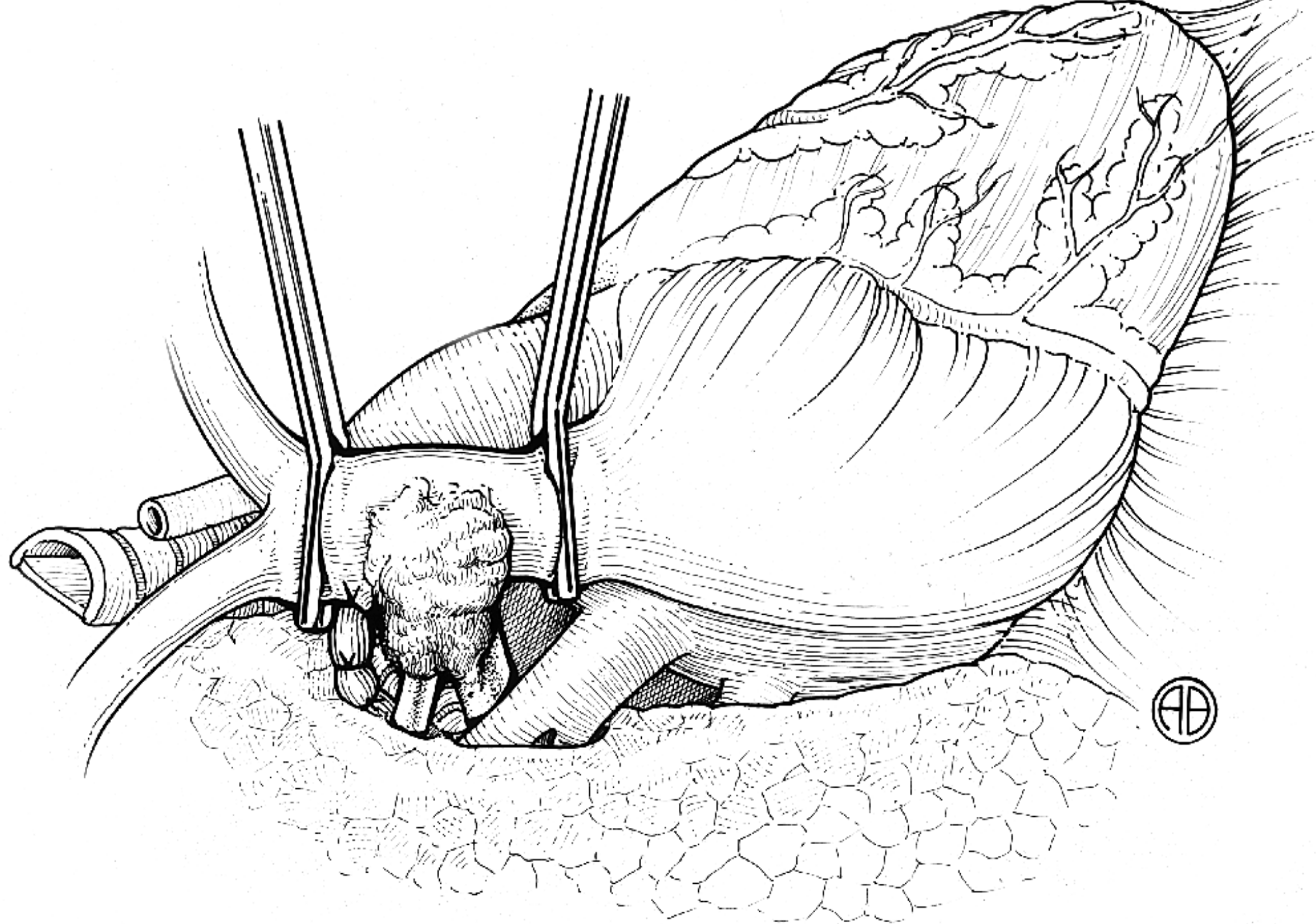
- **For the tumor => Perfectly assess local extension (R0 resection)**
 - Tracheal involvement (radial EBUS, mediastinoscopy)
 - Angiograms, CT 3D-reconstructions

