

Lung Transplantation A look Inside A Surgeon's Perspective

Hassan Nemeh, MD

Henry Ford Hospital

Michigan Society of Respiratory Care

Spring Conference 2016

Historical background

Alexis Carrel 1905

Reported on heart and lung
transplant in a cat model



Historical background

Vladimir Demikhov

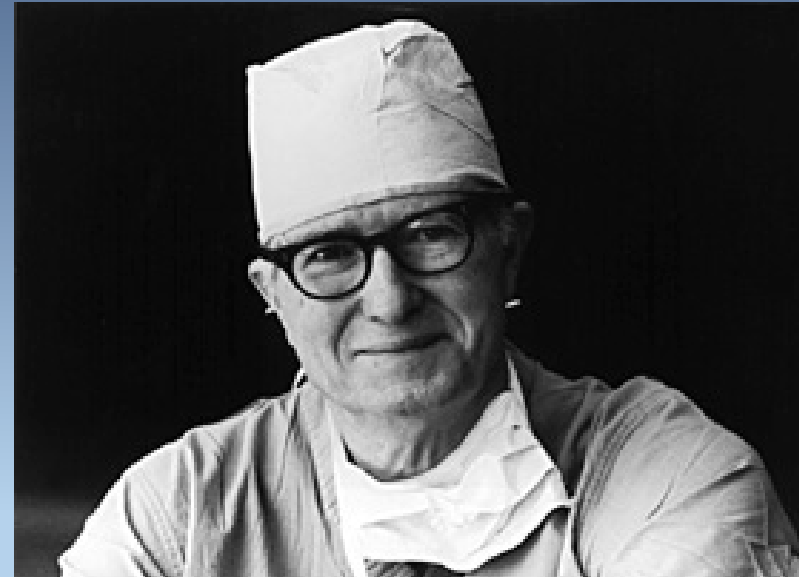
Reported on 20 different
techniques of heart and heart-
lung transplant in 1950



Historical background

James Hardy, MD

First human lung transplant 1964
by Hardy



Historical background

- Fritz Derom achieved a 10 months survival after lung transplant in a patient with pulmonary silicosis in 1971.



Historical background

- Bruce Reitz started a clinical trial in heart-lung transplant in 1981 after success in primate model in the lab



Historical background

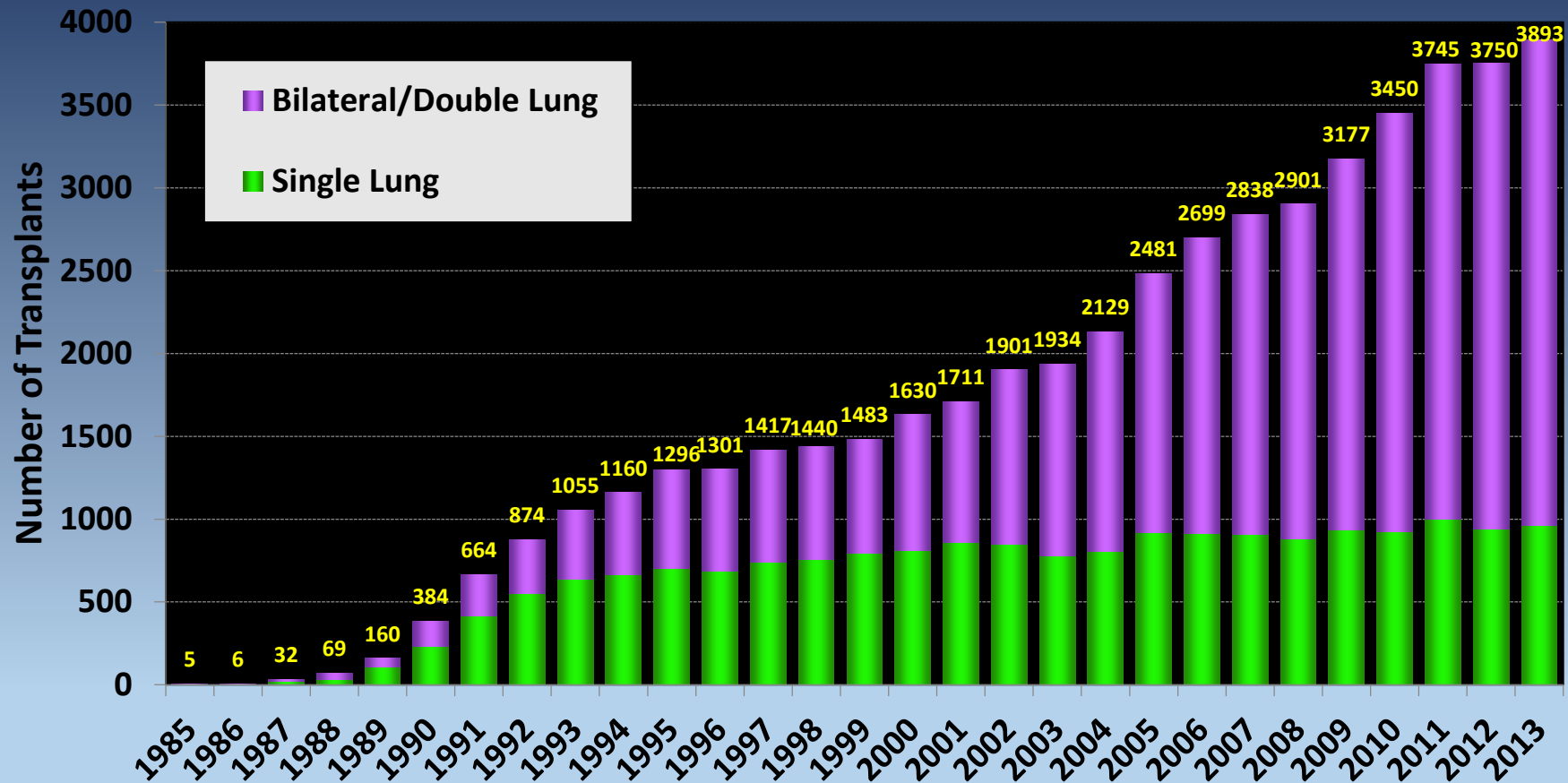
- The Toronto group headed by Joel Cooper established lung transplant as we know it today



Joel Cooper, MD,
FACS, FRCPS

Adult Lung Transplants

Number of Transplants by Year and Procedure Type



NOTE: This figure includes only the adult lung transplants that are reported to the ISHLT Transplant Registry. As such, this should not be construed as representing changes in the number of adult lung transplants performed worldwide.

Indications

- **Cystic fibrosis** FEV1 <30%, or clinical worsening
- **COPD** FEV1<25% or PCO2 >55 with pul. HTN
- **IPF** Symptomatic, VC <60-70%, DLCO <50-60%
- **PPH** NYHA class III or IV on vasodilator
- **Eisenmenger's** NYHA class III or IV

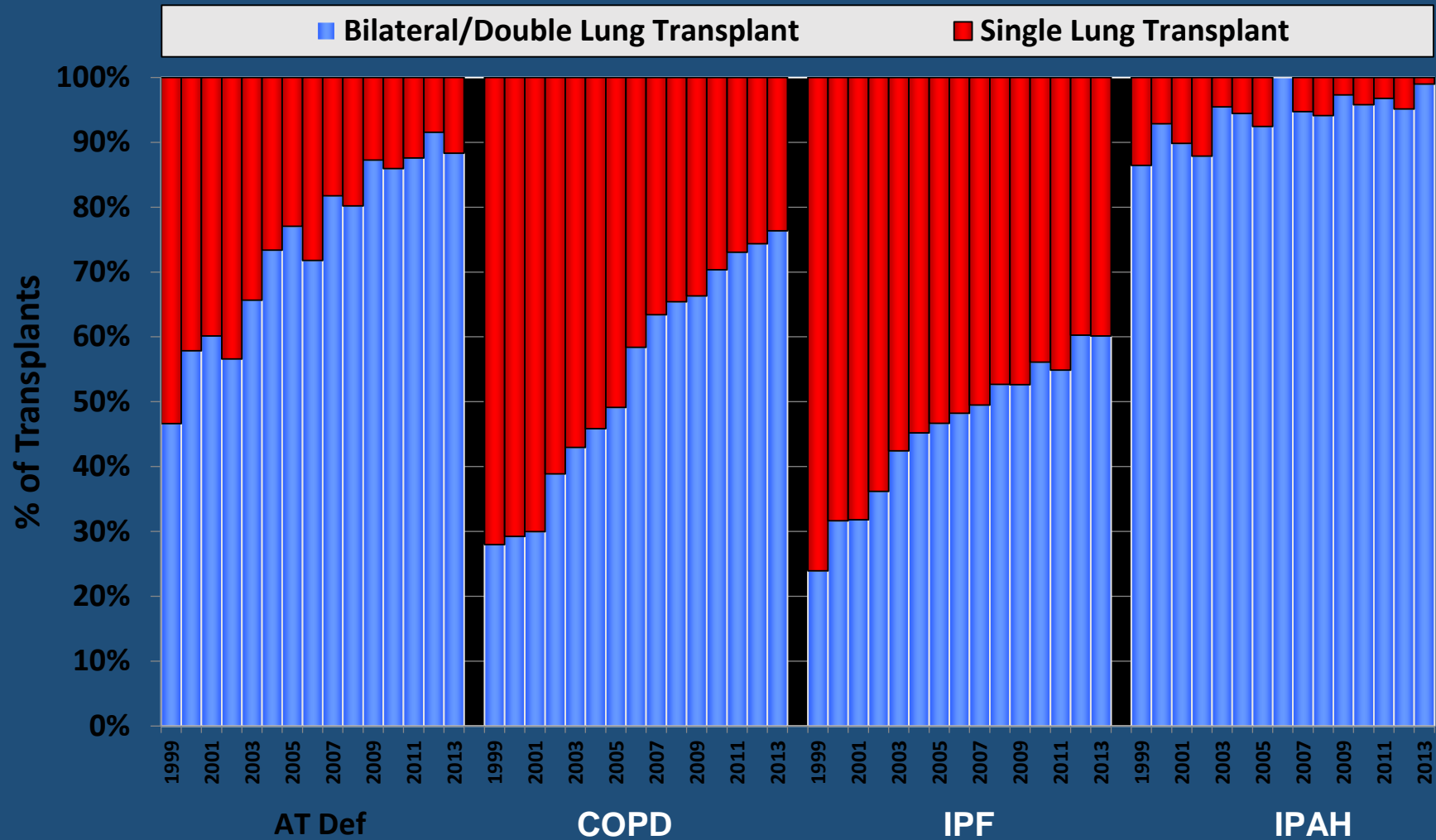
Adult Lung Transplants

Indications (Transplants: January 1995 – June 2014)

