

From Rescue Technique to Optimization Strategy: The Role of Hypothermic Oxygenated Perfusion in Good-Quality Livers – A Single-Center Experience

Mariana Lemos¹, Júlio Constantino^{1,2}, Pedro Oliveira^{1,2}, Emanuel Furtado^{1,2}, José Tralhão¹, Dulce Diogo^{1,2}

¹General Surgery Department, ULS de Coimbra, Coimbra – Portugal
²Adult Liver Transplant Unit, ULS de Coimbra, Coimbra – Portugal



Introduction

The introduction of liver perfusion techniques has been a major milestone in liver transplantation (LT) over the past decade. Several studies have shown that hypothermic oxygenated perfusion (HOPE) improves post-transplant outcomes when using extended criteria donors (ECD). Our center has been using HOPE since 2020 and, from 2024 onwards, the technique has been applied to all grafts. Over time, we observed a reduction in the overall incidence of ischemic-type biliary lesions (ITBL), from 16.7% (before HOPE) to approximately 8%.

The aim of this study is to evaluate the impact of HOPE on LTs with non-ECD grafts.

Methods

Retrospective study LTs performed between 19/08/2020 and 30/11/2024

Recipients: age > 18 years old, follow-up until 31/05/2025;

Exclusion criteria

Donors & Grafts	Recipients
- age>67 years - BMI>30 kg/m² - cold ischemia time >8 h - macrosteatosis >30%, - serum sodium >165 mEq/L - ALT >3× upper limit of normal - UCI >7 days - Split grafts	- post-transplant hepatic artery thrombosis or stenosis - primary sclerosing cholangitis - follow-up < 6 months (death or re-transplant) (only for the analysis of ischemic-type biliary lesions)

Two groups

- Without HOPE - HOPE p<0.05	Outcome - Early Alograft Disfunction (Olthoff) - Graft loss - Mortality - Ischemic-type biliary lesions (symptomatic)
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ITBL - Ischemic-type biliary lesions

Definition

- Biliary stricture involving the anastomosis, exceeding 5 mm in length.
- Stricture(s) distant from the anastomosis or mixed.

Diagnosis of biliary stricture

MRCP or PTC images were independently assessed by two experienced liver transplant surgeons, and cases considered when a consensus diagnosis was reached.



Statistical analysis

Fisher's exact test, Chi-square test, Kaplan-Meier curves; IBM SPSS Statistics Version 29

Machine Perfusion VitaSmart® - MEDICA
Perfusion - portal vein
Maximum pressure: 3 mmHg
Maximum flow: 250 ml/min
Oxygenation: PaO2: 450 mm/Hg
Temperature: 4-10° C