Surgical approach

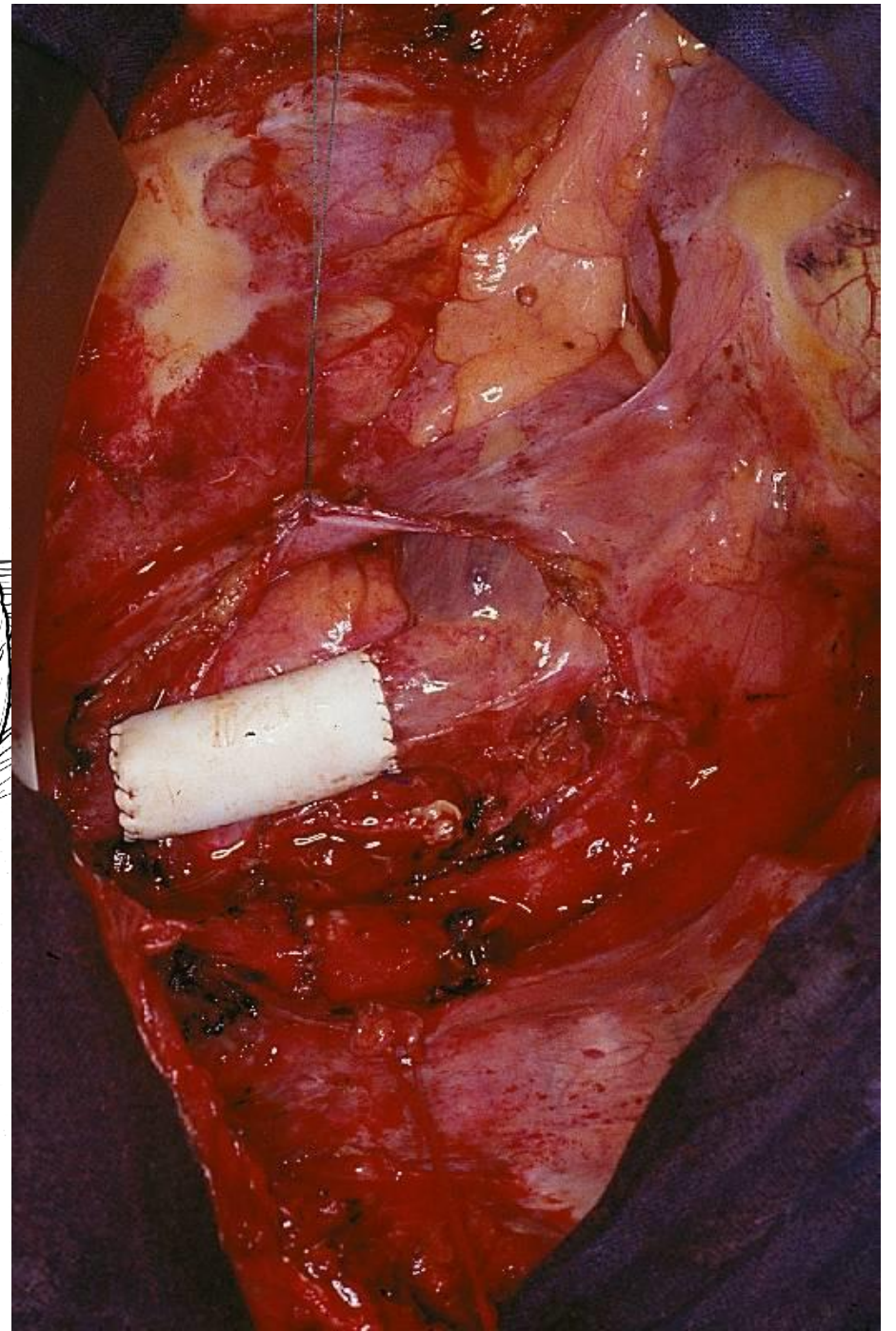
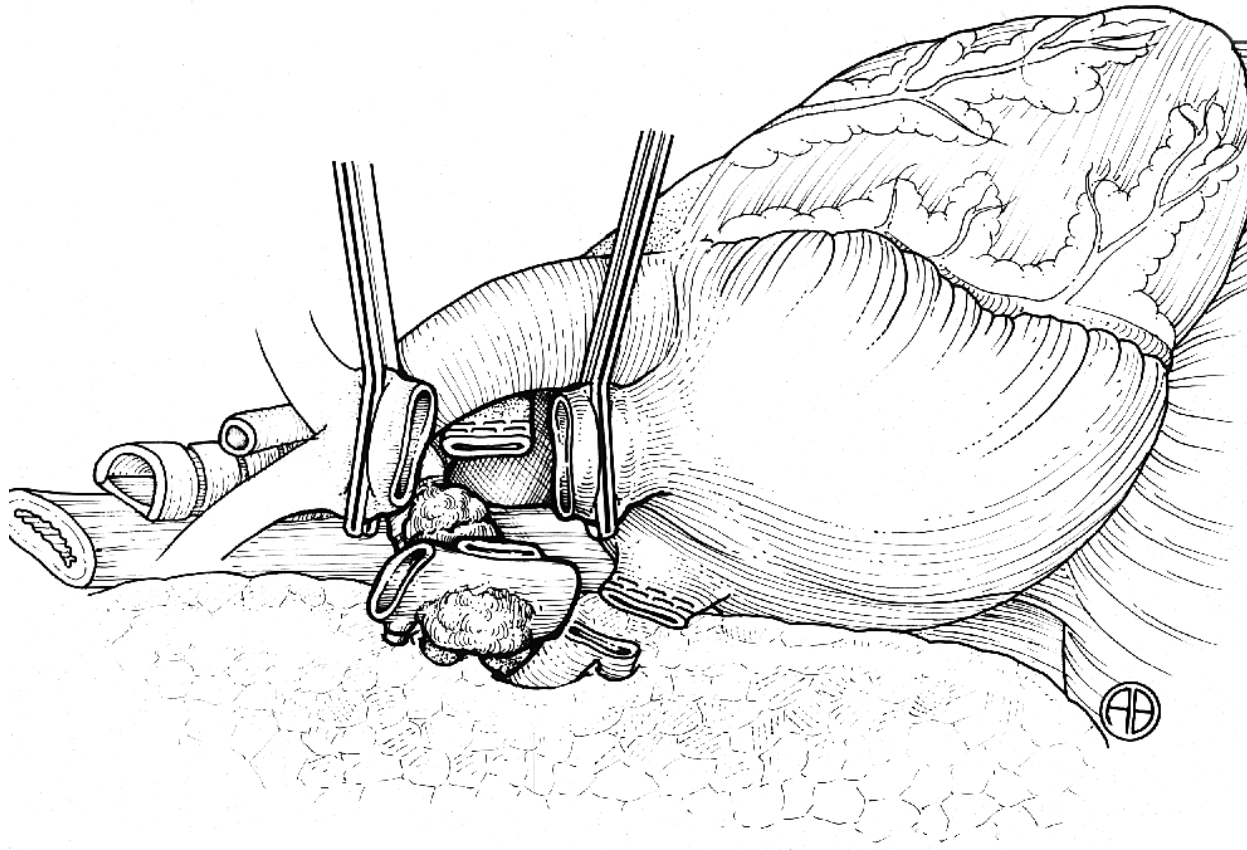


