Retrograde pulmonary perfusion improves results of pulmonary embolectomy for massive pulmonary embolism
Mortality for pulmonary embolectomy for massive pulmonary embolism is reported around 30%, reaching 60% in the patients that had experienced a cardiac arrest prior to surgery.

(Gray HH et al. Pulmonary embolism for acute massive pulmonary embolism: an analysis of 71 cases. BR H J 1988)
The cause of death

• We suppose that during pulmonary embolectomy occur introduction of air into the pulmonary arterial tree.
Air Embolism

- Mechanical obstruction and arterial vasoconstriction
- Pulmonary hypertension
- Pulmonary edema
- Lung injury
Air Embolism
Neutrophils aggregation around air embolus

**FIG. 4.** Histological micrographs of air-embolized sheep lungs. **A:** embolization (1 h). Frozen histology of air bubbles (arrows) located in small pulmonary arteries (PA). **B:** embolization (4 h). Neutrophils (arrows) are aggregated around an air embolus (AE) in a small pulmonary artery (PA). **C:** embolization (4 h). Neutrophils (arrows) have formed a clump in a small pulmonary artery (PA). We believe these clumps are remnants of air bubble-blood interfaces after air has been resorbed.
Severe hemorrhagic edema
Changes in pulmonary circulation

FIG. 1. Changes in pulmonary arterial (PAP), capillary (PCP), and venous (PVP) pressures in response to a 1-min infusion of 0.25 ml air. Arrow, start of air infusion. Overlapping symbols, values at start and conclusion of 1-min air infusion. SE bars fell within area covered by symbols.
Changes in pulmonary circulation

**Fig. 3.** Changes in PAP in isolated rat lung in response to air emboli. **A:** time course of changes (means ± SE) after 1-min infusion of different amounts of air (0.1–0.25 ml). Arrow, start of air infusion. SE bars are not shown when they fall within area covered by a symbol. **B:** peak values of PAP expressed as a function of amount of air infused. Least-squares equation: PAP = 161.6 air + 12.6.
Changes in pulmonary circulation

**FIG. 5.** Effect of air embolism on lung weight gain (LWG). A: time course of LWG after 1-min infusion of air at various rates. *Statistically different from baseline value (P < 0.05). B: correlation between LWG 60 min after embolization and amount of air infused. LWG = 17.0 air − 1.9.
Retrograde perfusion

• We have adopted a technique of retrograde pulmonary perfusion as an adjunct to standard pulmonary embolectomy
Retrograde perfusion

- Removal of all air and residual thrombotic material from the pulmonary arterial branches
Clinical experience

- A consecutive series of 21 severely compromised patients over a period of fifteen years
Patient Population

- **Pts**: 21
- **Age**: 35-75 (mean 55)
- **Sex**: 8 M / 13 F
Diagnosis

- Had been achieved by pulmonary angiography and/or by echocardiography

- Two patients were taken directly to the OR from the ward where they had arrested
Pathogenesis

- Thrombophlebit 8
- Orthopedic surgery 7
- Other surgery 4
- Trauma 2
Clinical data

- Inotrops 19
- Cardiac arrest in OR 3
- Cardiac arrest in ward 2
Treatment

- Thrombolysis 5
- Heparine 6
Echocardiography

- RV failure 19
- Parad. movement of sept. 8
- Thromb in RA 1
Pulmonary angiography

- Obstruction >50% 19
- PAP mean 52+/-14.25
Results

Cardiac complications

• Tamponade  1
• Pericardial effusion  2
• AF  3

Pulmonary complications

• Pleural effusion  2
• Pneumothorax  1
Mortality

0\%
Conclusions

- Retrograde pulmonary perfusion may contribute to decrease mortality and morbidity in patients undergoing pulmonary embolectomy for MPE
- The reason for this is not completely clear. Possibly, removal of both residual thrombi and air from the PA tree