Diagnosis	SLT (N=16,226)	BLT (N=29,457)	TOTAL (N=45,683)
COPD/Emphysema	6,826 (42.1%)	7,856 (26.7%)	14,682 (32.1%)
Idiopathic Pulmonary Fibrosis	5,561 (34.3%)	5,442 (18.5%)	11,003 (24.1%)
Cystic Fibrosis	228 (1.4%)	7,191 (24.4%)	7,419 (16.2%)
Alpha-1	792 (4.9%)	1,667 (5.7%)	2,459 (5.4%)
Idiopathic Pulmonary Arterial Hypertension	91 (0.6%)	1,250 (4.2%)	1,341 (2.9%)
Pulmonary Fibrosis, Other	758 (4.7%)	1,125 (3.8%)	1,883 (4.1%)
Bronchiectasis	65 (0.4%)	1,167 (4.0%)	1,232 (2.7%)
Sarcoidosis	301 (1.9%)	857 (2.9%)	1,158 (2.5%)
Retransplant: Obliterative Bronchiolitis	338 (2.1%)	440 (1.5%)	778 (1.7%)
Connective Tissue Disease	200 (1.2%)	481 (1.6%)	681 (1.5%)
Obliterative Bronchiolitis (Not Retransplant)	110 (0.7%)	381 (1.3%)	491 (1.1%)
LAM	142 (0.9%)	330 (1.1%)	472 (1.0%)
Retransplant: Not Obliterative Bronchiolitis	210 (1.3%)	246 (0.8%)	456 (1.0%)
Congenital Heart Disease	93 (0.6%)	333 (1.1%)	426 (0.9%)
Cancer	7 (0.0%)	30 (0.1%)	37 (0.1%)
Other	504 (3.1%)	661 (2.2%)	1,165 (2.6%)

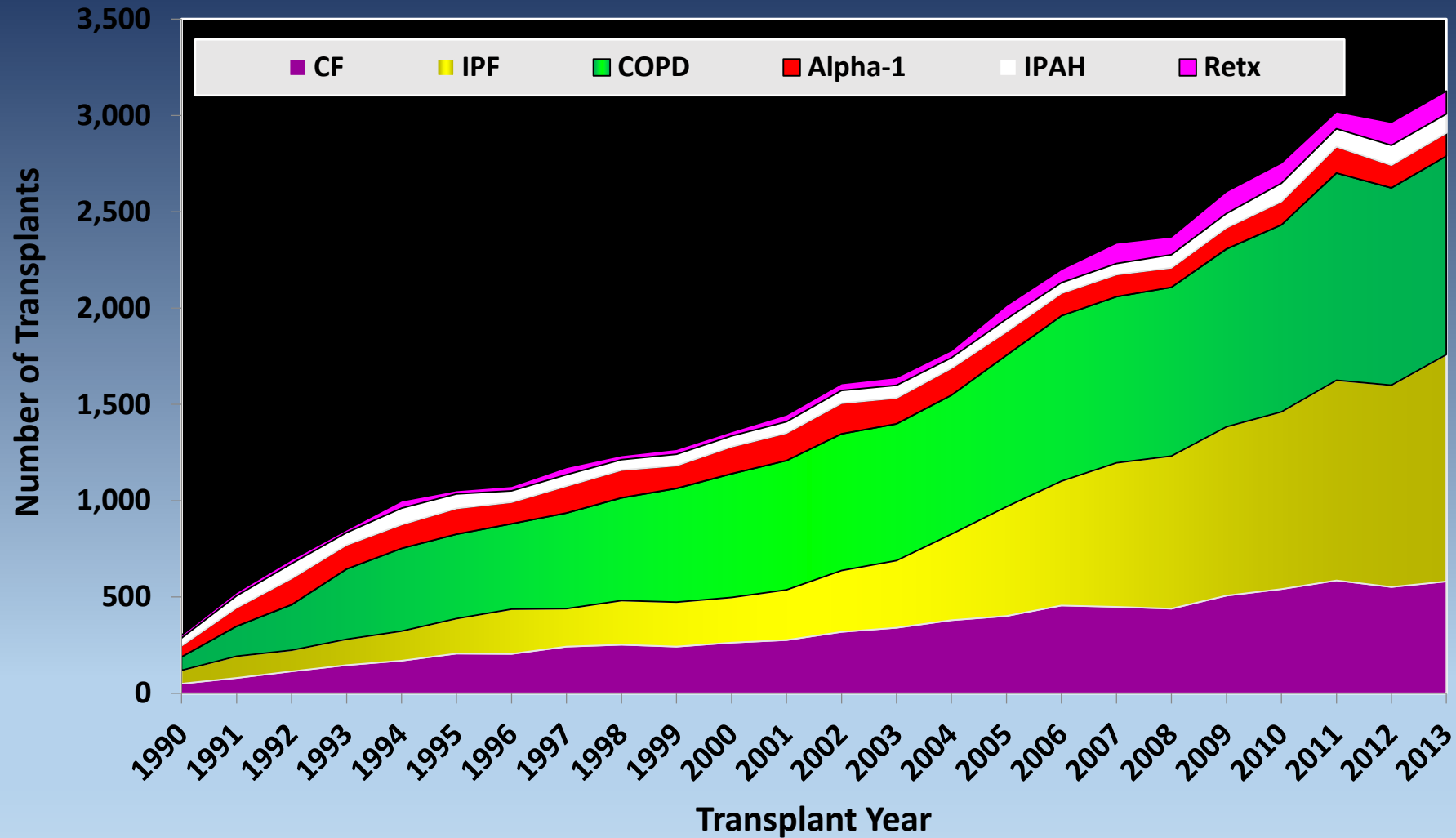
Adult Lung Transplants

Procedure Type within Indication, by Year

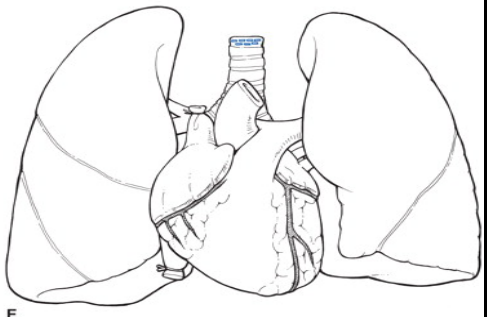
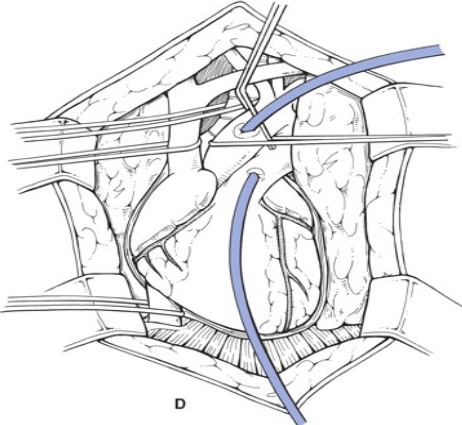
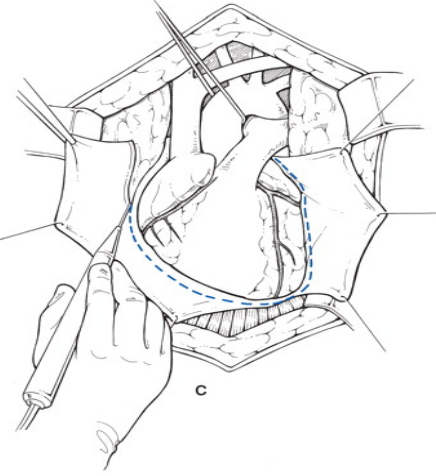
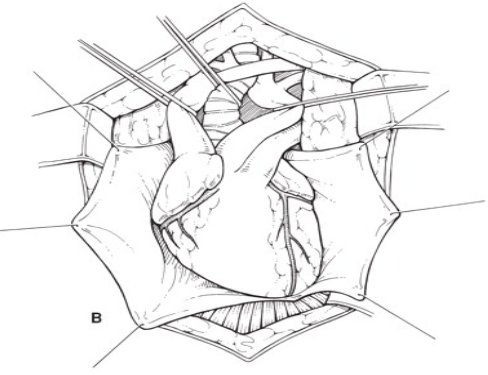
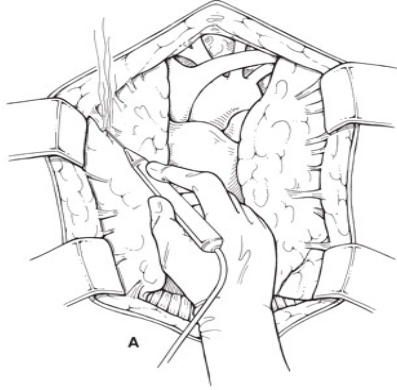