- Right carinal pneumonectomy
- Carinal Reconstruction with RUL
- RUL





SVC replacement by PTFE graft size 18



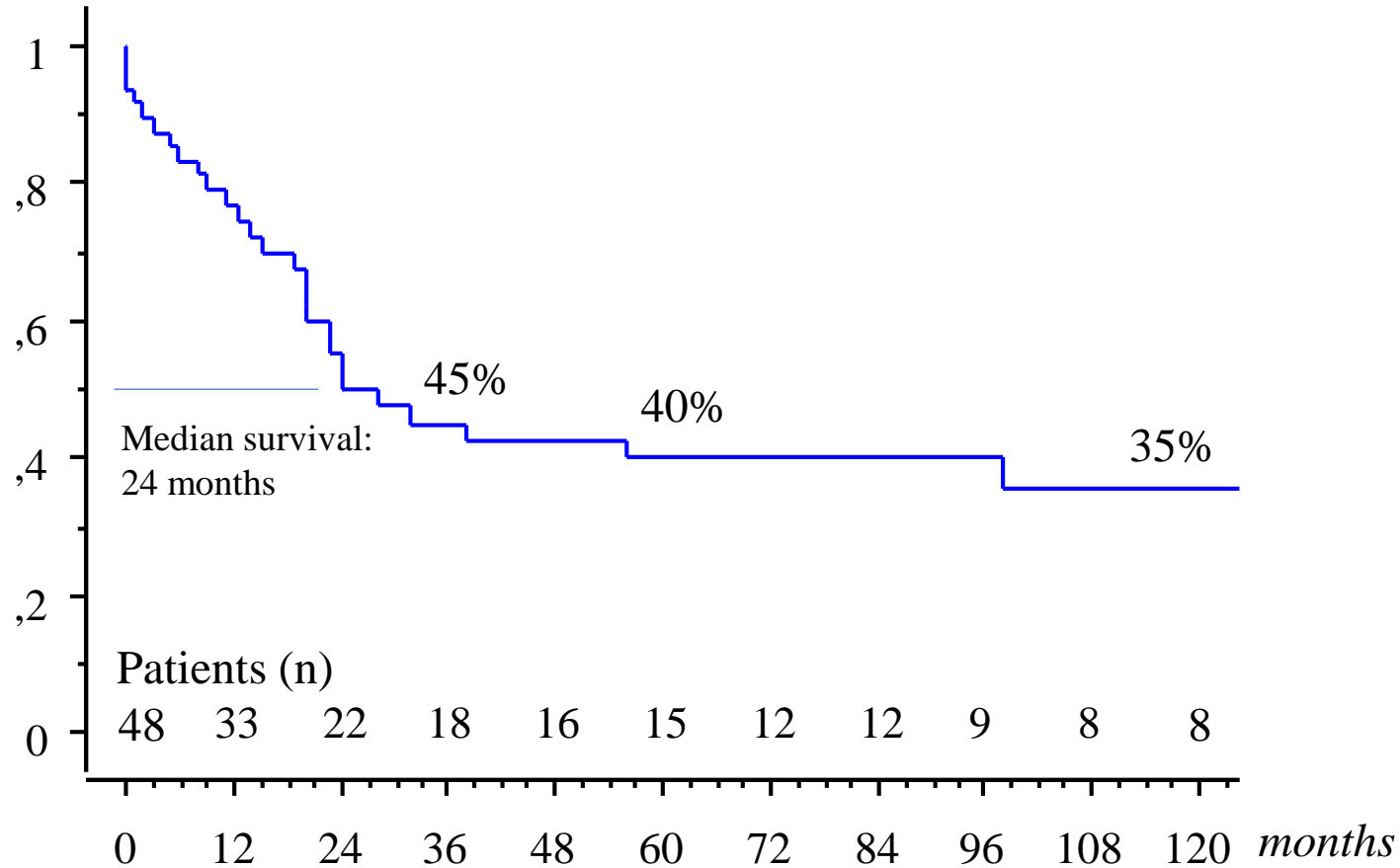


DR ANGEL
M: 5/24
I: 12/24
FLTR: 15%
LNDMK: 0%

Scene: 1
W-B: 700
W-C: 40
X: -0.1
Y: 0.0

LAO: 0 CRAN: 0

Results: Overall Survival (n=48)



Mean Clamping time =
29.4 min (15-50)

>90% SVC trunk resection

!! T4 \neq N2

Table 1
Results of SVC resection and reconstruction in the setting of lung cancer from selected case series

Author	Patients	Morbidity (%)	Mortality (%)	Median Survival	5-Year Survival (%)
Lanuti et al, ⁸ 2009	9			21.4 mo	31.0
Suzuki et al, ⁷ 2004	40	40.0	10.0		24.0
Shargall et al, ⁶ 2004	15		14.0	40.0 mo	57.0 (3-y)
Sekine et al, ⁹ 2010	9				18.8
Thomas et al, ¹⁰ 1994	15	20.0	7.0	8.5 mo	24.0
Yildizeli et al, ⁵ 2008	39	10.3	7.7	19.0 mo	29.4
Misthos et al, ¹¹ 2007	9		0	31.0 mo	11.0
Spaggiari et al, ¹² 2004	109	30.0	12.0	11.0 mo	21.0

Mediastinal Tumors

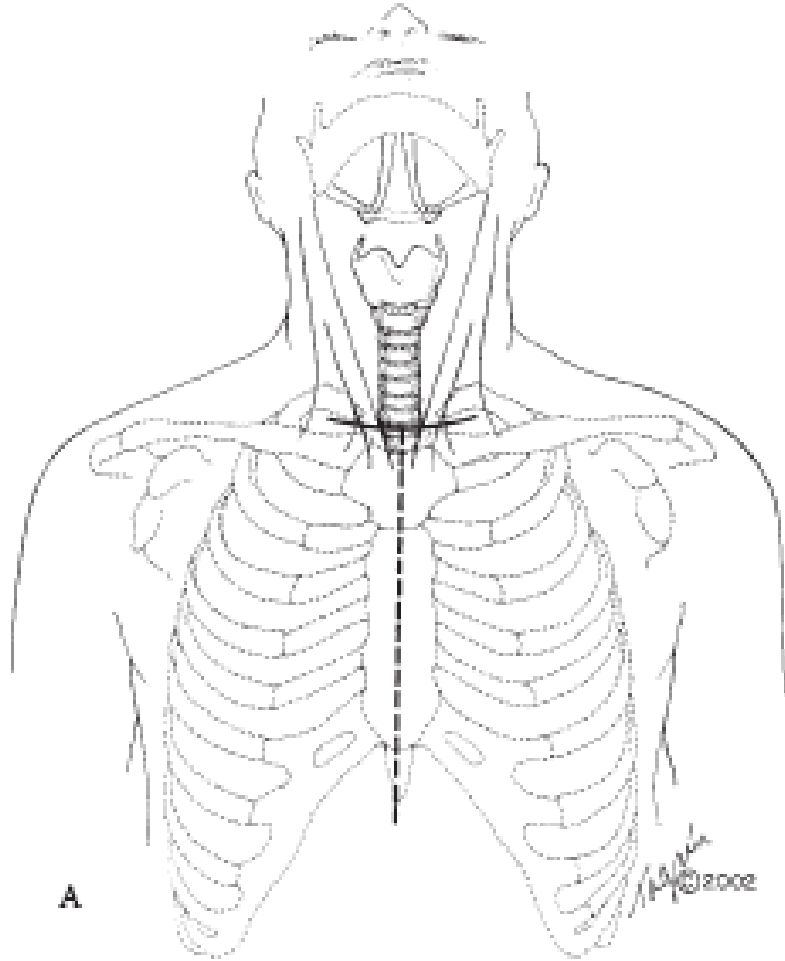
- Thymoma
- Germ cell tumors
- Sarcoma
- Others