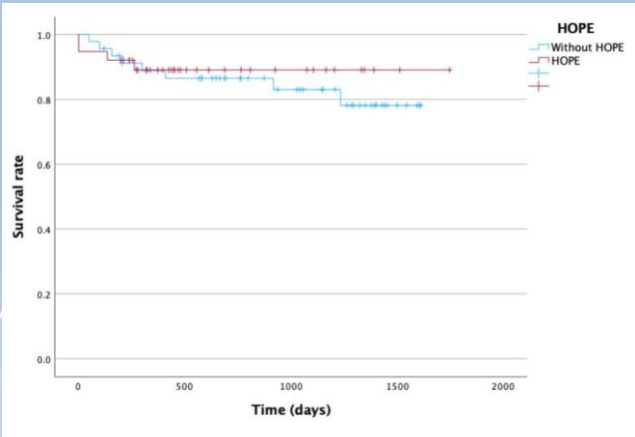
Results

N=100	Without HOPE n=57	HOPE n=43
Donors: 100% DBD		

n=100	Without HOPE n=57	HOPE n=43	p
Donors			
Age (years)	55 (IQR:36.5-60.5)	55 (IQR:48-64)	0.377
ICU (days)	2 (IQR:1-3)	3 (IQR:2-4)	0.100
BMI (kg/m2)	24.86 (IR: 22.7-26.94)	25.4 (IQR:22.6-27.2)	0.170
Recipients			
Age (years))	58 (IQR: 51-65)	62 (IQR:56-67)	0.806
MELD Na	18 (IQR: 11.5-25)	19 (IQR:14-24)	0.646
Urgent	22.8% (13/57)	30.2% (13/43)	0.116
"Times"			
CIT (min)	300 (IQR:259–340)	240 (IQR:204–271)	0.397
WIT (min)	37 (IQR: 30-47)	39 (IQR: 32-48)	0.383
HOPE (min)	-	135 (IQR:126–160)	-
BAR score	7 (IQR:3.5-11)	9 (IQR:4-11)	0.544
IRI¹	17.9% (10/56)	25.8% (8/31) ²	0.238
Follow up			
Days	982.5 (IQR:579.75–1375.25)	450 (IQR:270.5–963.25)	0.418
ALT peak (U/L)	597.5 (IQR:392.25–1341.75)	431.5 (IQR:218.75–1076.75)	0.580
EAD	22.8% (13/57)	25.6% (11/43)	0.534
Graft loss	3.5% (2/57) ³	0 (0/43) ⁴	0.215
Mortality	19.3% (11/57) ⁵	9.3% (4/43) ⁶	0.240
ITBL	12 patients excluded	9 patients excluded	
Incidence	15.6% (7/45)	2.9% (1/34)	0.031
Manifestation	Before 6 m FU	Before 6 m FU	-

¹Up to moderate; ²20% missing

Recipient's Survival



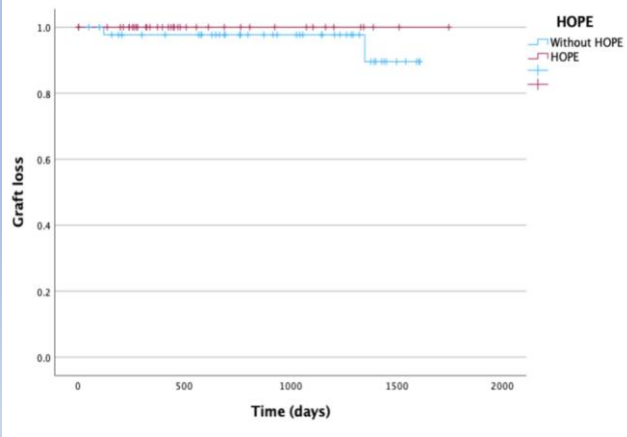
⁵Without HOPE n=11

- Neoplasia (n=4)
- (1 HCC recurrence)
- Sepsis/MOF (n=4)
- (1 after treatment of ITBL)
- Trauma (n=1)
- GVHD (n=1)
- Hemorrhagic stroke (n=1)

⁶HOPE n=4

- MOF (sepsis) (n=2 – D1)
- At home (unknown) (n=1)
- PTLD (sepsis) (n=1)

Graft Loss (in the surviving recipientes)



³Without HOPE n=2

- HA thrombosis (HA injury during procurement)
- Biliary CAST syndrome

⁴HOPE n=0

Conclusions

In our center, the use of HOPE in non-ECD grafts:

- improved post-LT outcomes
- significant reduction in the incidence of ITBL
- HOPE may have contributed to the lower mortality

Reference: Eden J, Brüggewirth IMA, Berlakovich G, Buchholz BM, Botea F, Camagni S, Cescon M, Cillo U, Colli F, Compagnon P, De Carlis LG, De Carlis R, Di Benedetto F, Dingfelder J, Diogo D, Dondossola D, Drefs M, Fronek J, Germinario G, Gringeri E, Györi G, Kocik M, Küçükerbil EH, Koliogiannis D, Lam HD, Lurje G, Magistri P, Monbaliu D, Moumni ME, Patrono D, Polak WG, Ravaoli M, Rayar M, Romagnoli R, Sörensen G, Uluk D, Schlegel A, Porte RJ, Dutkowski P, de Meijer VE. Long-term outcomes after hypothermic oxygenated machine perfusion and transplantation of 1,202 donor livers in a real-world setting (HOPE-REAL study). J Hepatol. 2025 Jan;82(1):97-106. doi: 10.1016/j.jhep.2024.06.035. Epub 2024 Jul 3. PMID: 38969242.