



EPA team - Le sfide del trapianto di fegato nel 2023

## La perfusione ipotermica

**Dott. Riccardo De Carlis**

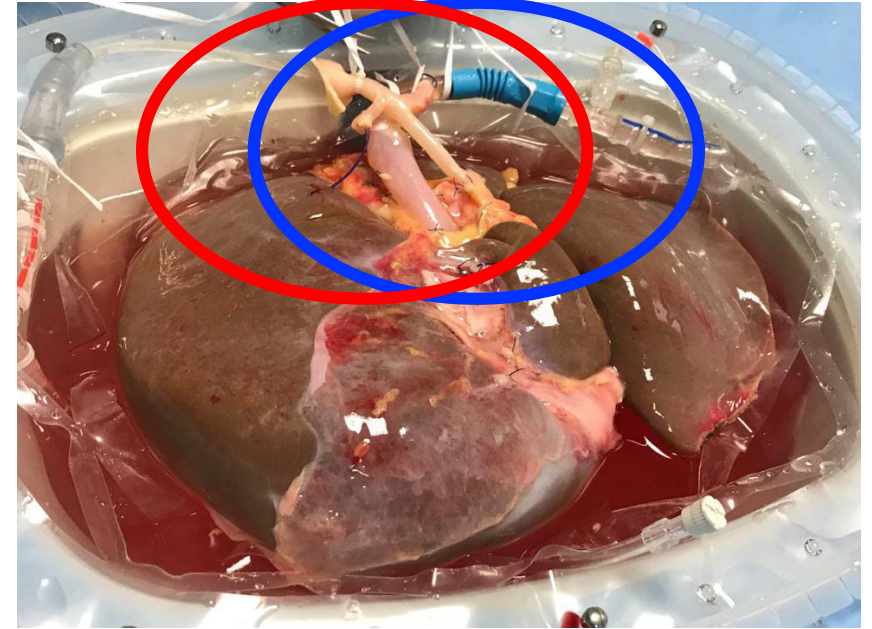
ASST GOM Niguarda – Milano

## PROTOCOLLO D-HOPE

- Belzer® solution for MP\*
- $t = 10^{\circ}\text{C}$
- $p\text{O}_2 = 60 \text{ kPa}$
- $P (\text{v. porta}) = 4 \text{ mmHg}$  (Q continuo)
- $P (\text{a. epatica}) = 25 \text{ mmHg}$  (60 bpm)



Groningen

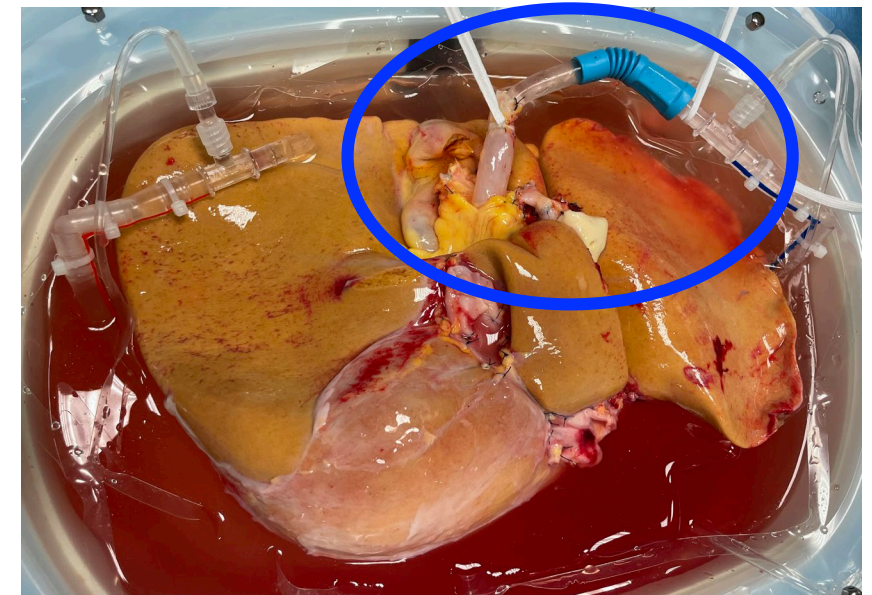


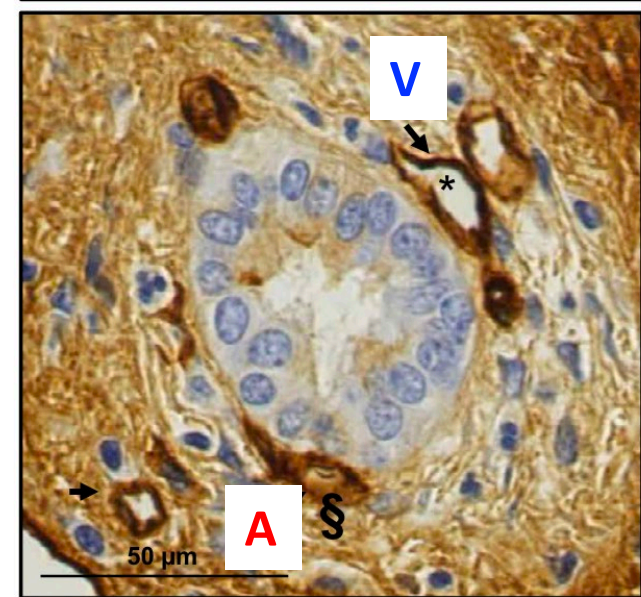
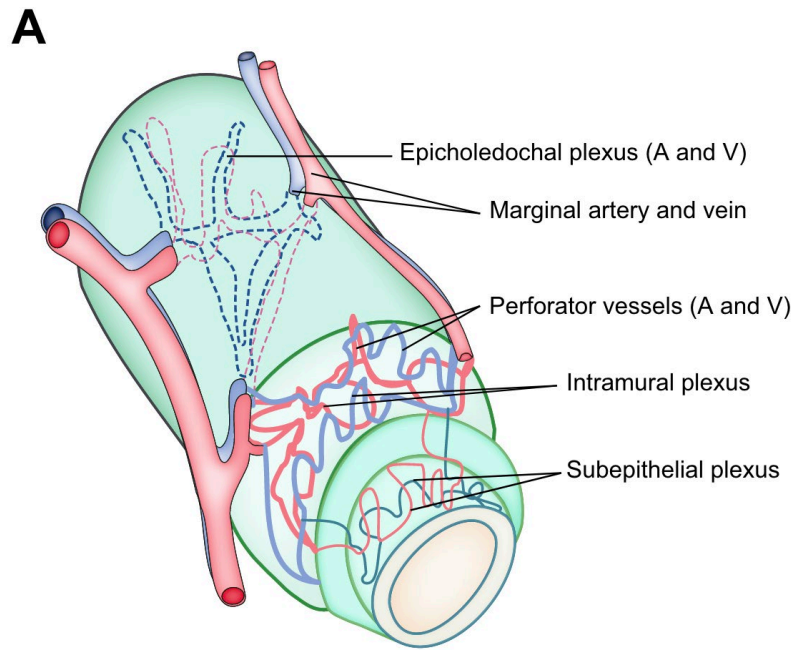
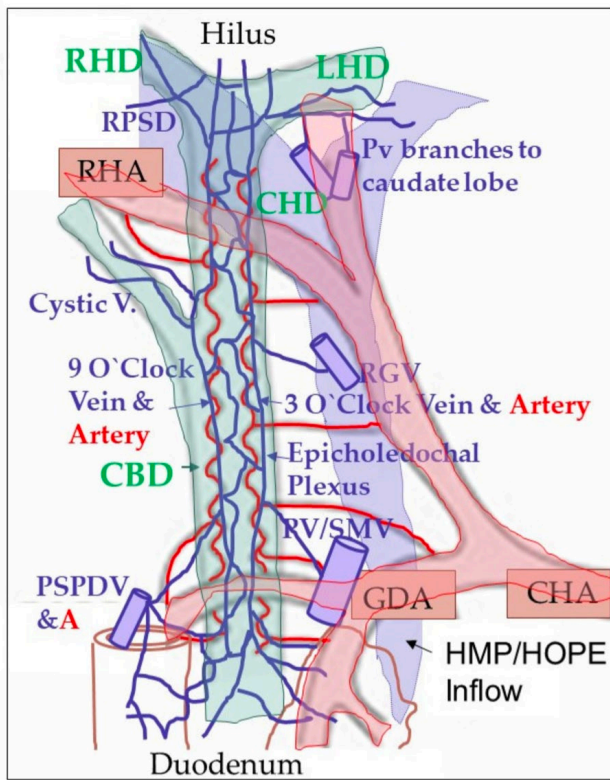
## PROTOCOLLO HOPE