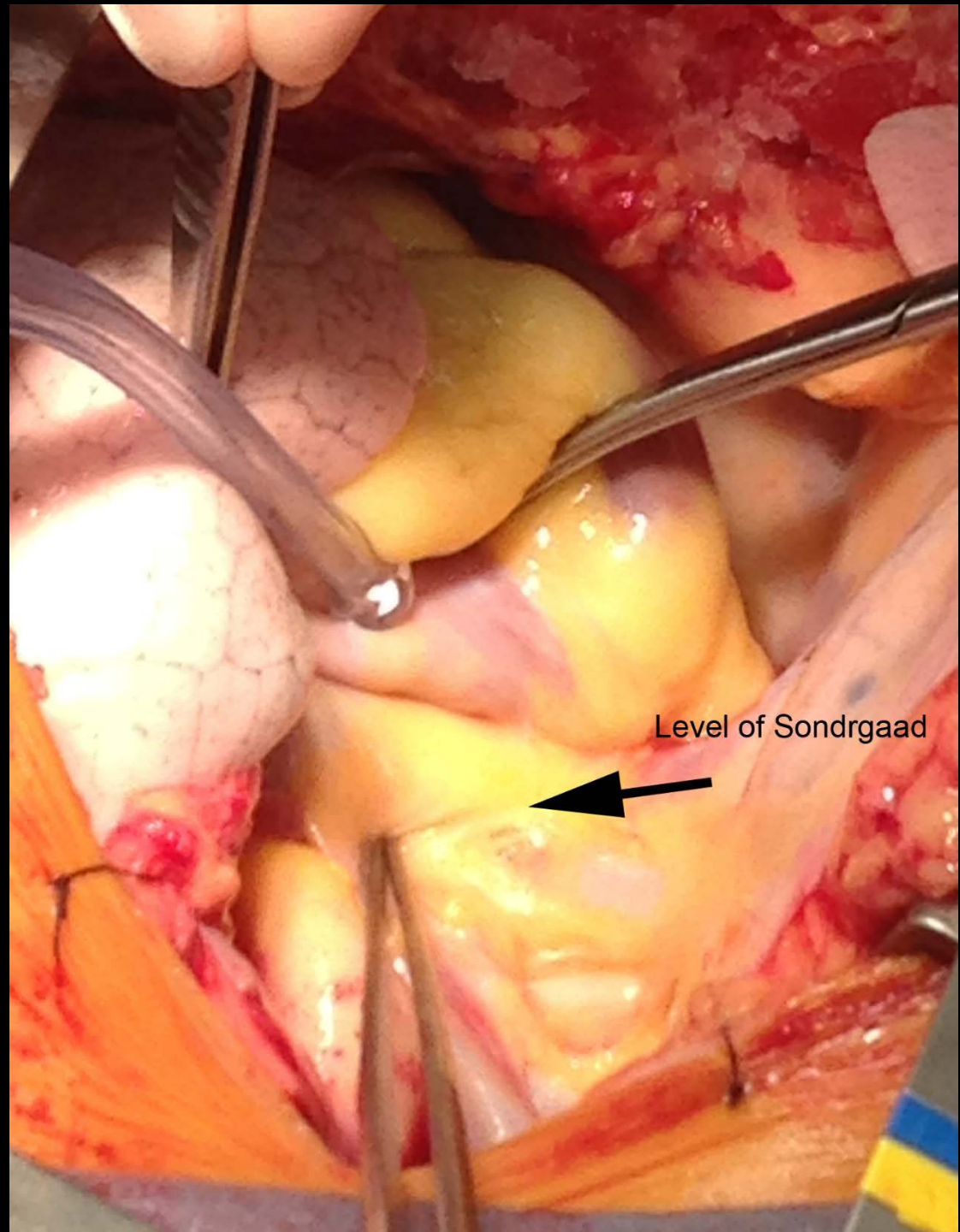
Adult Lung Transplants

Major Indications by Year (Number)



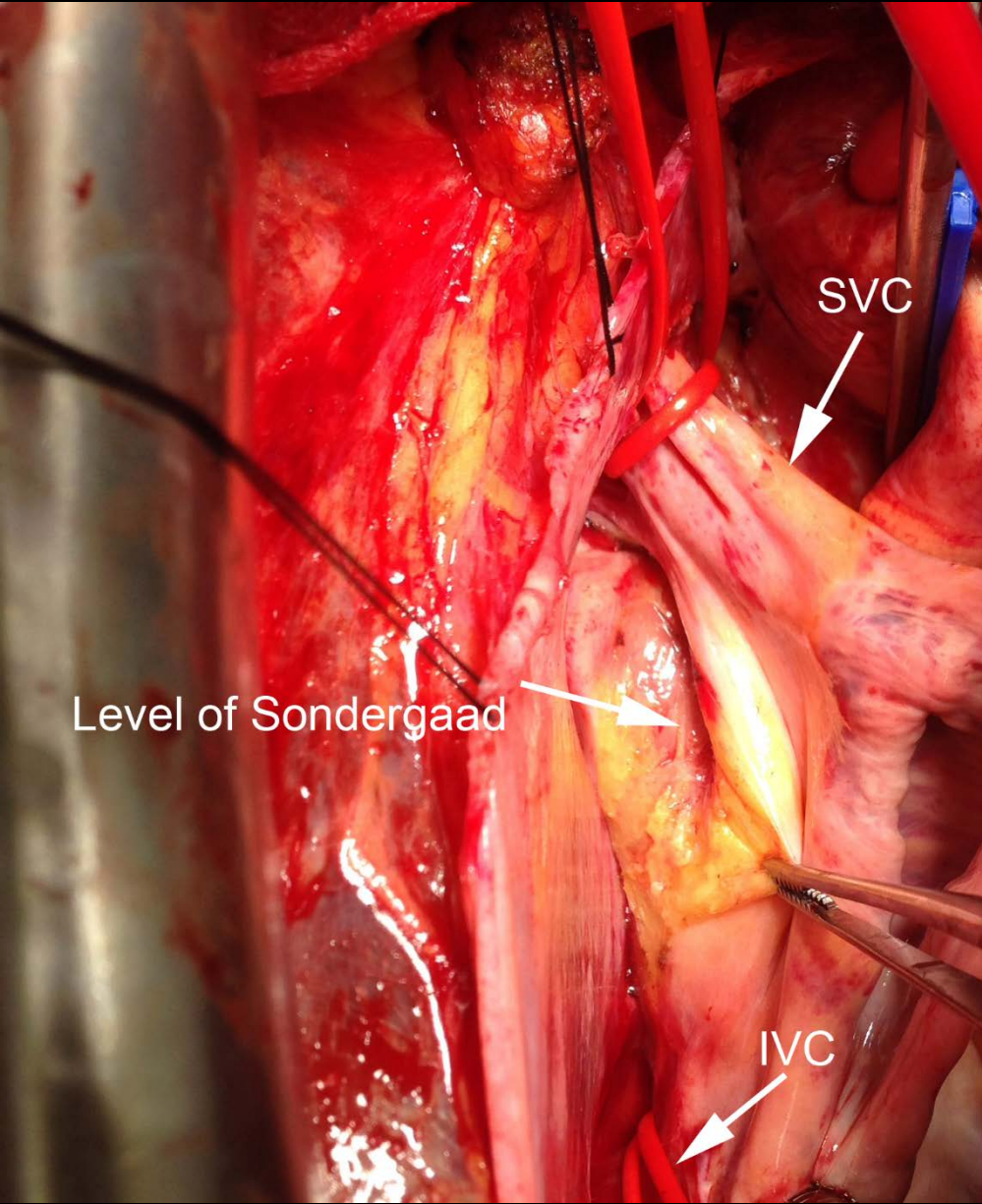
For some retransplants, a diagnosis other than retransplant was reported, so the total percentage of retransplants may be greater.