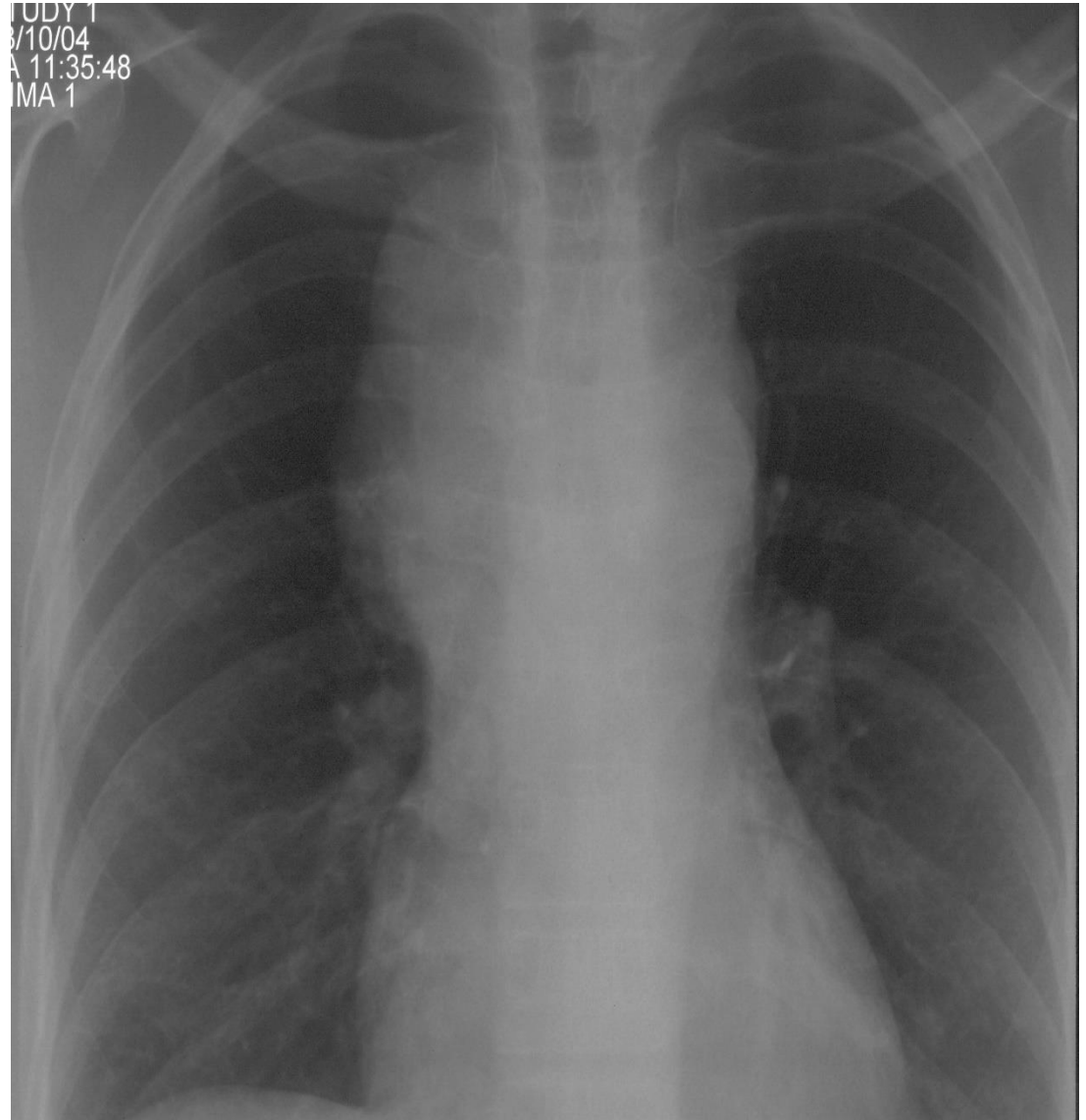
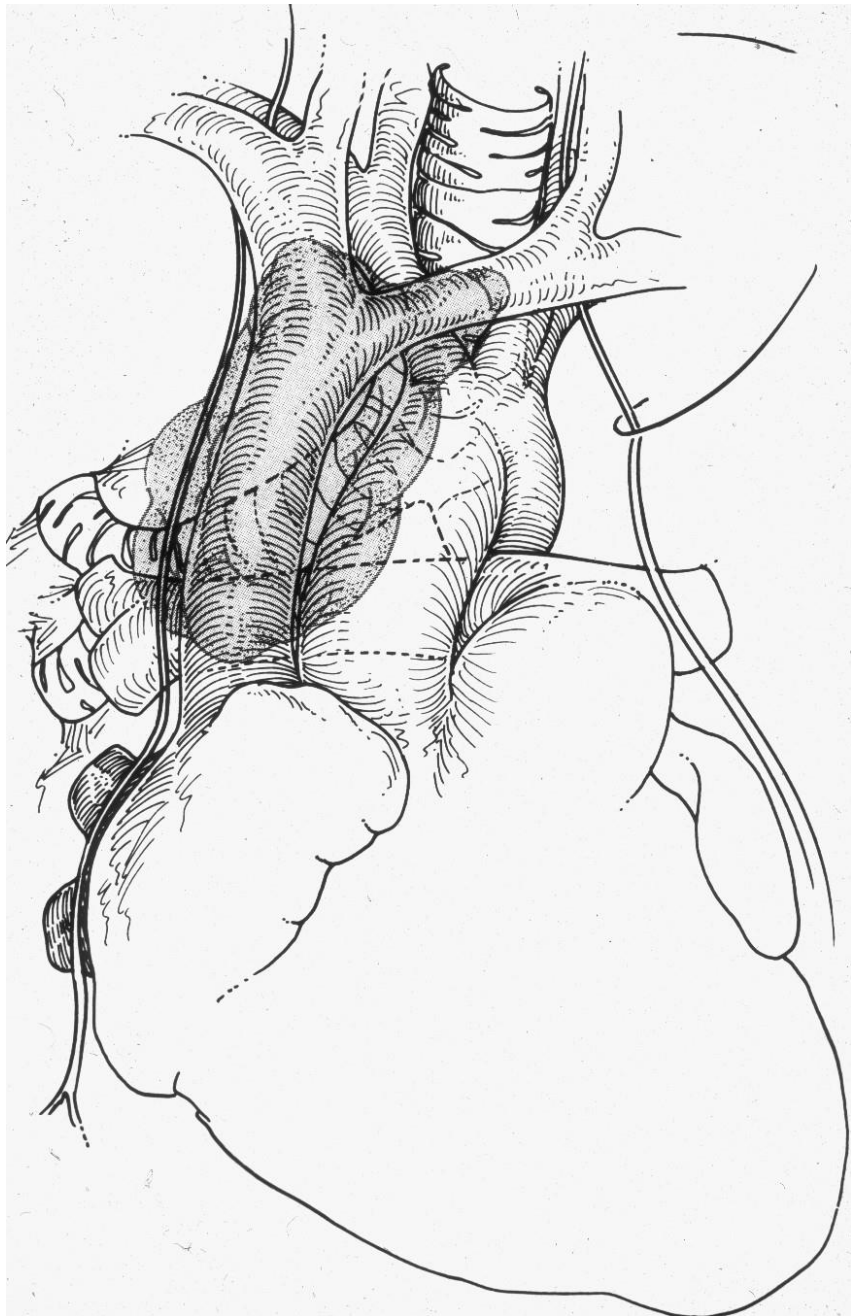
SVC Syndrome