- Perfusione esclusivamente portale
- $T = 8\text{--}12^{\circ}\text{C}$
- $p\text{O}_2 = 70\text{--}110 \text{ kPa}$
- $P (\text{v. porta}) = 3 \text{ mmHg}$
- Q continuo, 150-300 mL/min



Zurich





**B**

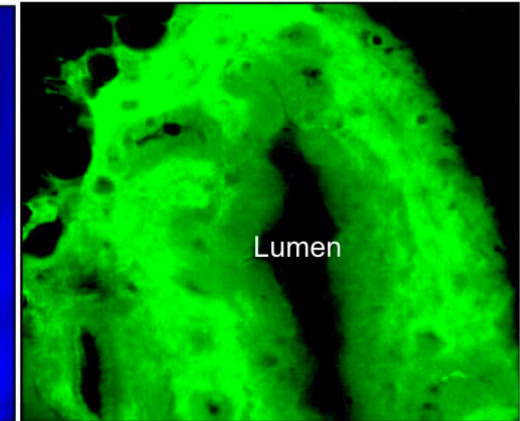
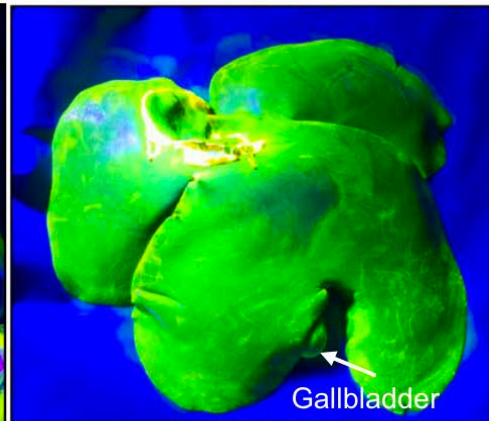
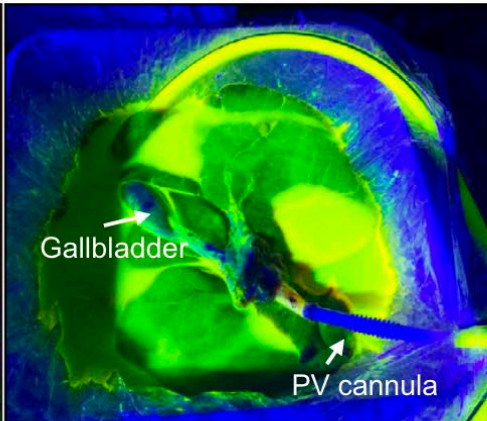
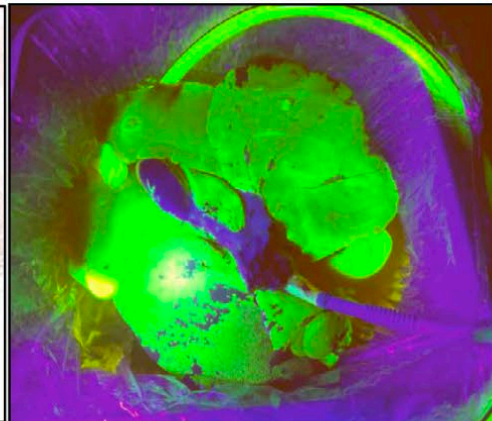
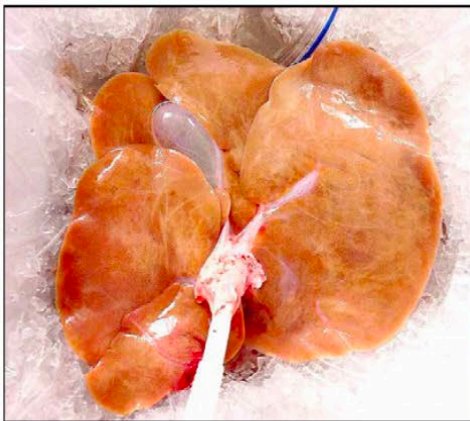
Liver before HOPE