Level of Sondrgaad

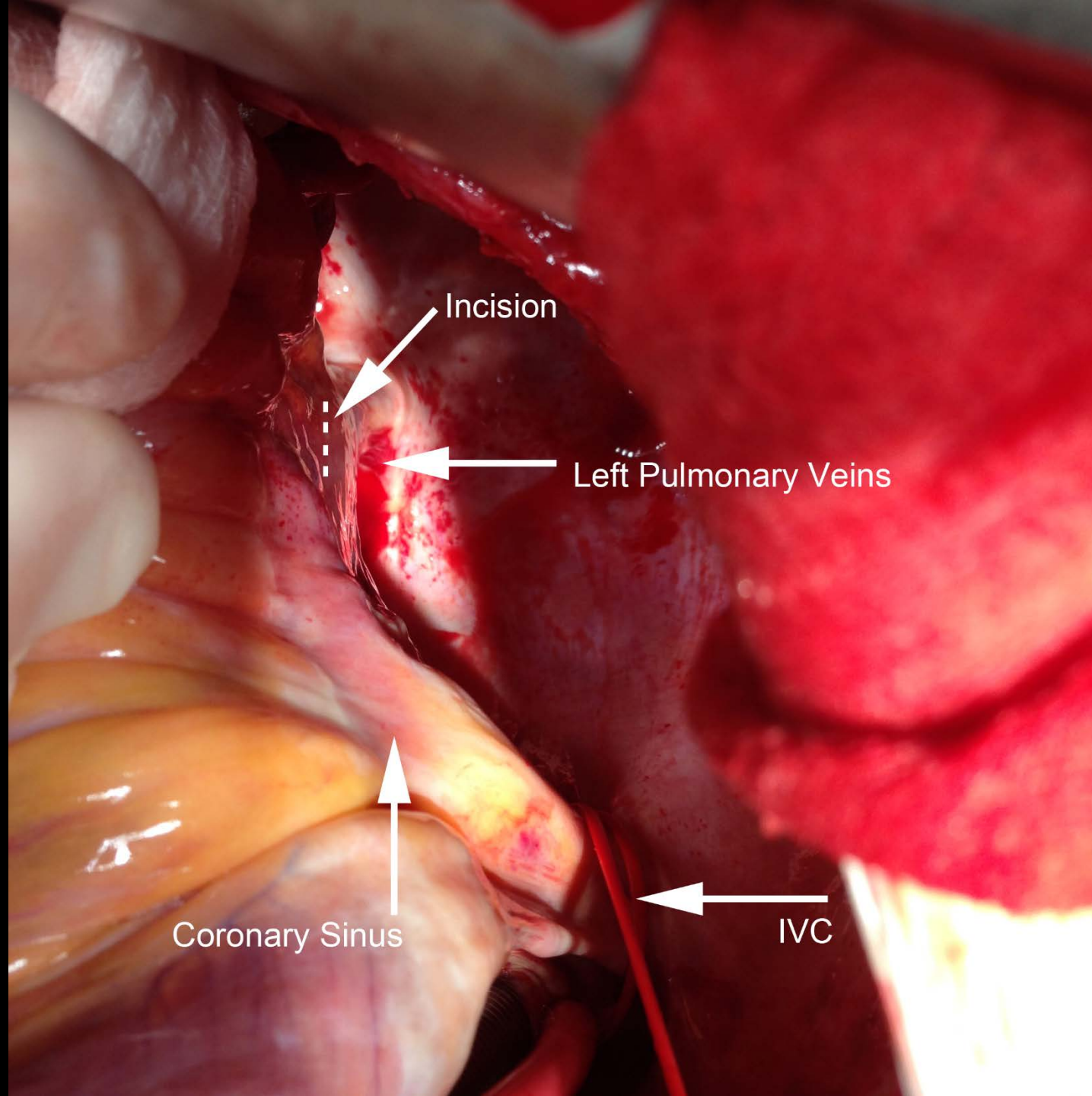




SVC

Level of Sondergaard

IVC



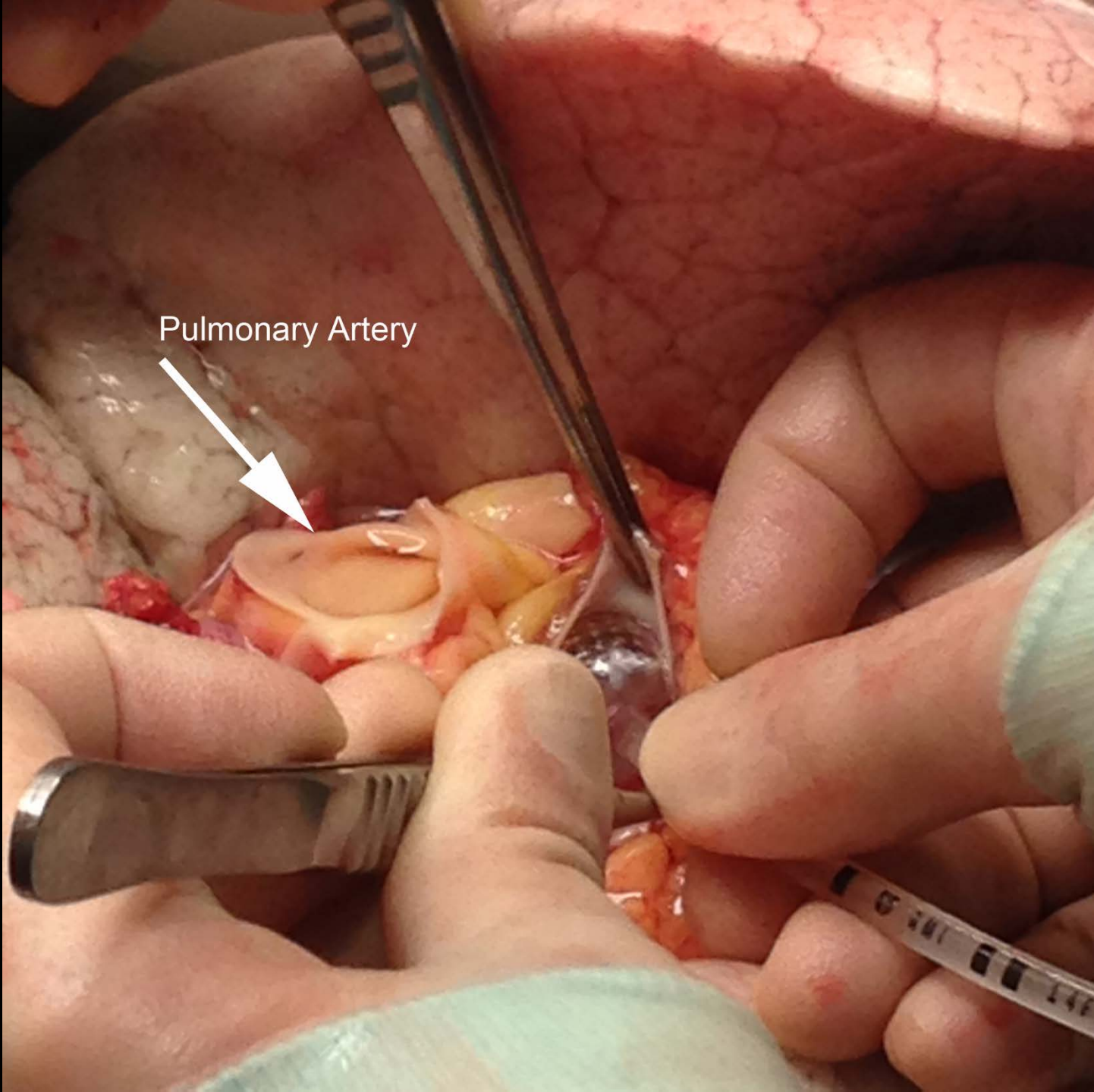
Incision

Left Pulmonary Veins

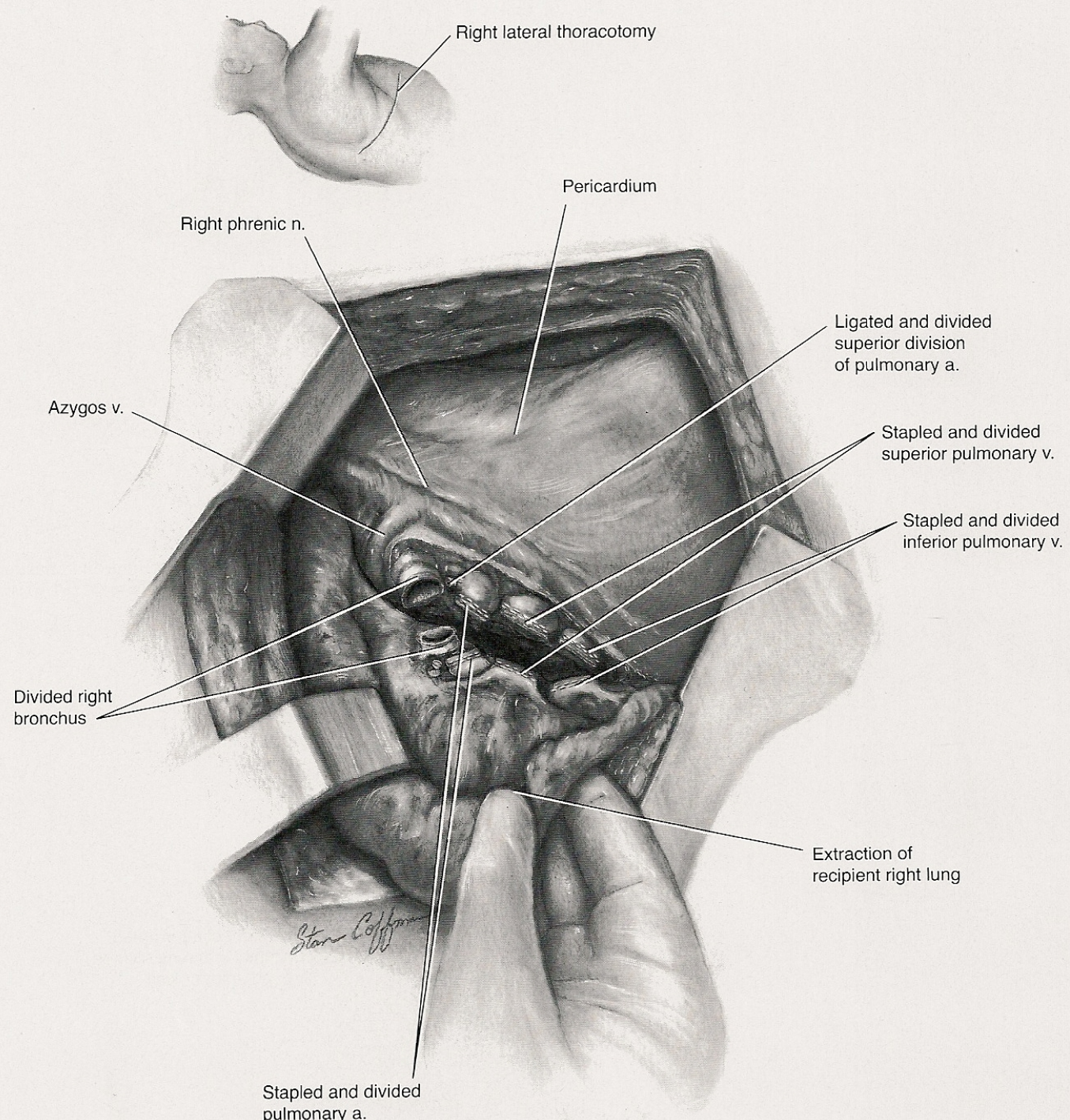
Coronary Sinus

IVC