Collaterals

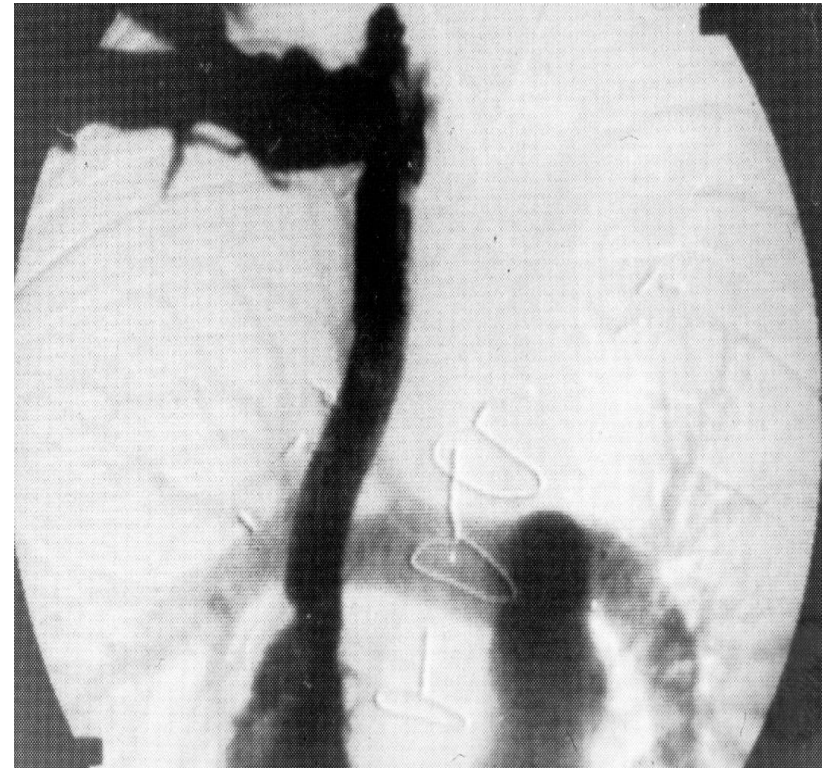
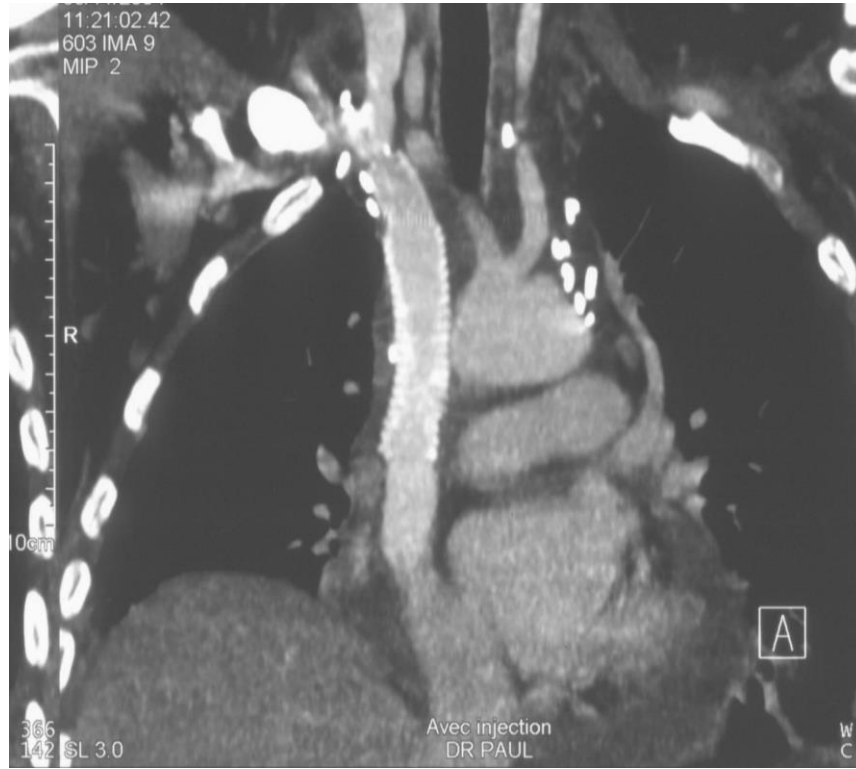
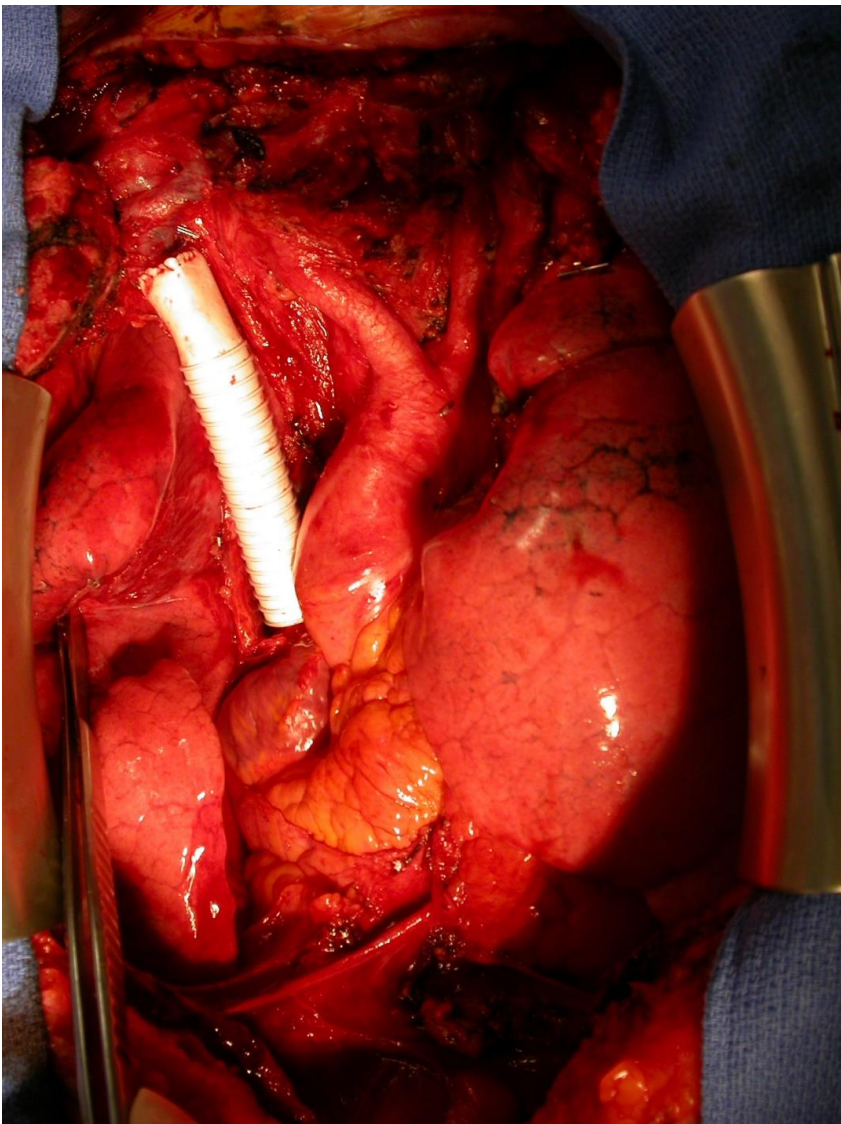
Surgical approach