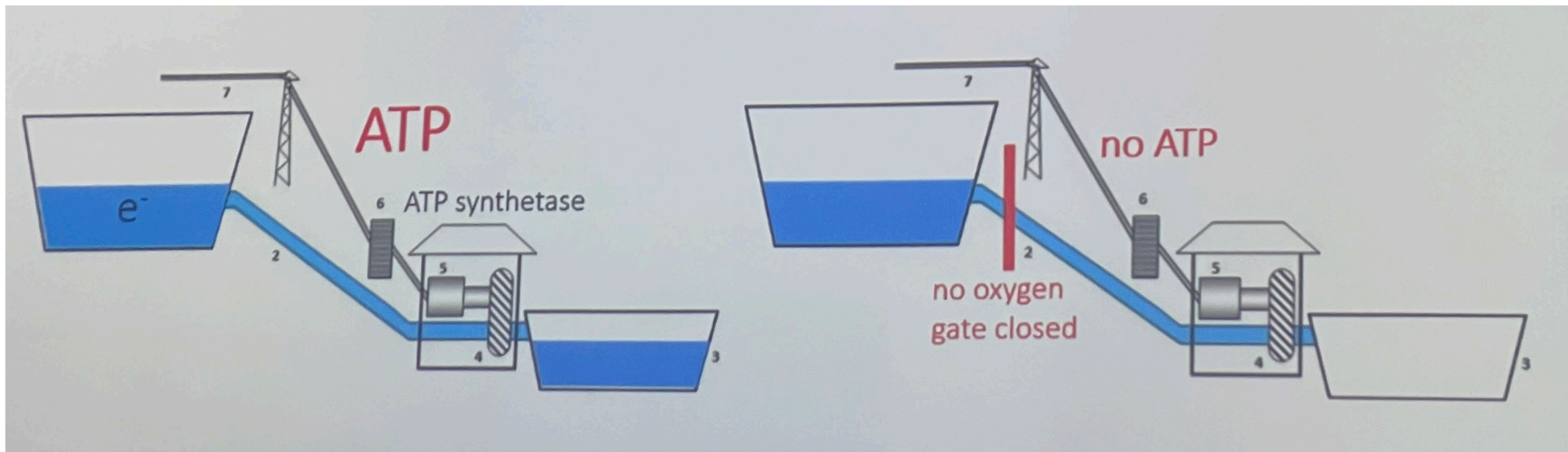
30 sec after HOPE start

3 min of HOPE

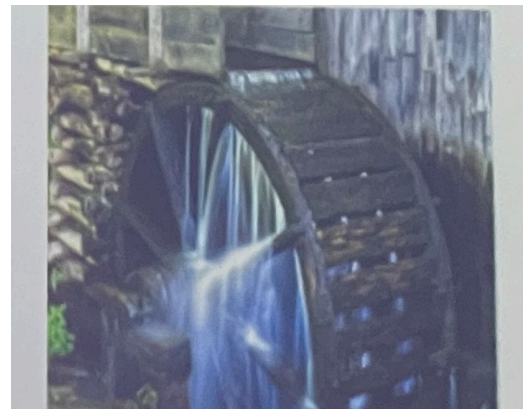
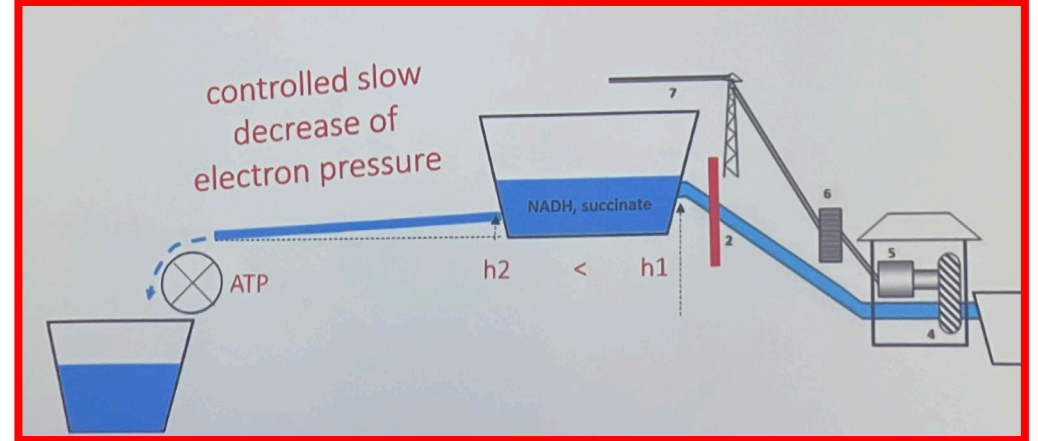
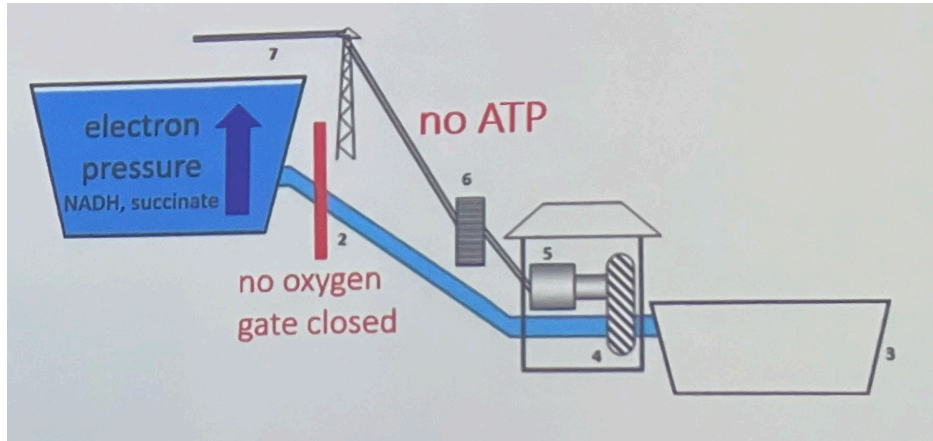
End of HOPE

Tip of common bile duct at the end of HOPE (histology)





**HOPE**



# Ricondizionamento dei graft marginali



# Hypothermic Machine Perfusion in Liver Transplantation — A Randomized Trial

R. van Rijn, I.J. Schurink, Y. de Vries, A.P. van den Berg, M. Cortes Cerisuelo, S. Darwish Murad, J.I. Erdmann, N. Gilbo, R.J. de Haas, N. Heaton, B. van Hoek, V.A.L. Huurman, I. Jochmans, O.B. van Leeuwen, V.E. de Meijer, D. Monbaliu, W.G. Polak, J.J.G. Slangen, R.I. Troisi, A. Vanlander, J. de Jonge, and R.J. Porte, for the DHOPE-DCD Trial Investigators\*