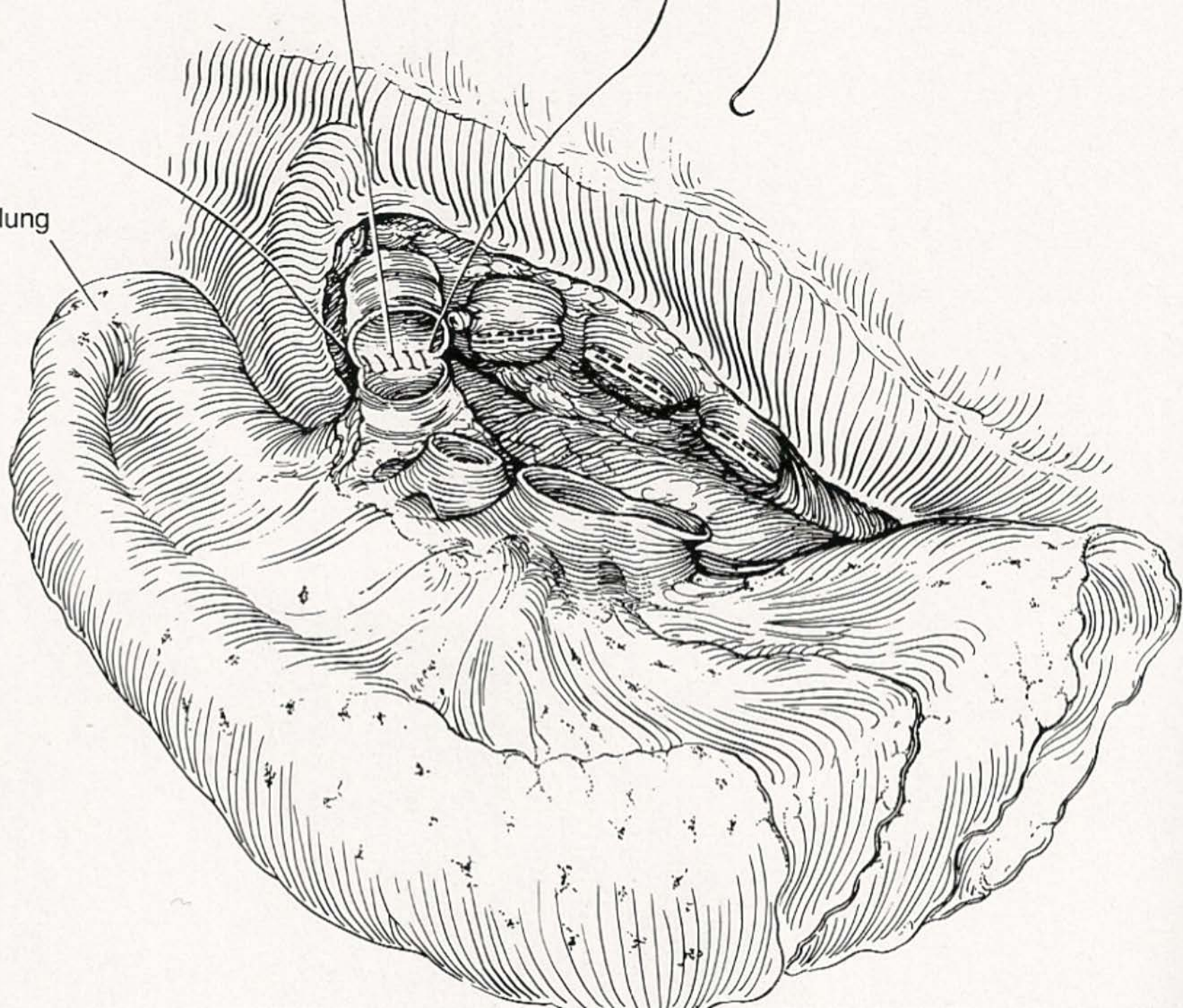
Pulmonary Artery



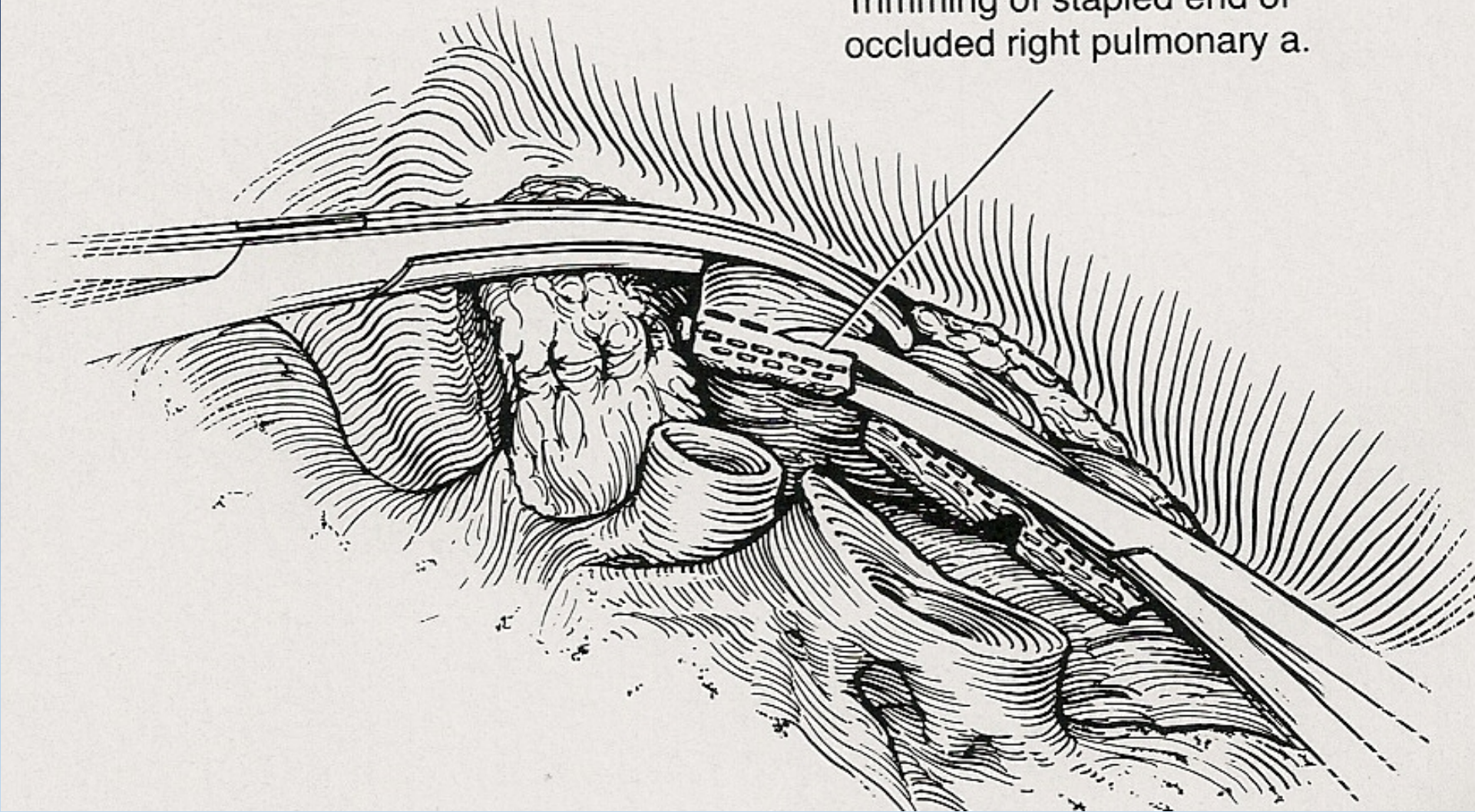




Donor lung



Trimming of stapled end of
occluded right pulmonary a.

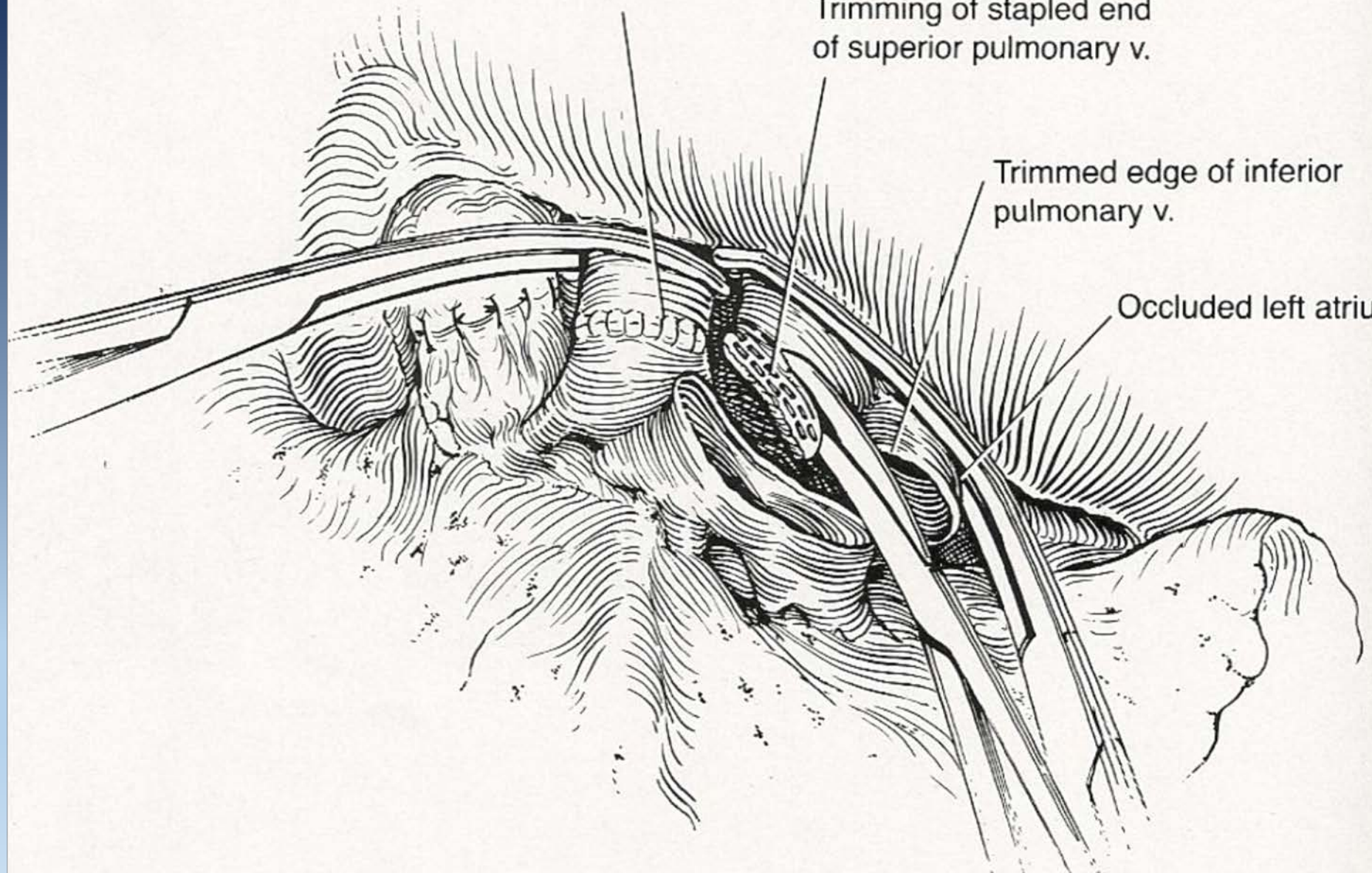


Completed anastomosis
of pulmonary a.

