LUNGLUNG TRANSPLANTATION:STATE OFTTRANSPANTATION:STATE OF THE ARTHE ART
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Genova, March 21 – 23, 2013

LUNG TRANSPLANTS
The Journal of Heart and Lung Transplantation, 2012

PATHOLOGY
The Journal of Heart and Lung Transplantation, 2012

SURVIVAL
The Journal of Heart and Lung Transplantation, 2012
QUALITY OF LIFE

The Journal of Heart and Lung Transplantation, 2012

ANTHROPOMETRIC DATA:
- Age, sex, weight, height
- $CV(m) = 6,103 \times h$ (meters) – $0,028 \times a - 4,654$
- $CV(f) = 4,664 \times h$ (meters) – $0,024 \times a - 3,284$

FUNCTIONAL DATA:
- PO2 AT 100% FIO2 with 5 PEEP
- fiberbronchoscopy
- Chest X-ray

LUNG TRANSPLANT
Potential donor alert

“LUNGS IN THE BAG”
EXTRA-CORPOREAL CIRCULATION

If serious hypoxemia, hypercapnia, pulmonary hypertension, or hemodynamic dysfunction
- Central
- Peripheral

Severe Respiratory Failure → Lung transplant

Management process

- Lung Specialist
- CF Center
- Pathologist
- Thoracic Surgeon
- Physiotherapist
- Anesthesiologist

Collaboration in the decision-making process

POST-OPERATIVE MANAGEMENT

Immunosuppression:
- Induction therapy (IL-2)
- Maintenance therapy
  - Calcineurin inhibitors: Cyclosporine (Neoral, Sandimmune), Tacrolimus (FK-506, Prograf)
  - Anti-metabolite drugs: Azathioprine (Imuran), Mycophenolate (Cellcept)
  - Corticosteroids

Monitoring of spirometry parameters
  - trans-bronchial biopsies

Continuous physiotherapy

Evaluation of the onset of complications:
- Rejection - BOS
- Infections

International Guidelines for the Selection of Lung Transplant Candidates
American Journal of Respiratory and Critical Care Medicine, 1998

More than 6,400 lung transplants have been performed since the first successful operations in the early 1980s (1). Lung transplant programs now exist in many countries. Internationally, the number of donor organs available is far fewer than the number of patients with end-stage lung disease. Because of this, many candidates die on the waiting list, and the average wait to receive a donor organ may approach 2 yr (2). Overall survivals are between 50 and 65% at 2 yr and approximately 40% at 5 yr (1).

Lung transplantation remains a developing field within pulmonary medicine and thoracic surgery.
Lung transplantation is now a generally accepted therapy for the management of a wide range of severe lung disorders, with evidence supporting quality of life and survival benefit for lung transplant recipients (2). However, the number of donor organs available remains far fewer than the number of patients with end-stage lung disease who might potentially benefit from the procedure.

LUNG TRANSPLANT
Shortage of lung donors
Exponential increase in the number of patients on waiting list, **without** a proportional amount of increase in the number of lung donors.

Possible strategies:
- Legislative system
- Sensibilisation campaign to raise public awareness and training of hospital personnel
- Allocation
- Decrease the number of retransplants
- Potential donor management
- Expanded donor criteria
PUBLIC OPINION

- School
- Hospital

HOSPITAL STAFF
Education and training

- Intensive Care Unit (medical and nursing personnel)
- Surgeons

DONOR MANAGEMENT
Background

- The lung is a fragile organ
- The quality of the donor lung is correlated with the probability of PGD in the recipient (short-term outcome), which in turn is a risk factor for BOS (long-term outcome)
- Only in 15% of donors lungs are considered suitable for transplantation (Chang AC, 2006)

DONOR MANAGEMENT
Brain Death

Instability:
- Loss of vasomotor control / perfusion deficit
- Loss of thermoregulation
- Hormonal imbalance (diabetes insipidus, hypothyroidism)

→ Neurogenic pulmonary edema (interstitial edema + alveolar hemorrhage)
**ECMO: Emergency National Program 2010**