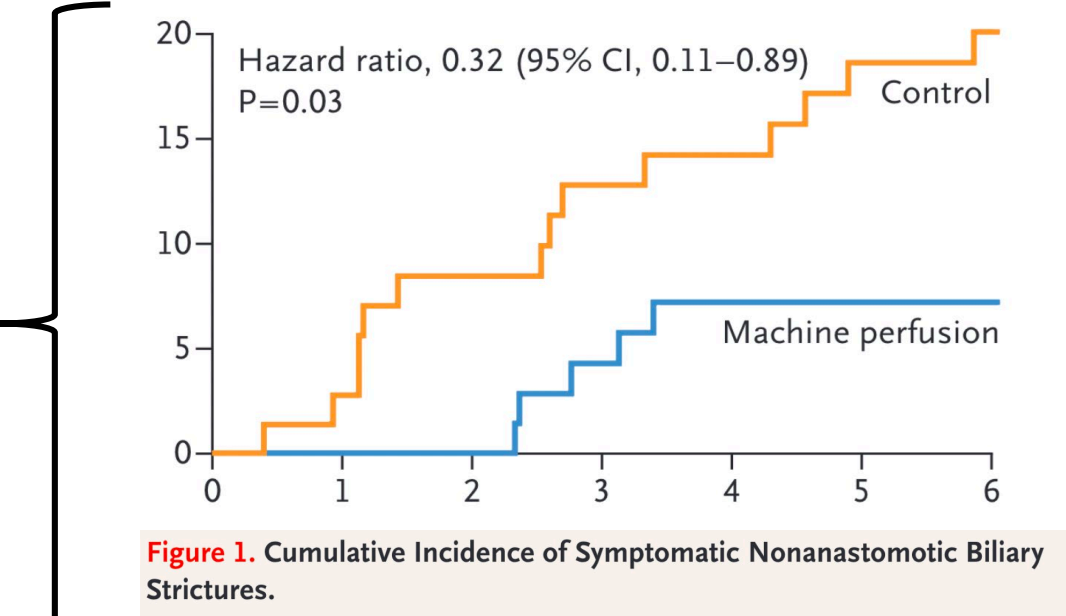
# Hypothermic Oxygenated Machine Perfusion Reduces Early Allograft Injury and Improves Post-transplant Outcomes in Extended Criteria Donation Liver Transplantation From Donation After Brain Death

Results From a Multicenter Randomized Controlled Trial (HOPE ECD-DBD)

Czigany, Zoltan MD, PhD\*; Pratschke, Johann MD†; Froněk, Jiří MD‡; Guba, Markus MD§; Schöning,

Annals of Surgery: November 2021 - Volume 274 - Issue 5 - p 705-712

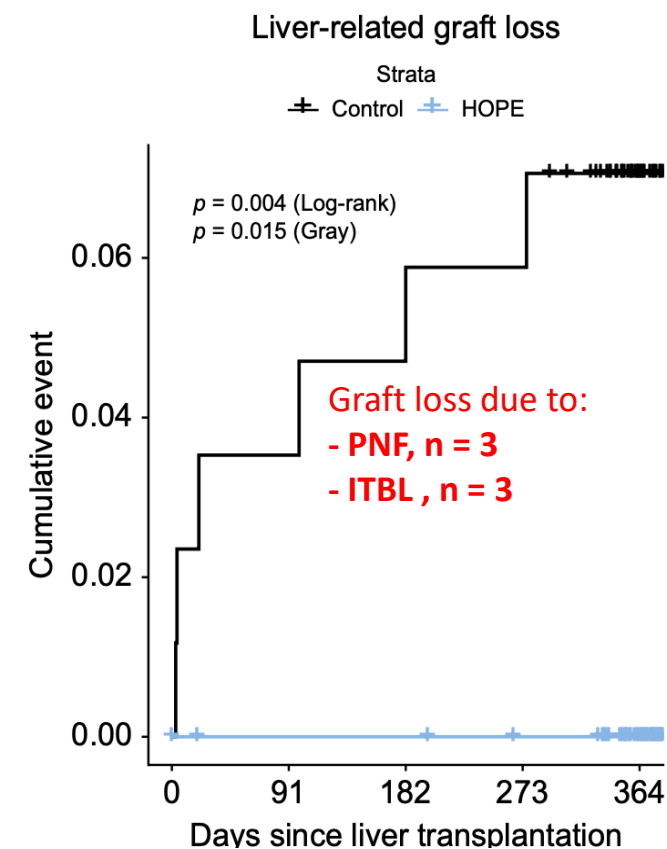
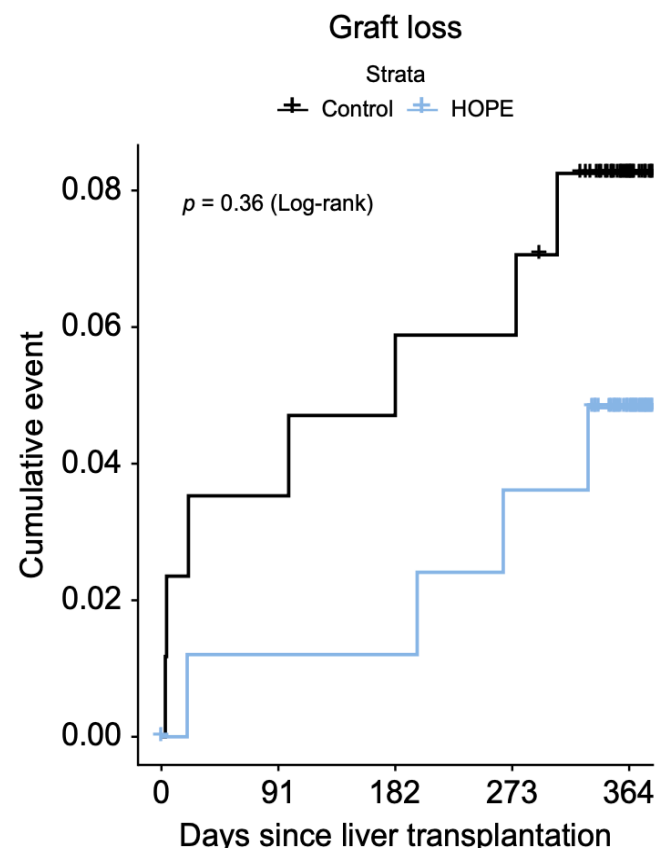
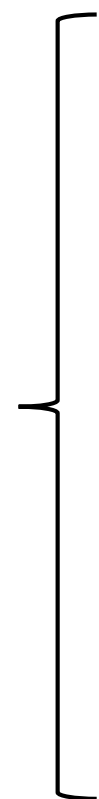
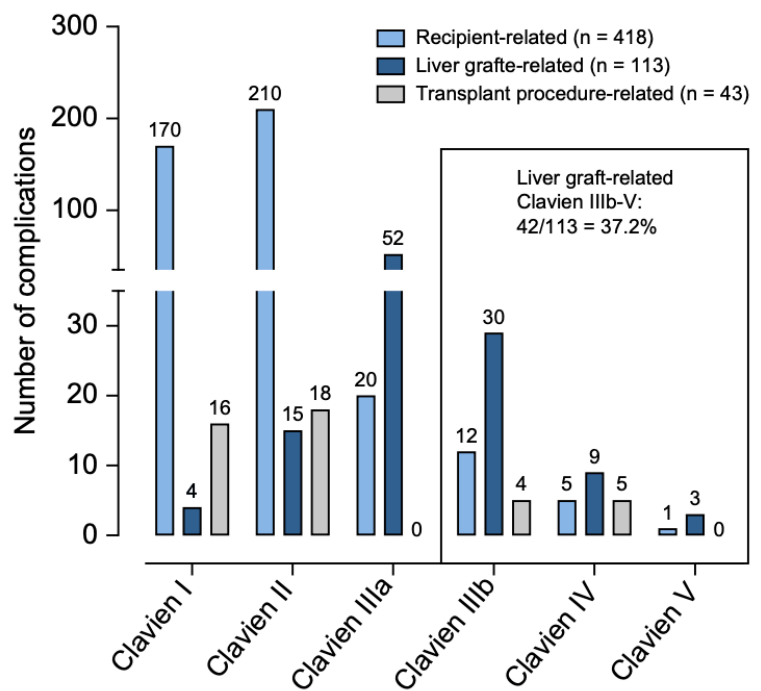
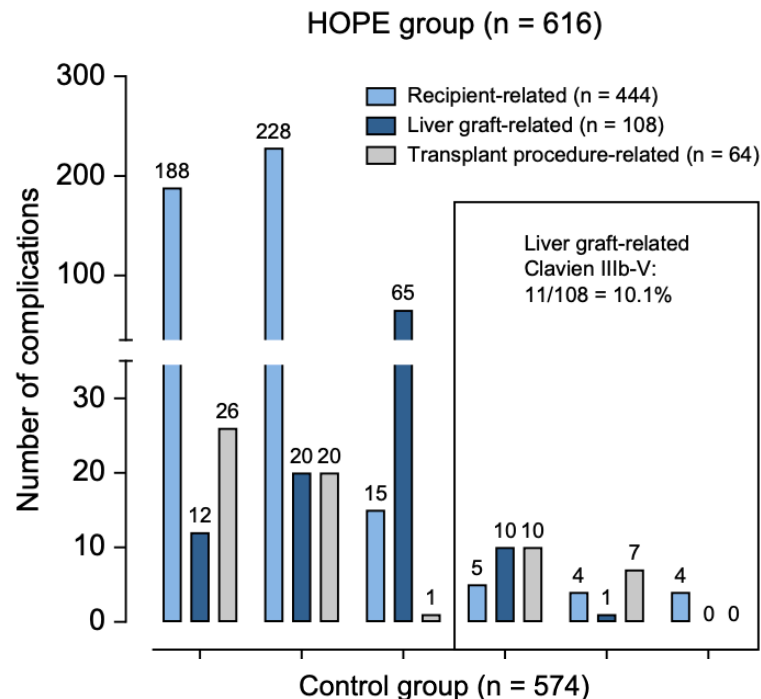
doi: 10.1097/SLA.00000000000005110