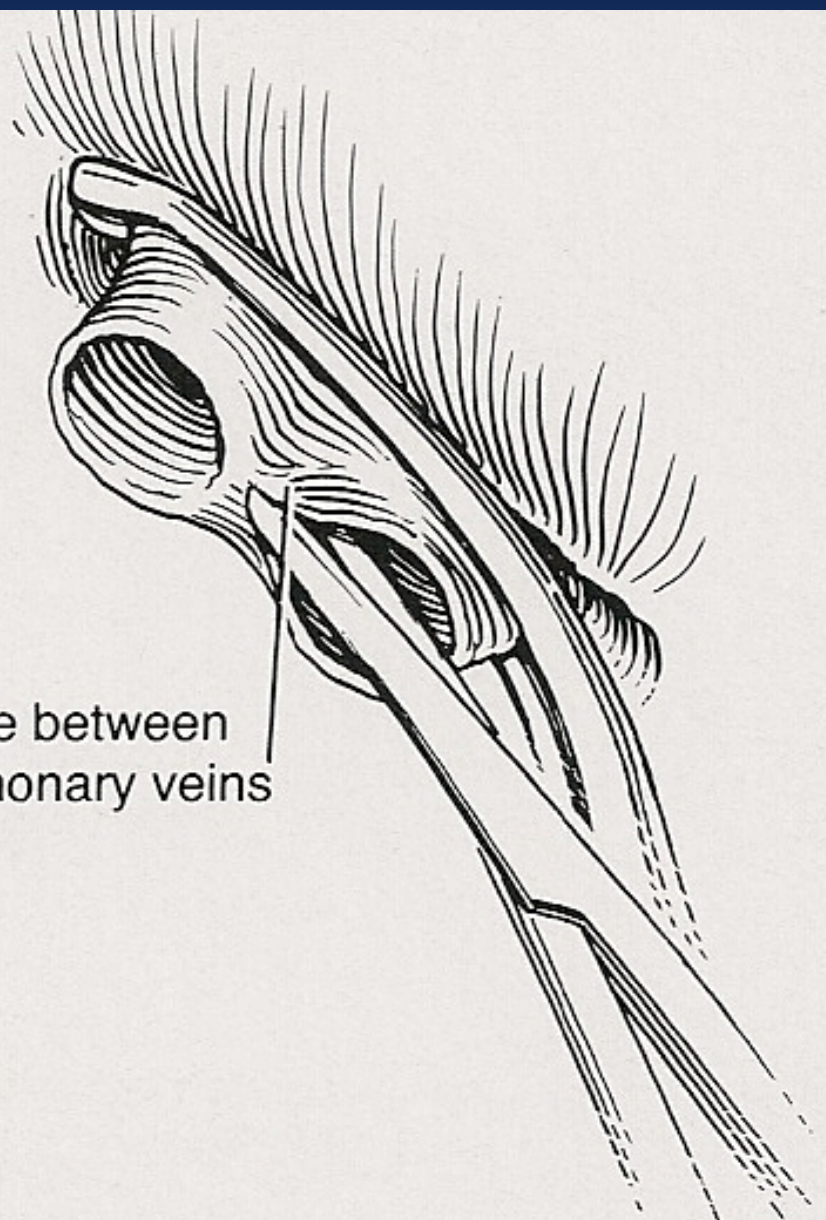
Trimming of stapled end
of superior pulmonary v.

Trimmed edge of inferior
pulmonary v.