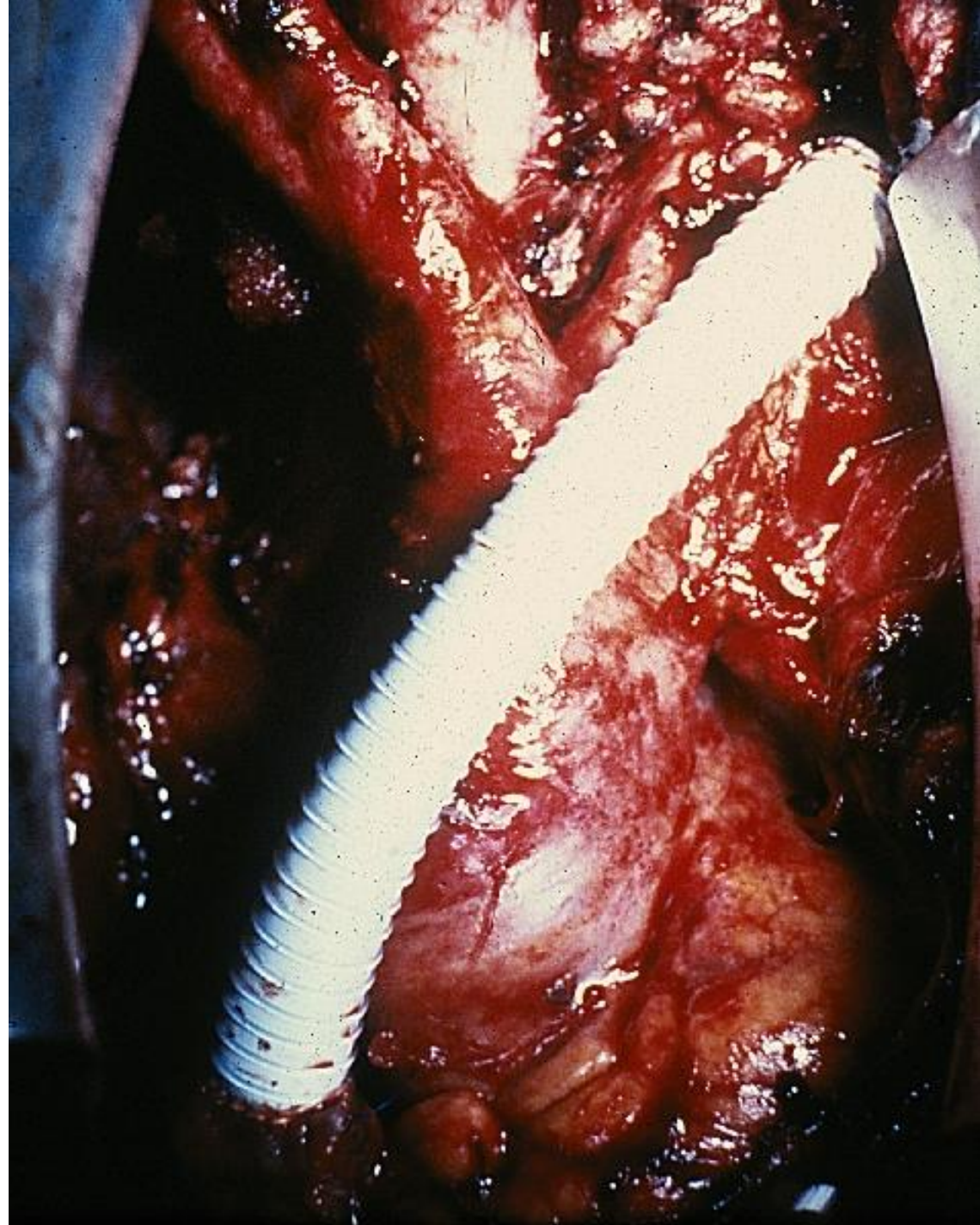
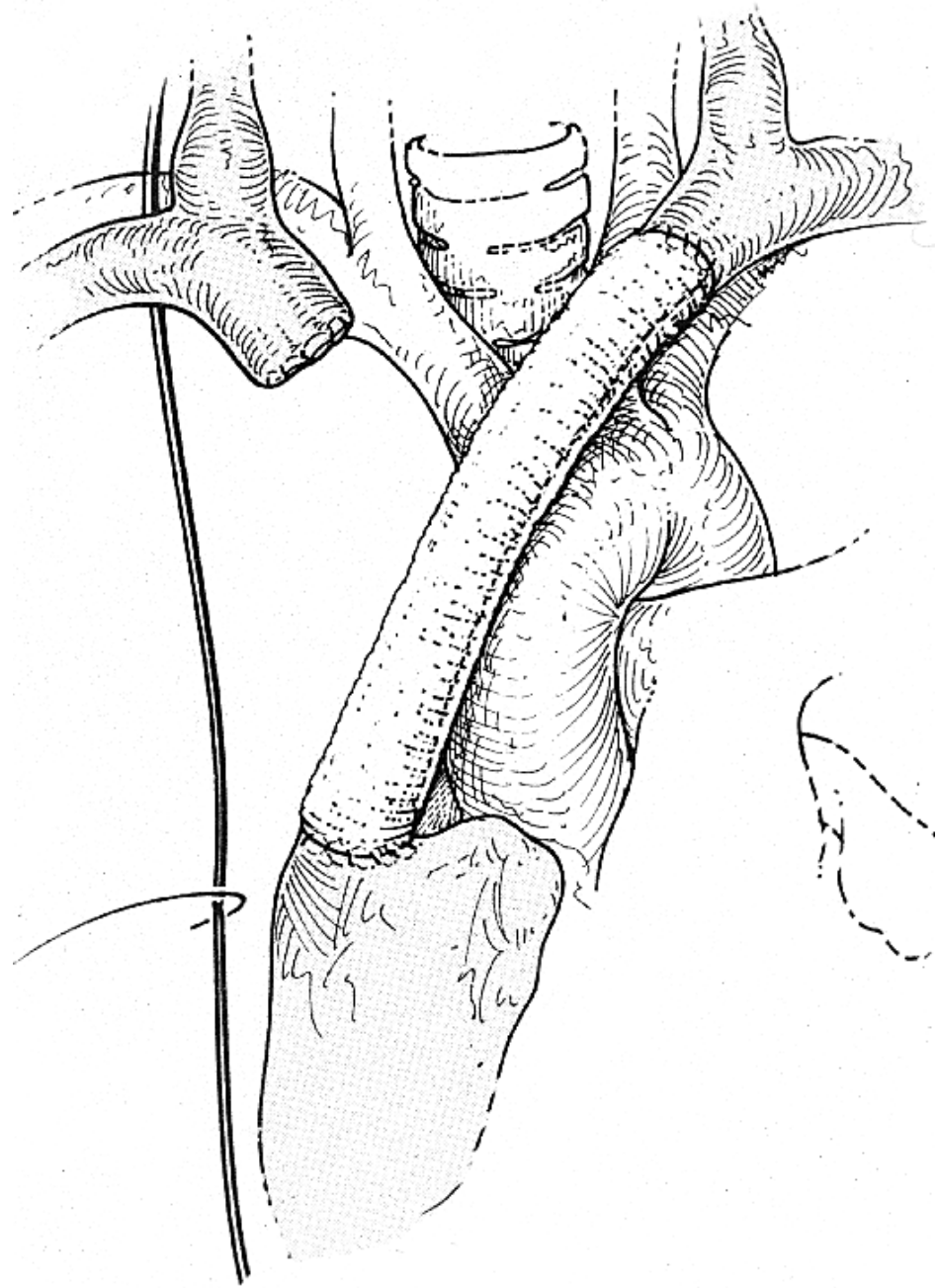


- Access to both pleural cavities
- Possible extension to the neck
- Potential use of CPB for extended surgery



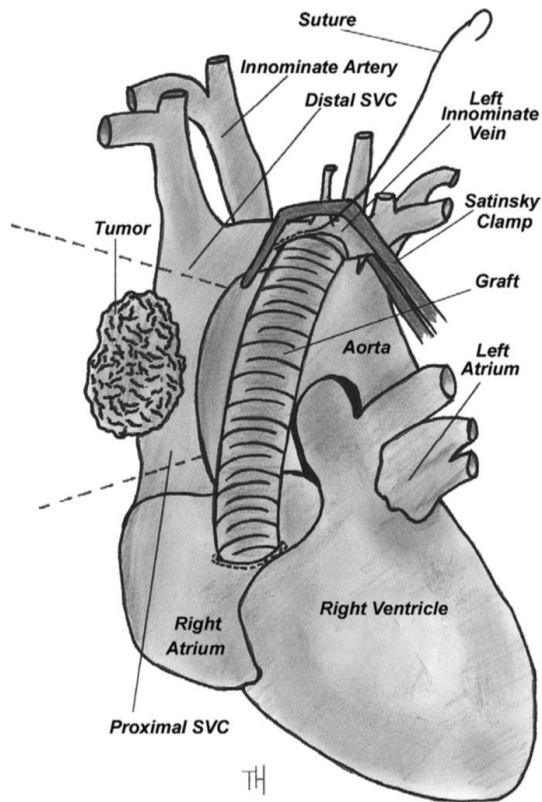
- Longer clamping time (mean 74 min.)
- Innominate > trunk