- Serum peak ALT**  
418 (IQR: 221–828) vs 796 (IQR: 477–1195) IU/L,  $P = 0.030$
- 90-day complications**  
44% vs 74% CD grade  $\geq 3$ ,  $P = 0.036$   
32 (IQR: 12–56) vs 52 (IQR: 35–98) CCI,  $P = 0.021$
- Hospital-stay**  
20 (IQR: 16–27) vs 36 (IQR: 23–62) days,  $P = 0.002$

# A multicenter randomized-controlled trial of hypothermic oxygenated perfusion (HOPE) for human liver grafts before transplantation

Andrea Schlegel, Matteo Mueller, Xavier Muller, ..., Beat Müllhaupt, Pierre-Alain Clavien, Philipp Dutkowski

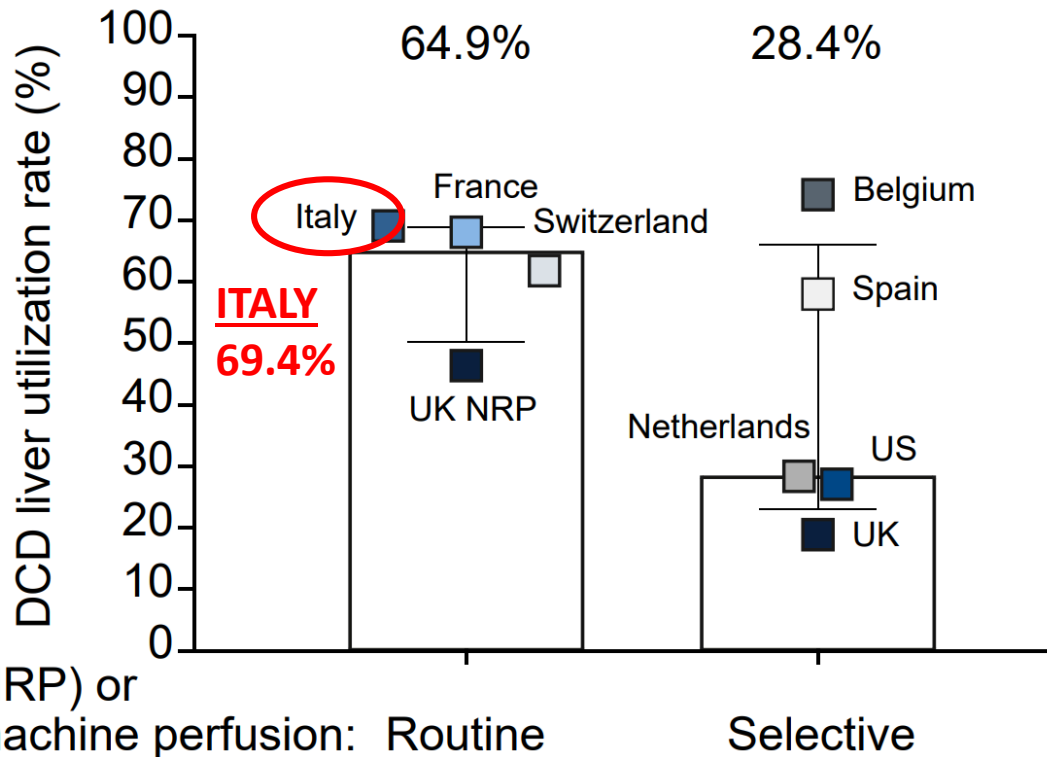


# Utilization of livers donated after circulatory death for transplantation – An international comparison

Janina Eden<sup>1</sup>, Richard Sousa Da Silva<sup>1</sup>, Miriam Cortes-Cerisuelo<sup>2</sup>, Kristopher Croome<sup>3</sup>, Riccardo De Carlis<sup>4</sup>, Amelia J. Hessheimer<sup>5</sup>, Xavier Muller<sup>6</sup>, Femke de Goeij<sup>7</sup>, Vanessa Banz<sup>8</sup>, Giulia Magini<sup>9</sup>, Philippe Compagnon<sup>9</sup>, Andreas Elmer<sup>10</sup>,