Occluded left atrium



Dividing connecting tissue between
superior and inferior pulmonary veins

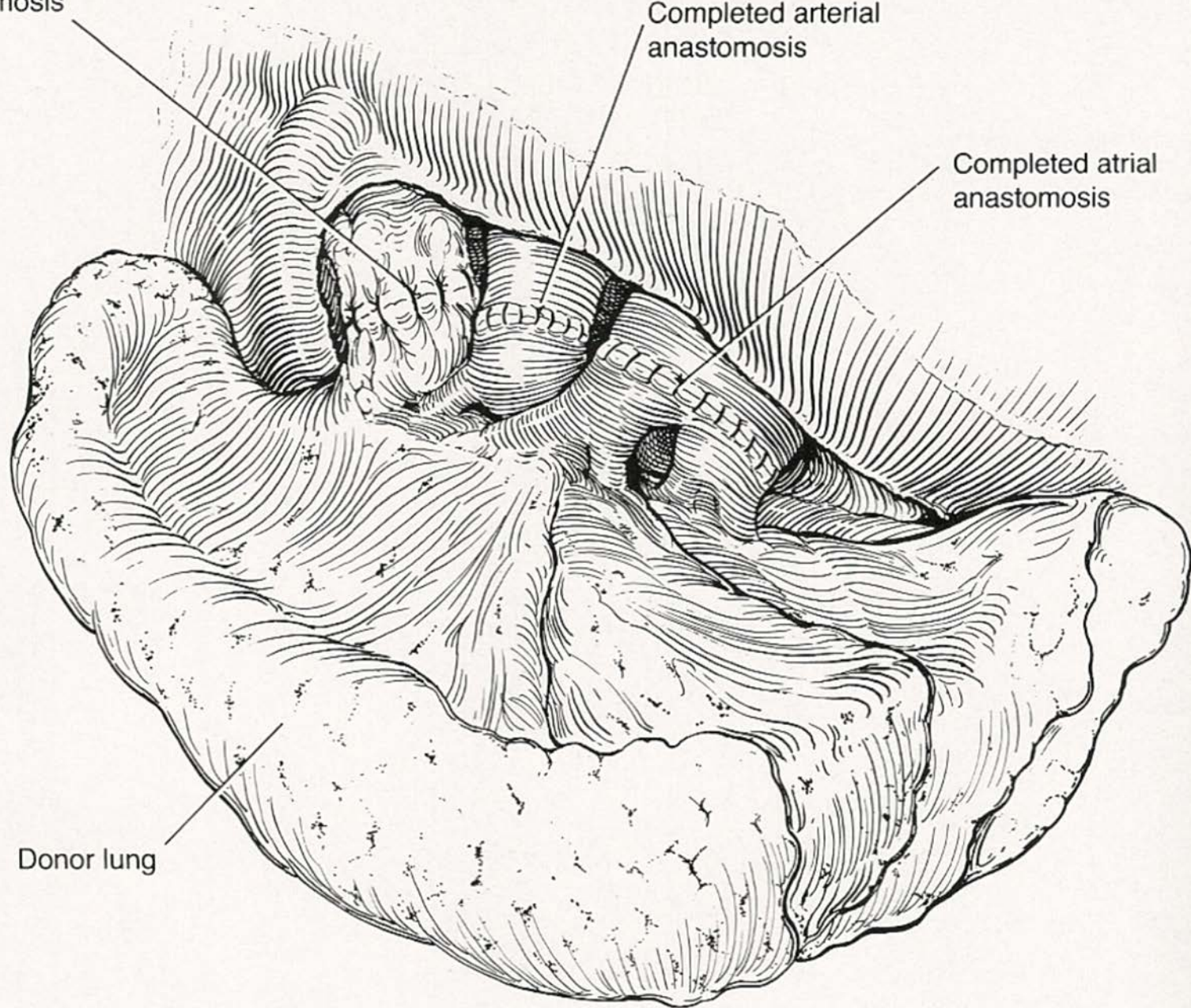


Completed bronchial anastomosis

Completed arterial anastomosis

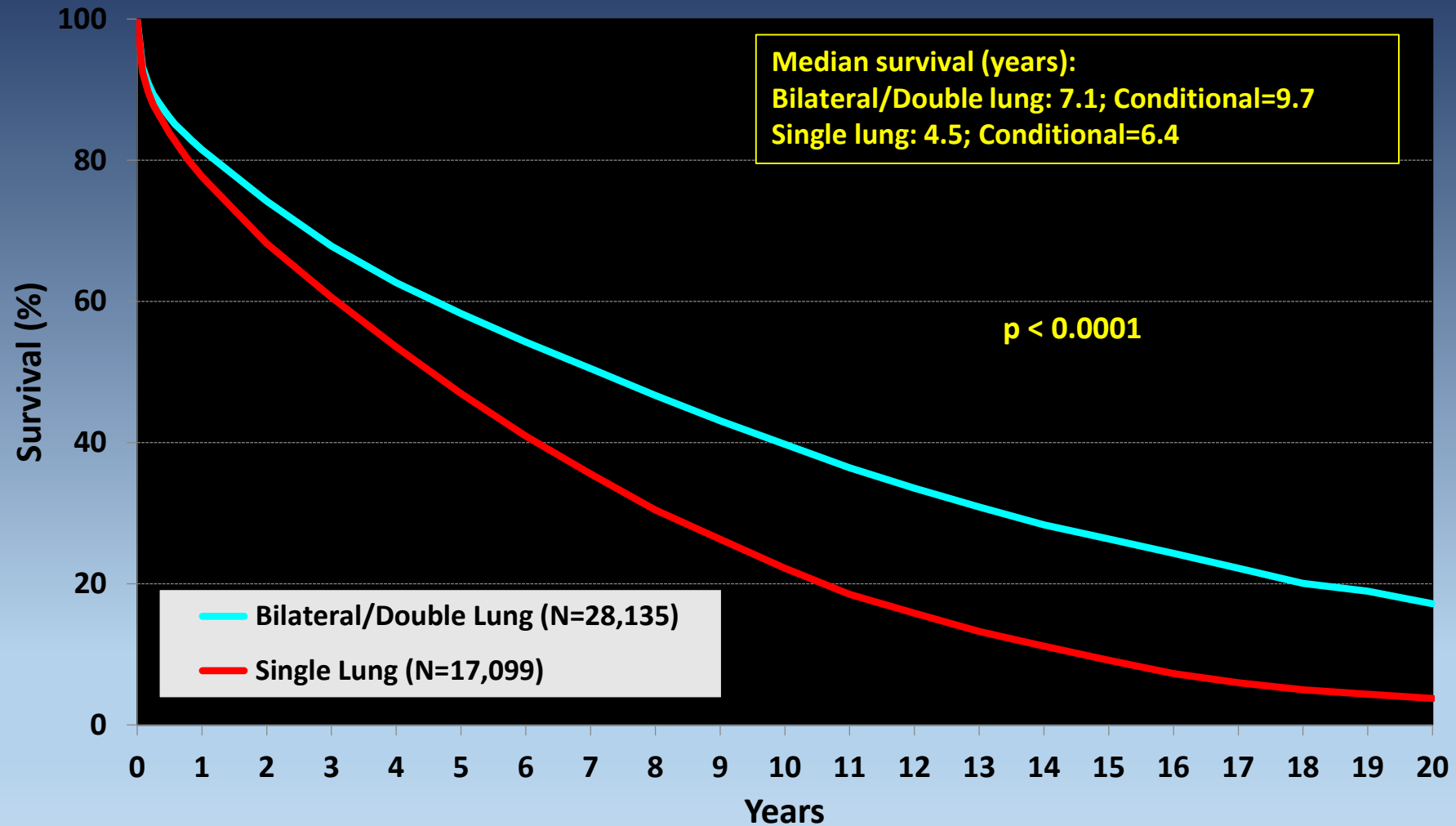
Completed atrial anastomosis

Donor lung



Adult Lung Transplants

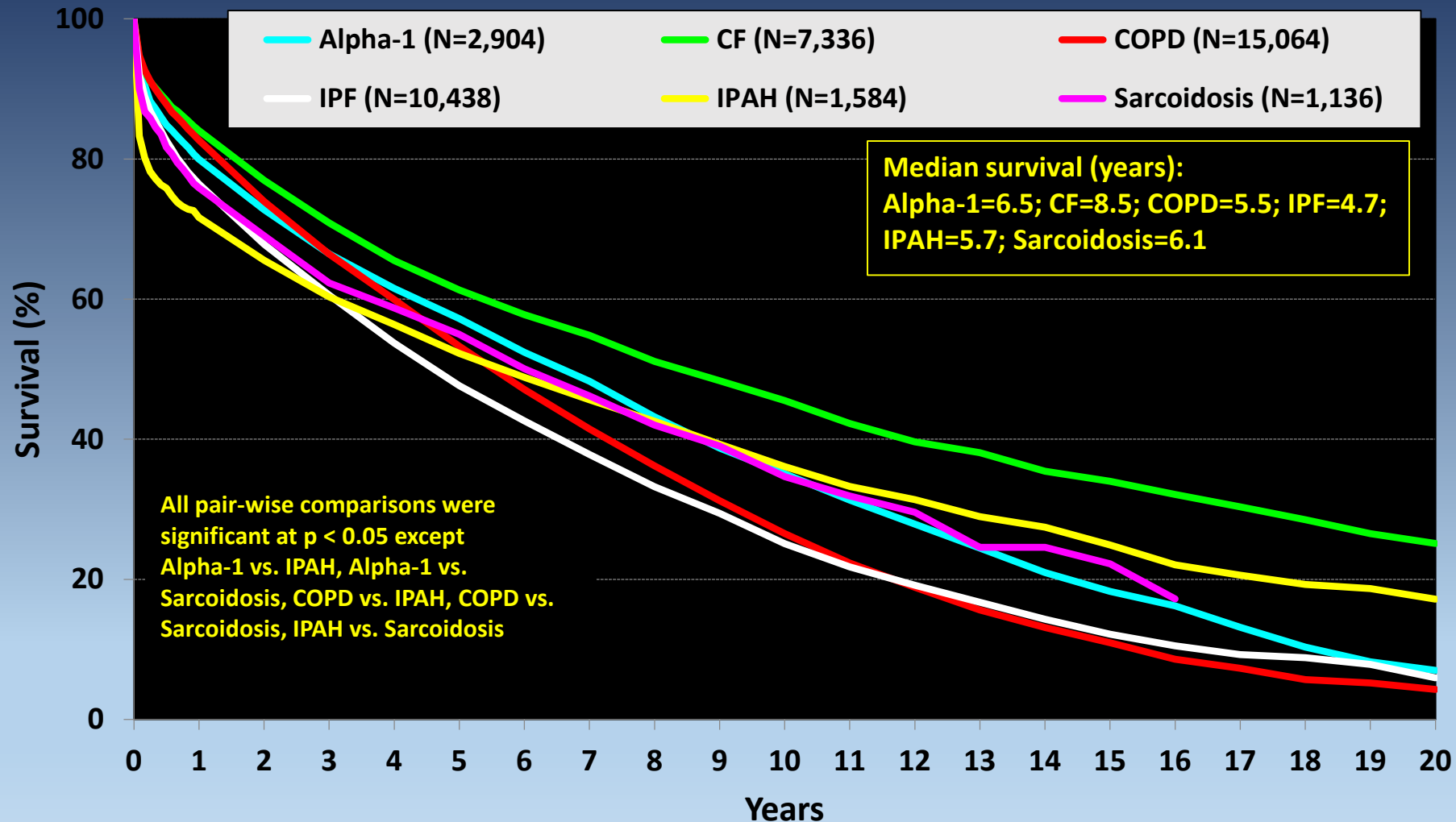
Kaplan-Meier Survival by Procedure Type for Primary Transplant Recipients
(Transplants: January 1990 – June 2013)



Adult Lung Transplants

Kaplan-Meier Survival by Diagnosis

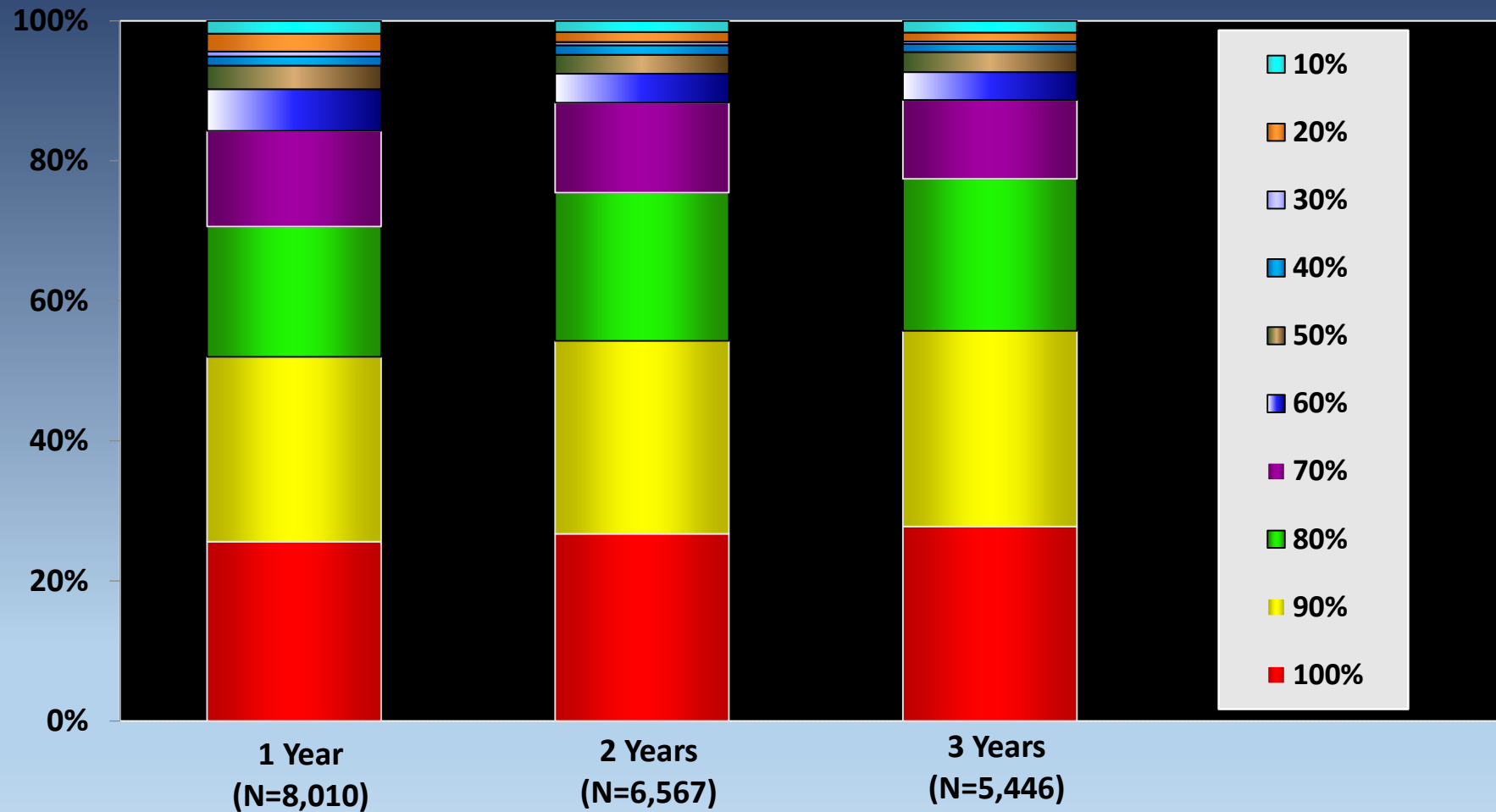
(Transplants: January 1990 – June 2013)