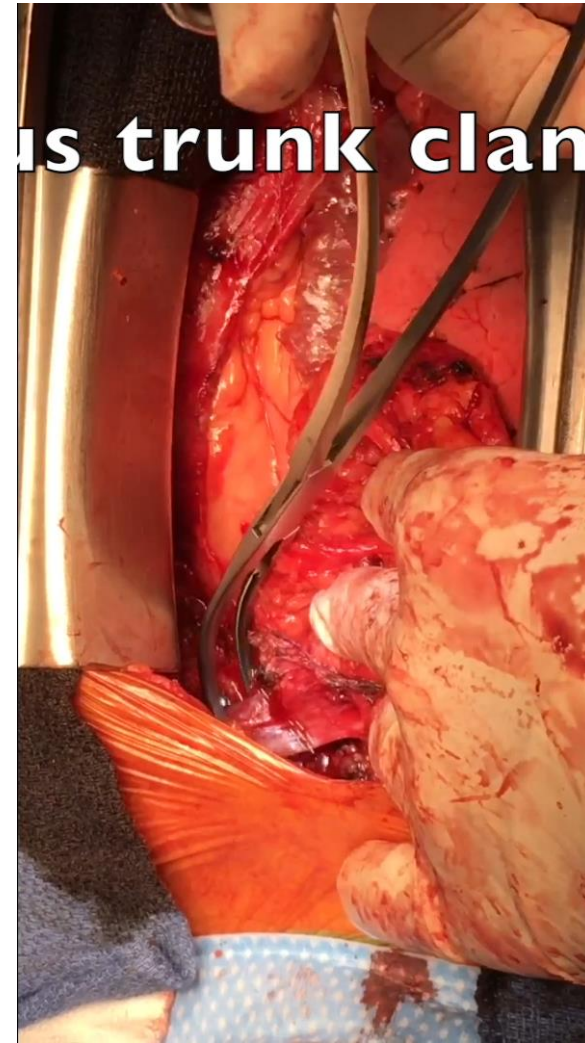


Tips and Trick limiting brain damage risks

- Close monitoring blood pressure
- NIRS



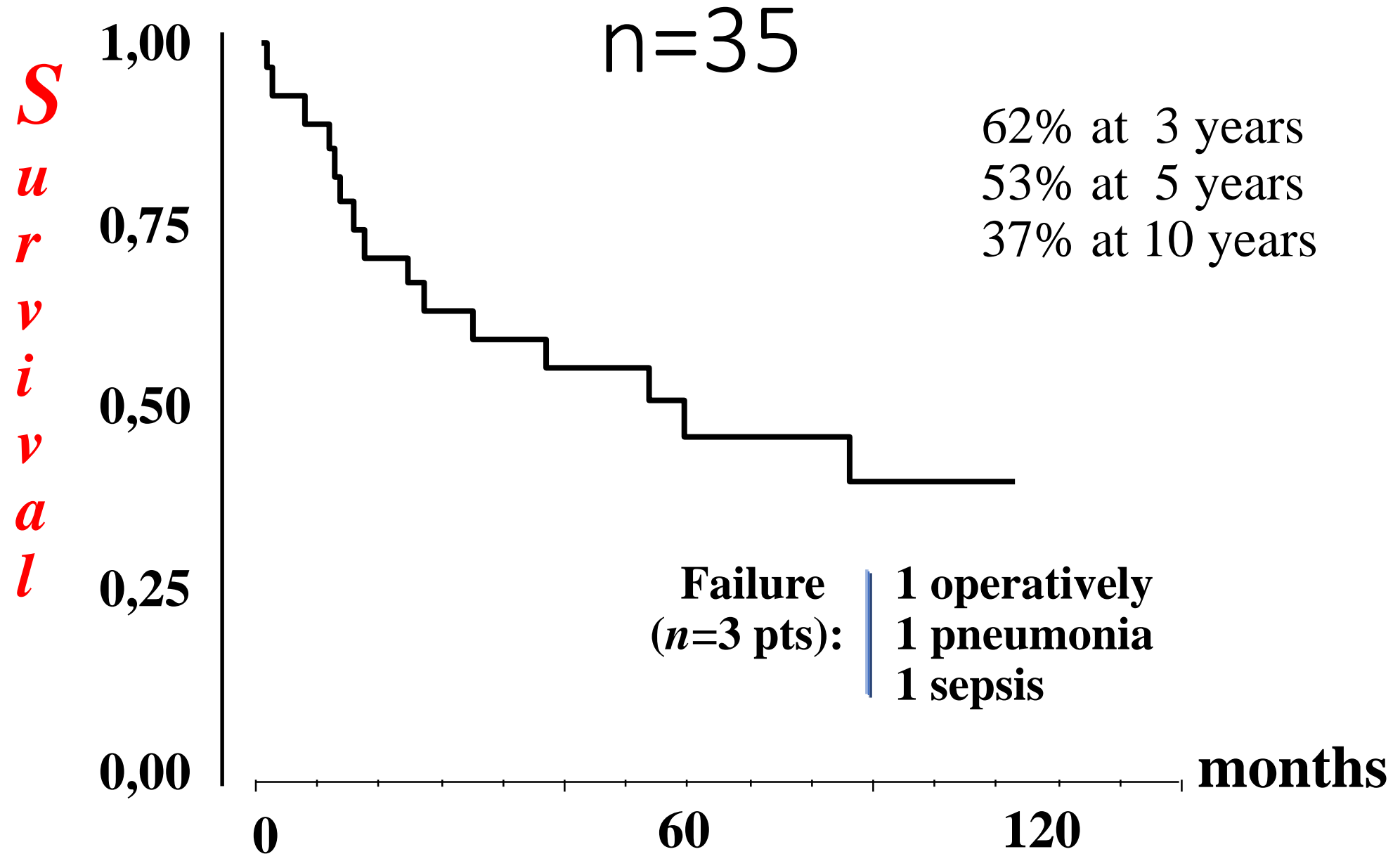
- Graft interposition first



Movie Dr Aurélien Vallée

- SVC temporary Shunting

Malignant Mediastinal Tumors



First Author, Year [Reference]	Patients	Reconstruction Material	Intraoperative Management	Mortality (%)	5-Year Survival (%)
Bacha, 1998 [7]	10	PTFE	CC	NR	NR
Shintani, 2005 [19]	11	PTFE	CC, CPB	0 (operative)	NR
Spaggiari, 2007 [23]	9 ^a	PTFE, BovP	CC	5.5	45
Okereke, 2010 [29]	10	PTFE	CC, CPB	7.9 ^b	100 (21-month)
Sekine, 2010 [20]	8	PTFE	CC	0	62.5
Nakano, 2014 [21]	10 ^a	PTFE	CC	0 (operative)	50
Sun, 2017 [9]	13	PTFE	CC	8 (3-month)	59.1