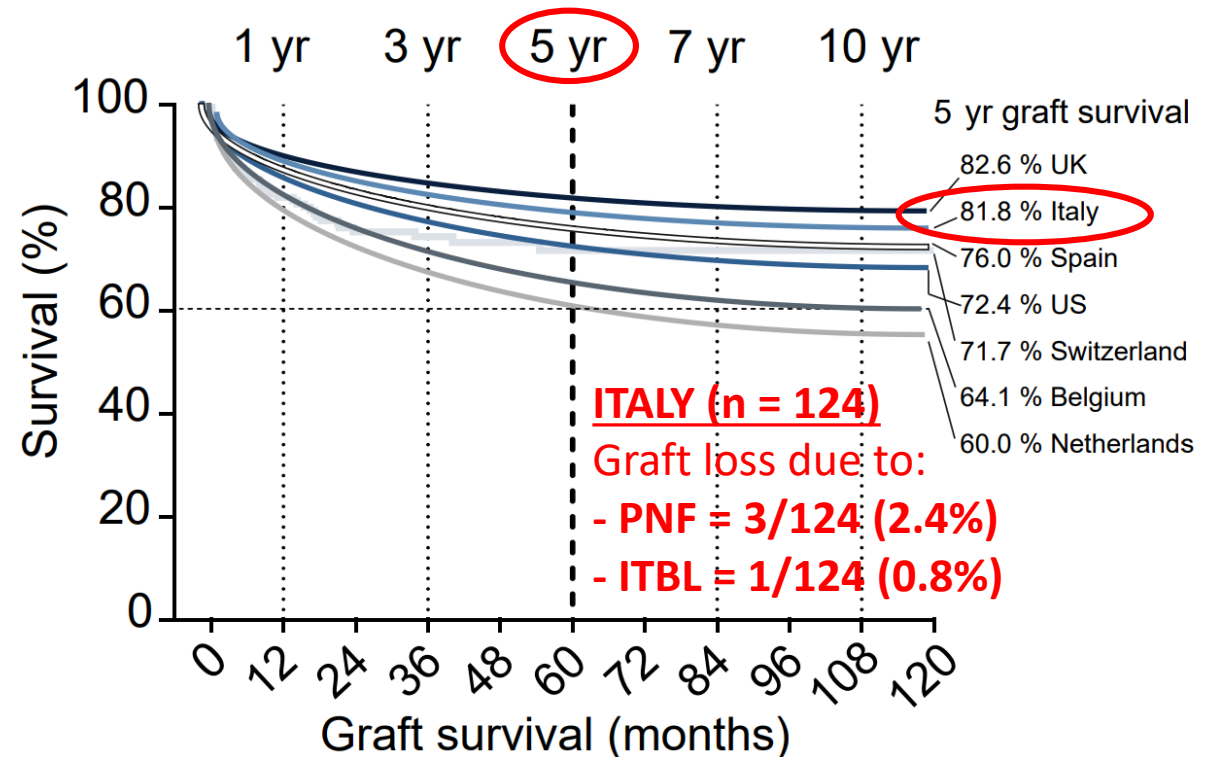
**E**

**Utilization: transplants/offered**  
≠  
**Rescue: transplants/recovered (or perfused)**



**F**

Graft survival/country

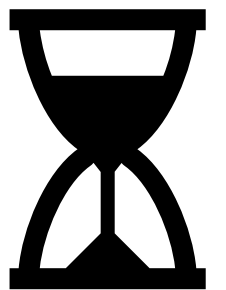




Ricondizionamento dei  
graft marginali



Prolungamento della  
preservazione



# Hypothermic Machine Perfusion of Liver Grafts Can Safely Extend Cold Ischemia for Up to 20 Hours in Cases of Necessity

Riccardo De Carlis<sup>1</sup>, Andrea Lauterio, Fabio Ferla, Stefano Di Sandro, Raffaella Sguinzi, Luciano De Carlis

Case 1



Case 2

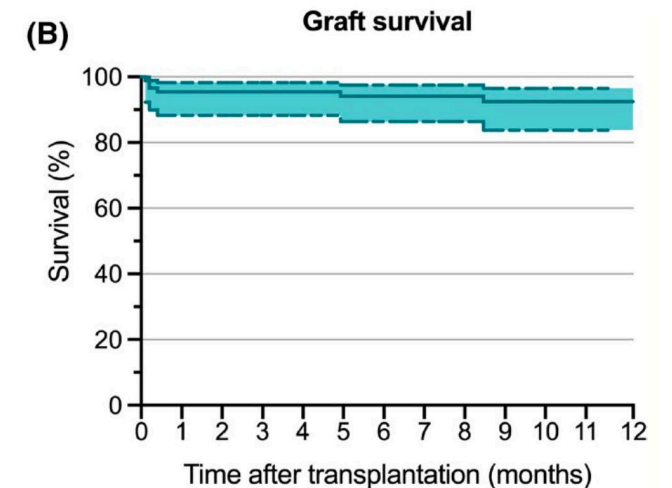
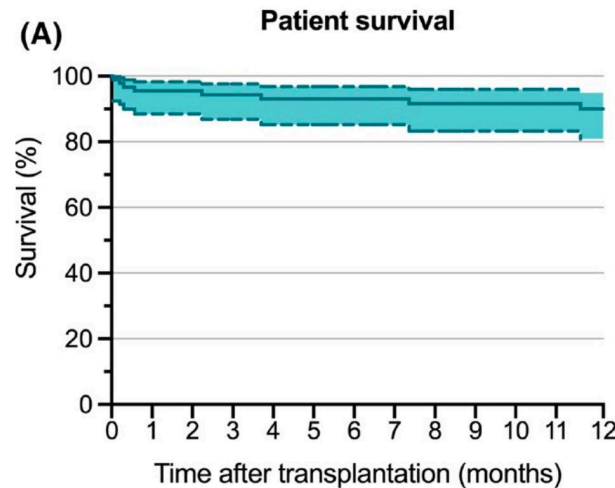
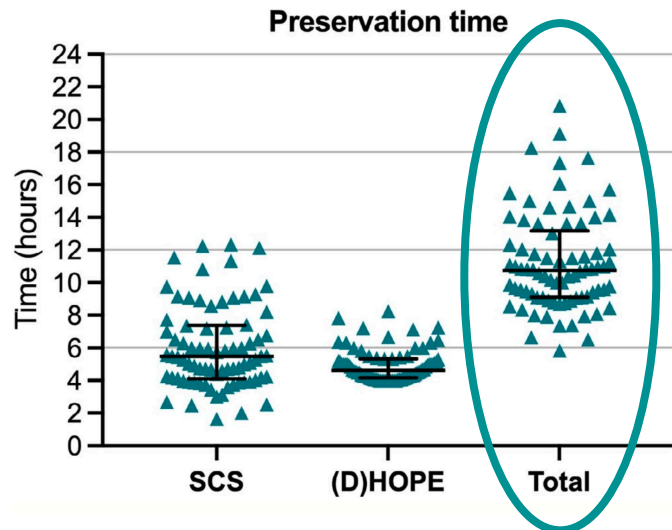