Adult Lung Transplants

Functional Status of Surviving Recipients

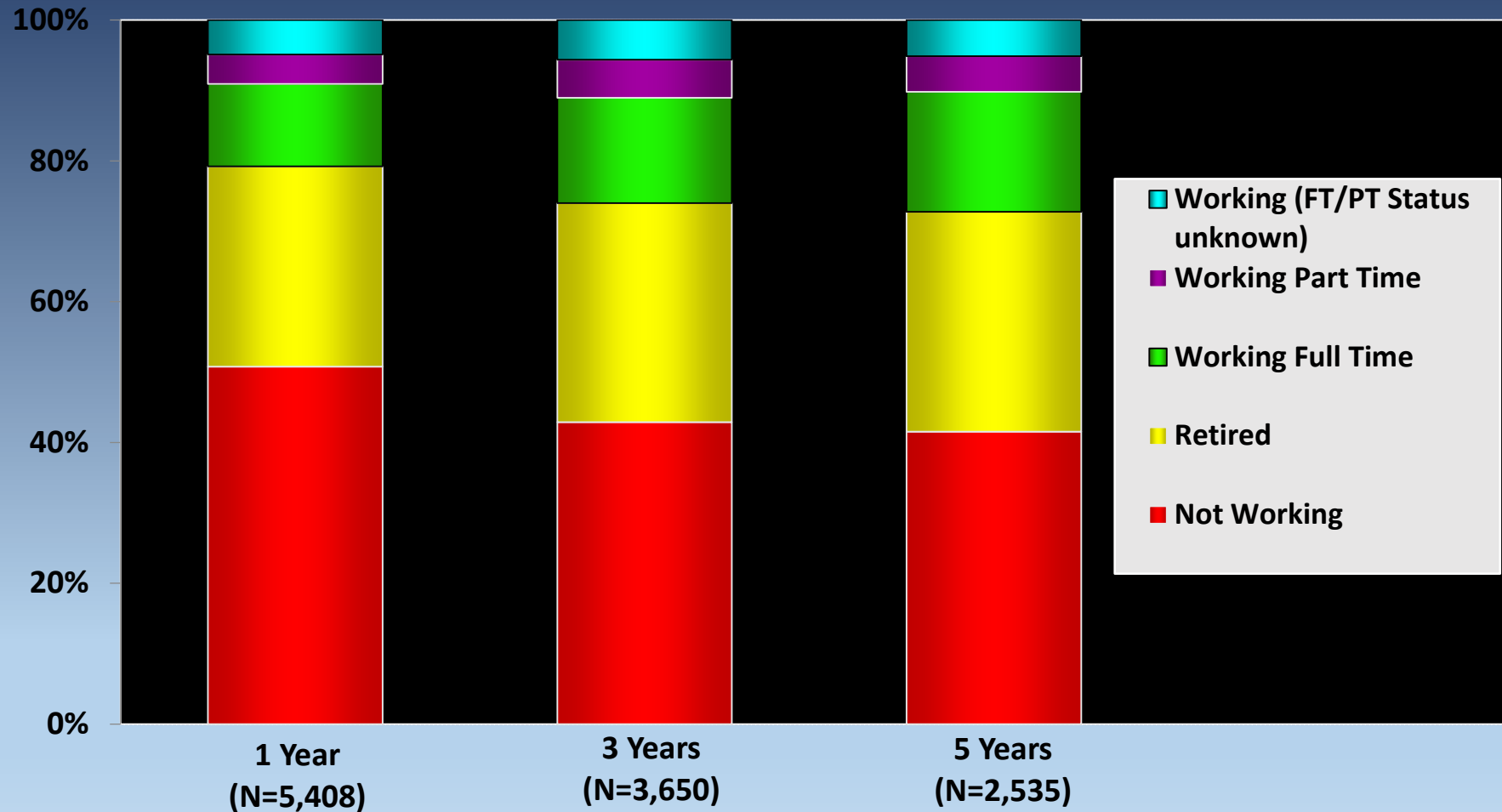
(Follow-ups: January 2009 – June 2014)



Adult Lung Transplants

Employment Status of Surviving Recipients

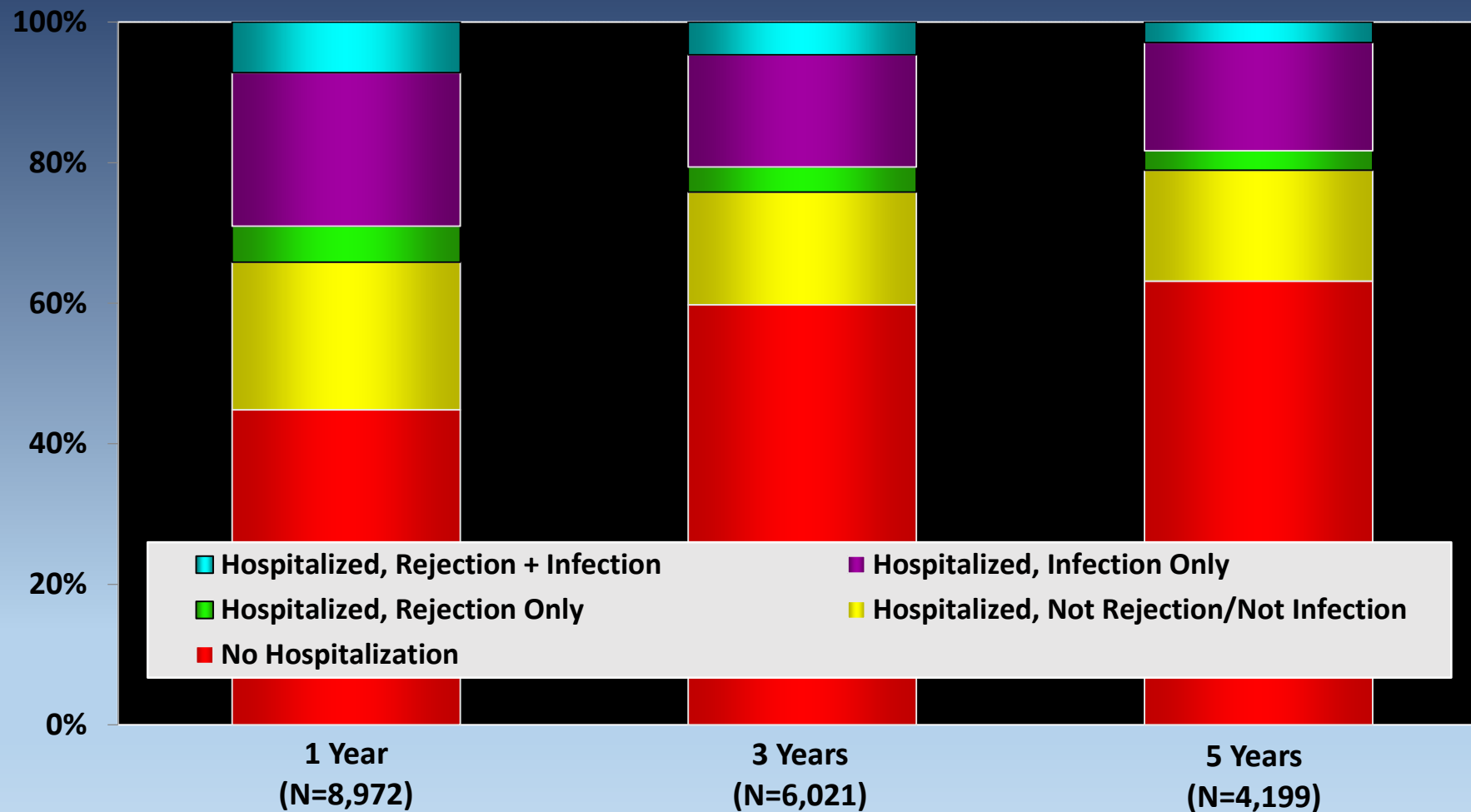
(Follow-ups: January 2009 – June 2014)



Adult Lung Transplants

Rehospitalization Post Transplant of Surviving Recipients

(Follow-ups: January 2009 – June 2014)



Adult Lung Transplants

Cumulative Morbidity Rates in Survivors within 1 and 5 Years Post Transplant (Follow-ups: April 1994 – June 2014)

Outcome	<u>Within 1 Year</u>	<u>Total number with known response</u>	<u>Within 5 Years</u>	<u>Total number with known response</u>
Hypertension	51.7%	(N=17,813)	80.7%	(N=5,293)
Renal Dysfunction	22.5%	(N=20,551)	53.3%	(N=7,056)
<i>Abnormal Creatinine ≤ 2.5 mg/dl</i>	15.7%		35.3%	
<i>Creatinine > 2.5 mg/dl</i>	5.0%		14.3%	
<i>Chronic Dialysis</i>	1.7%		3.0%	
<i>Renal Transplant</i>	0.1%		0.8%	
Hyperlipidemia	26.2%	(N=18,510)	57.9%	(N=5,643)
Diabetes	23.0%	(N=20,502)	39.5%	(N=6,941)
Bronchiolitis Obliterans Syndrome	9.3%	(N=19,348)	41.1%	(N=5,987)

Adult Lung Transplants

Cumulative Post Transplant Malignancy Rates in Survivors(Follow-ups: April 1994 – June 2014)

Malignancy/Type		1-Year Survivors	5-Year Survivors	10-Year Survivors
No Malignancy		20,260 (96.3%)	6,191 (83.4%)	1,222 (70.9%)
Malignancy (all types combined)		780 (3.7%)	1,234 (16.6%)	501 (29.1%)
<i>Malignancy Type*</i>	<i>Skin</i>	279	882	359
	<i>Lymphoma</i>	272	111	47
	<i>Other</i>	200	294	139
	<i>Type Not Reported</i>	29	10	2

Other malignancies reported include: adenocarcinoma (2; 2; 1), bladder (2; 1; 0), lung (2; 4; 0), breast (1; 5; 2); prostate (0; 5; 1), cervical (1; 1; 0); liver (1; 1; 1); and colon (1; 1; 0). Numbers in parentheses represent the number of reported cases within each time period.

* Recipients may have experienced more than one type of malignancy; therefore, the sum of individual malignancy types may be greater than the total number with malignancy.

Future Direction

Lung transplant

- Ex-vivo lung perfusion
- Ambulatory ECMO
- Induction of tolerance
- Bioengineered lung tissue