**ECMO and LUNG TRANSPLANT**

*Bridging urgency of wait list patients*

**Rationale:**
- CO2 removal
- Oxygenation
- Hemodynamic support (right ventricular)

**Advantages:**
- Patients not intubated
- Patients are awake, physical therapy (PT) is possible
- Less anticoagulation is needed

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**BRIDGE LT - OUR EXPERIENCE**

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<th>Age (yrs)</th>
<th>Diagnosis</th>
<th>ECMO Pre</th>
<th>Time (hr)</th>
<th>Donor</th>
<th>Outcome (at 60 days)</th>
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**EX VIVO LUNG PERFUSION (EVLP)**

*Our experience:

- **Case 1:**
  - Diagnosis: Fibrosis
  - ECMO Pre: VV
  - Time: 21 days
  - Donor: Marginal (Infective)
  - Outcome: Alive

- **Case 2:**
  - Diagnosis: CF
  - ECMO Pre: VV
  - Time: 14 days
  - Donor: Optimal
  - Outcome: Alive
**EXPANDED CRITERIA DONORS**

Ex-Vivo Lung Perfusion (EVLP)

- **Preservation**
  - possibility to optimally conserve the harvested organ for long periods of time
- **Resuscitation**
  - possibility to treat contusion, atelectasis, aspiration, infections, neurogenic edema in marginal lungs.
- **Conditioning**
  - possibility of immune and genic therapy in order to induce tolerance

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**EX VIVO LUNG PERFUSION (EVLP)**

Our experience: clinical stage

**1st CASE**

- M – 24 yrs
- Medical history
  - CF (Pseudomonas)
  - 2000 left pleurodesis
  - 2011 put on waiting list for Tx

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**EX VIVO LUNG PERFUSION (EVLP)**

Our experience: clinical stage

- 03/2011 Exacerbation of infection
- Hypoxic-hypercapnic respiratory failure
- Admission in ICU and non-invasive ventilation
- Awake ECMO
- Urgent lung transplant list

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**EX VIVO LUNG PERFUSION (EVLP)**

Marginal potential donor alert
EX VIVO LUNG PERFUSION (EVLP)
En bloc double lung harvest

EX VIVO LUNG PERFUSION (EVLP)
Tracheal intubation

EX VIVO LUNG PERFUSION (EVLP)
Lung ventilation

EX VIVO LUNG PERFUSION (EVLP)
Gas exchange improvement
EX VIVO LUNG PERFUSION (EVLP)

**Topical cooling**

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**Timing 1st Case**

- h. 3:00 CROSS-CLAMPING (PO2 190 mmHg)
- h. 6:00 DONOR LUNGS IN OPERATING ROOM
- h. 7:00 PREPARATION LUNGS EX SITU
- h. 7:30 START OF WARM EVLP
- h. 9:00 PO2 300 mmHg
- h. 9:30 END OF COLD EVLP
- h. 10:00 PO2 530 mmHg
- h. 10:30 INTUBATION
- h. 11:30 INCISION
- h. 15:30 RIGHT LUNG DECLAMPING
- h. 19:00 LEFT LUNG DECLAMPING
- h. 21:00 TRANSFER IN I.C.U.

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EX VIVO LUNG PERFUSION (EVLP)

**BLTx on vv-ECMO (1 in the world)**

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**Post-operative course**

- Immediate functional recovery of transplanted organs
- Extubation after 12 hrs
- Patient removed from ECMO after 24 hrs from lung transplant

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EX VIVO LUNG PERFUSION (EVLP)

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14 marzo 2011
**EX VIVO LUNG PERFUSION (EVLP)**

Discharge on postop. day 16

**PFR:**
- FVC 3.01 l (53%)
- FEV 2.90 l (61%)

**ECA in as:**
- pO\textsubscript{2} 76 mmHg
- pCO\textsubscript{2} 43 mmHg
- pH 7.46
- sO\textsubscript{2} 97.3%

**TRAPIANTO DI POLMONE**

Conclusions

**Future**
- Decrease in mortality of patients on waiting list
- Increase of organ procurement
- Increased survival of transplanted patients

**Research Guidelines**
- URGENCY
- ECMO
- MARGINAL DONOR
- EVLP
- NON HEART BEATING DONOR
- LESS BOS
- ANTI-REJECTION DRUGS