American Journal of  
**TRANSPLANTATION**

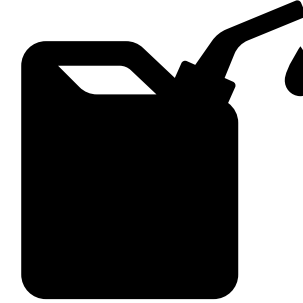
## Prolonged preservation by hypothermic machine perfusion facilitates logistics in liver transplantation: a European observational cohort study

Isabel M.A. Brüggewirth, Matteo Mueller, Veerle A. Lantinga, Stefania Camagni, Riccardo De Carlis, Luciano De Carlis, Michele Colledan, Daniele Dondossola, Moritz Drefs, Janina Eden ... See all authors

First published: 21 March 2022 | <https://doi.org/10.1111/ajt.17037>

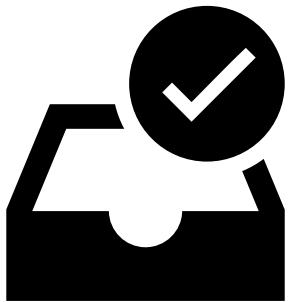
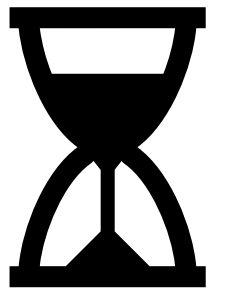


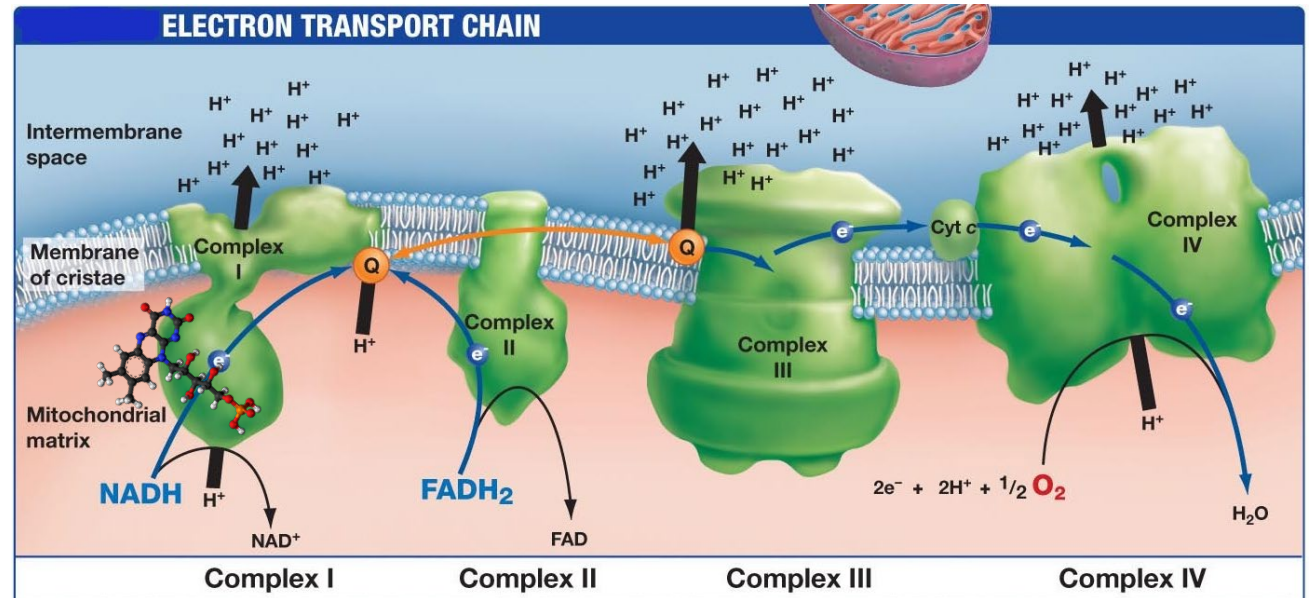
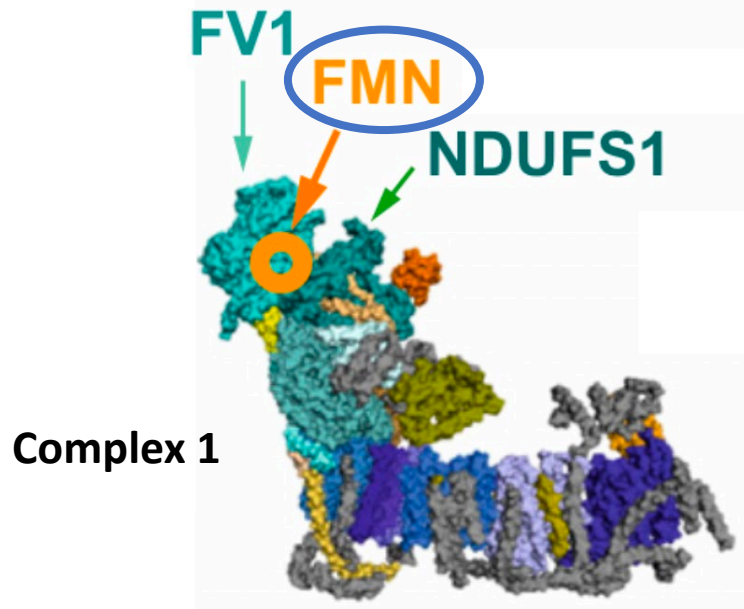
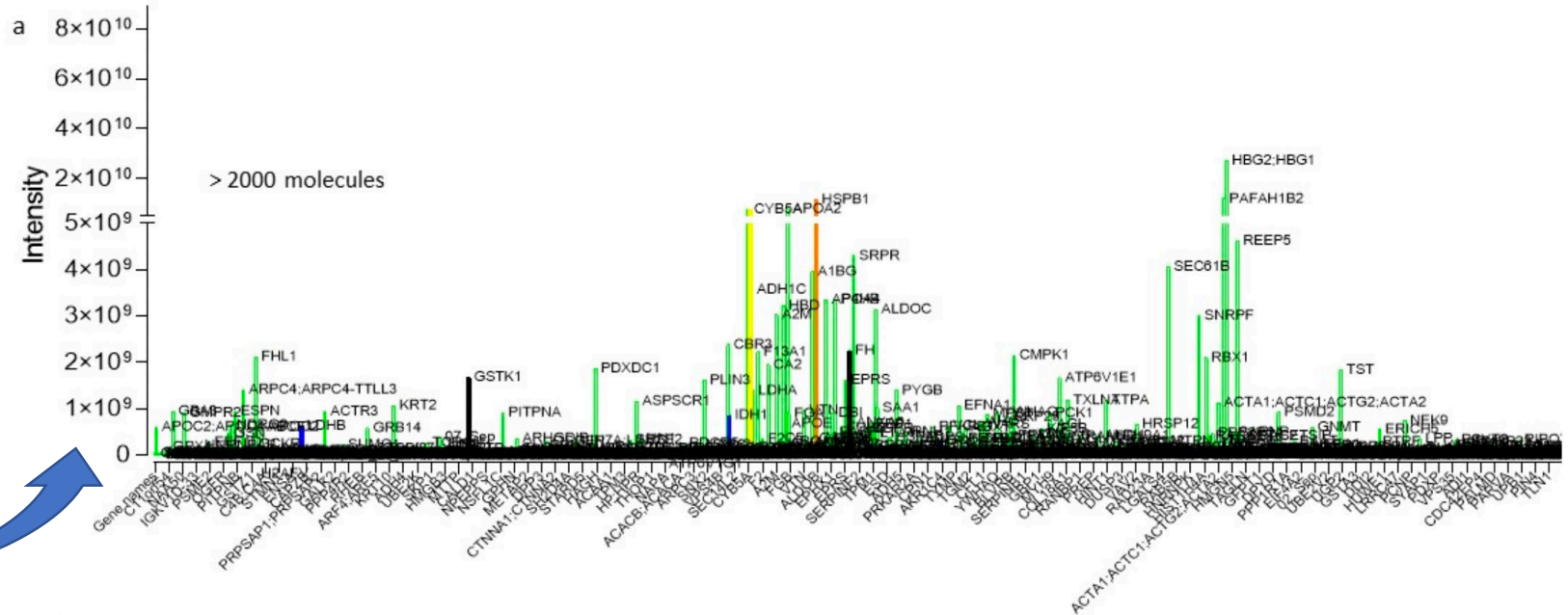
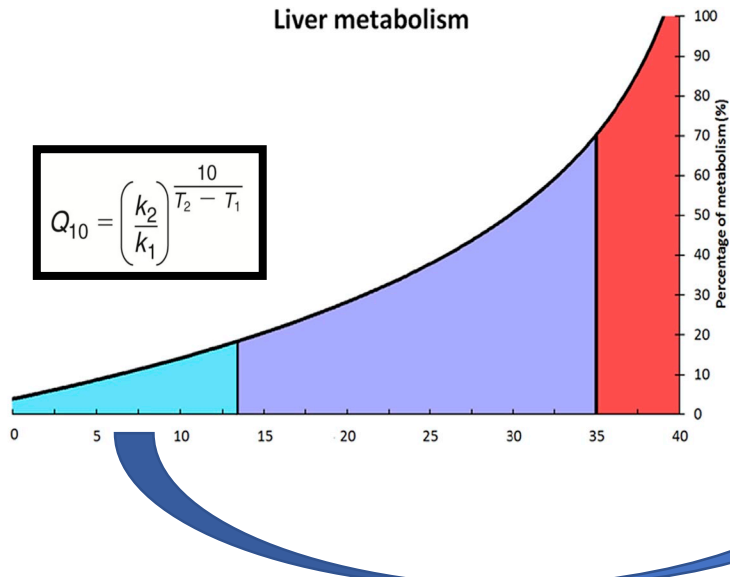
Ricondizionamento dei  
graft marginali