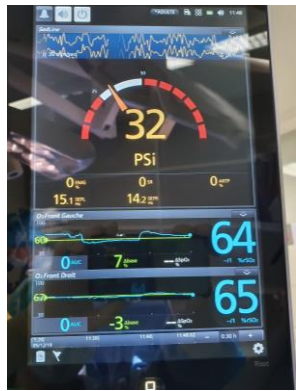
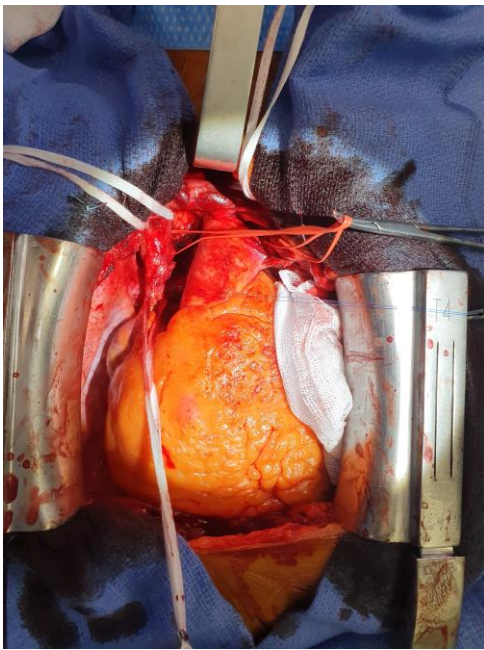
^a Mixed mediastinal malignancies.

^b Mediastinal and lung malignancies.

Maurizi, Ann Thorac Surg 2019

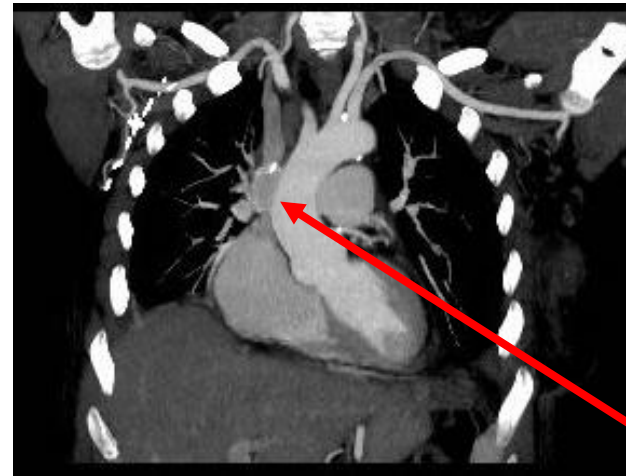
Benign Disease

- Catheter
- Rare SVC tumors
- Aneurysm



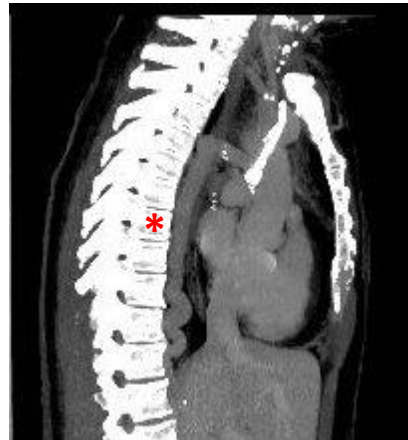
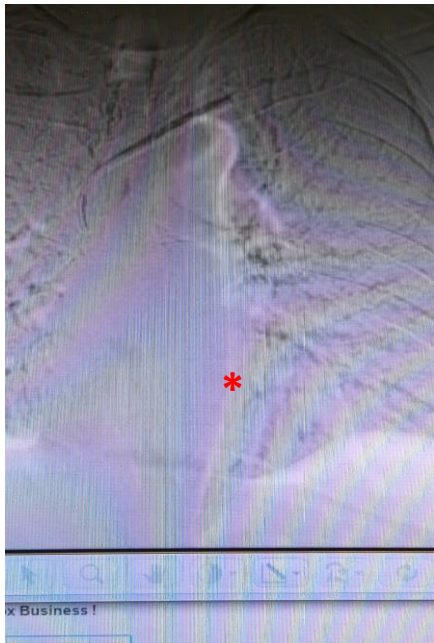
Cross Clamp
Technique

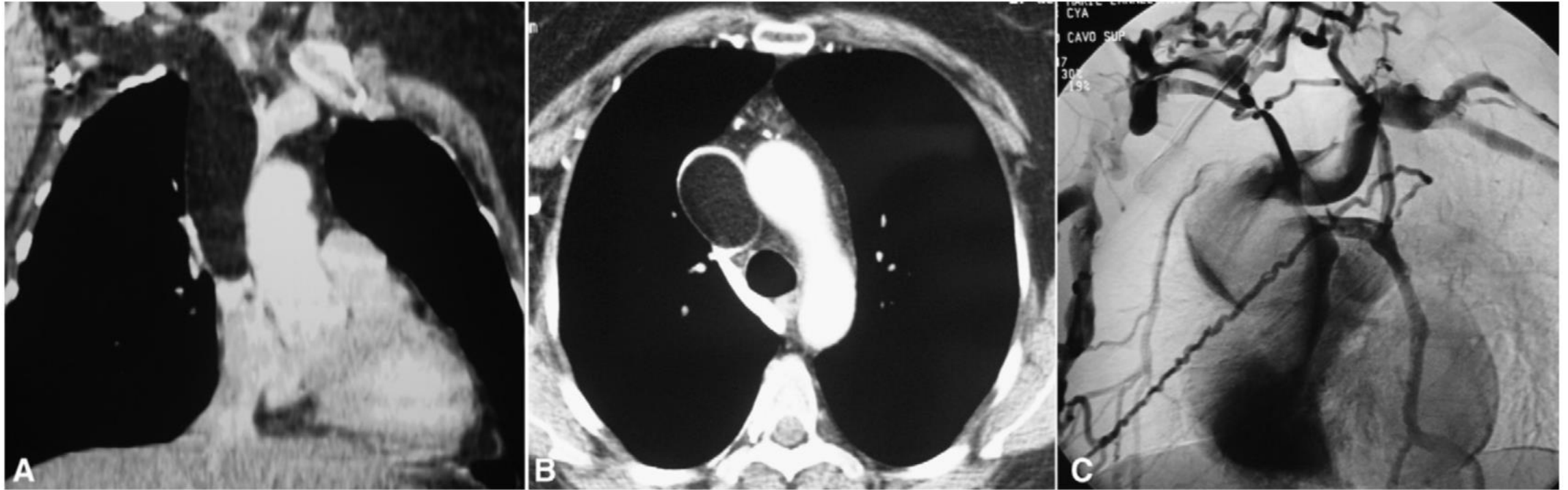
Perop monitoring
PTFE graft



PTFE graft

Azygos vein
ligation





Complications

		#	Deaths
<i>LC</i>	PTFE Infection, BPF Fistula	1	1
	BPF - Clagget	2	
	Pneumonia	2	2
	Extrapericardial Cardiac Herniation	1	
<hr/>			
<i>MMT</i>	PTFE Infection, Tracheal Fistula	1	
	Sternal infection	1	
	Pneumonia	1	1
	Bleeding	1	
TOTAL	(%)	11%	4.6%

Contra-indications

Widespread Collateral Venous Circulation

Subclavian Vein Thrombosis

Long-lasting SVC Syndrome

Invasion of the Trachea and the myocardium

CONCLUSIONS

- Surgical management of SVC replacement is well-established and achieves excellent long-term results
- Care must be paid in selecting patients to carry the lowest postoperative risk
- PTFE is the preferred vascular conduit for SVC reconstruction with satisfactory patency