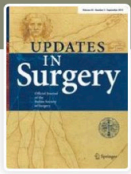
Valutazione e  
selezione

Prolungamento della  
preservazione










# Current practice of normothermic regional perfusion and machine perfusion in donation after circulatory death liver transplants in Italy


[Riccardo De Carlis](#) , [Andrea Lauterio](#), [Leonardo Centonze](#), [Vincenzo Buscemi](#), [Andrea Schlegel](#), [Paolo Muesan](#), [Luciano De Carlis](#) & [Italian DCD Collaborator Group](#)

[Updates in Surgery](#) (2022) | [Cite this article](#)

## Italian national survey (all adult liver transplant centers)

 20 min stand-off  21/21 (100%) answers

  19/21 (90.5%) ECMO available

 11/21 (52.4%) NRP program for cDCD

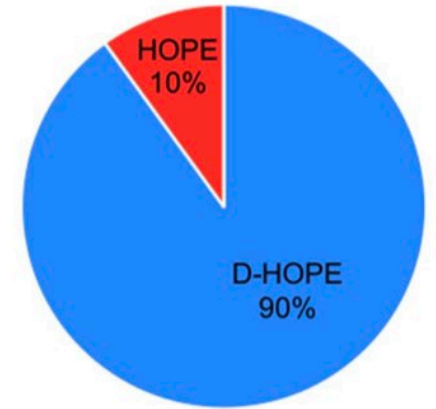
## Sequential MP 11/11 (100%) NRP → SCS → end-ischemic MP

 8/11 (72.7%) Hypothermic MP

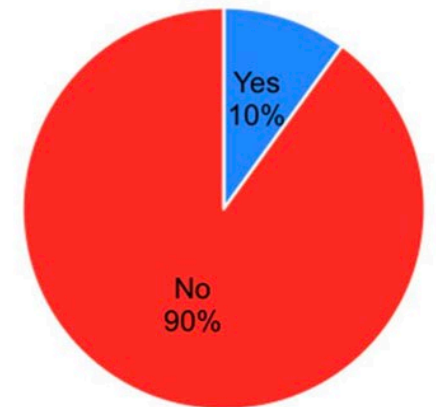
 1/11 (9.1%) Normothermic MP

 2/11 (18.2%) Both types depending on the case

What protocol do you use? [hypothermic MP]



Do you have the possibility to measure FMN? [hypothermic MP]



# Conclusioni

- Due protocolli sovrapponibili: DHOPE/HOPE
- Prolungamento della preservazione (non dell'ischemia fredda!)
- Vantaggio sulla colangiopatia ischemica nei fegati da DCD
- Selezione? L'FMN è il solo parametro che correla con la sopravvivenza d'organo. Ma manca ancora di una validazione esterna.



Grazie dell'attenzione!

**Dott. Riccardo De Carlis**  
ASST GOM Niguarda – Milano