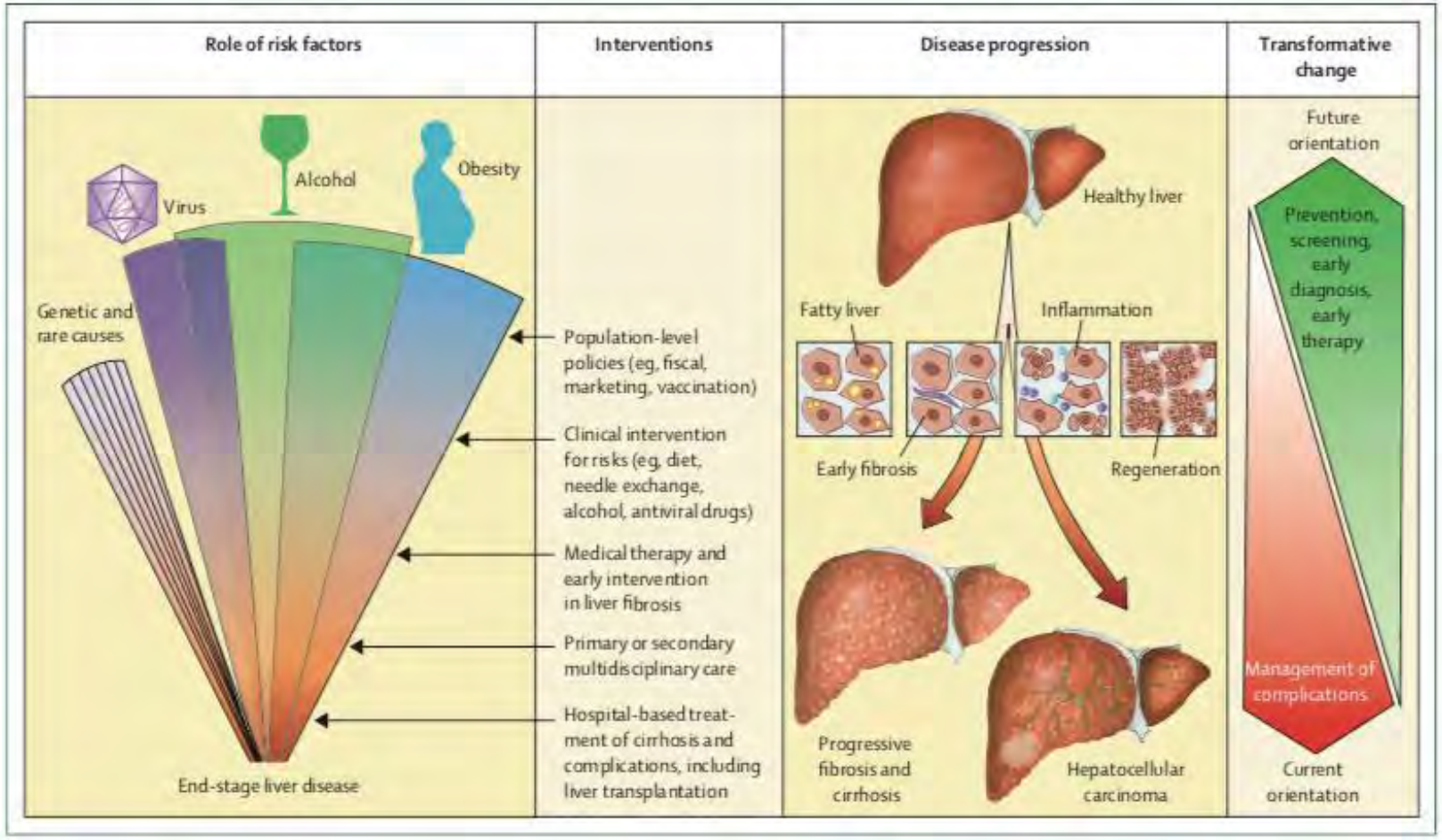
Liver transplantation in 2024

Patrizia Burra
Gastroenterology
Multivisceral Transplant Unit
Department of Surgery, Oncology and Gastroenterology
Padua University Hospital
Padua Italy

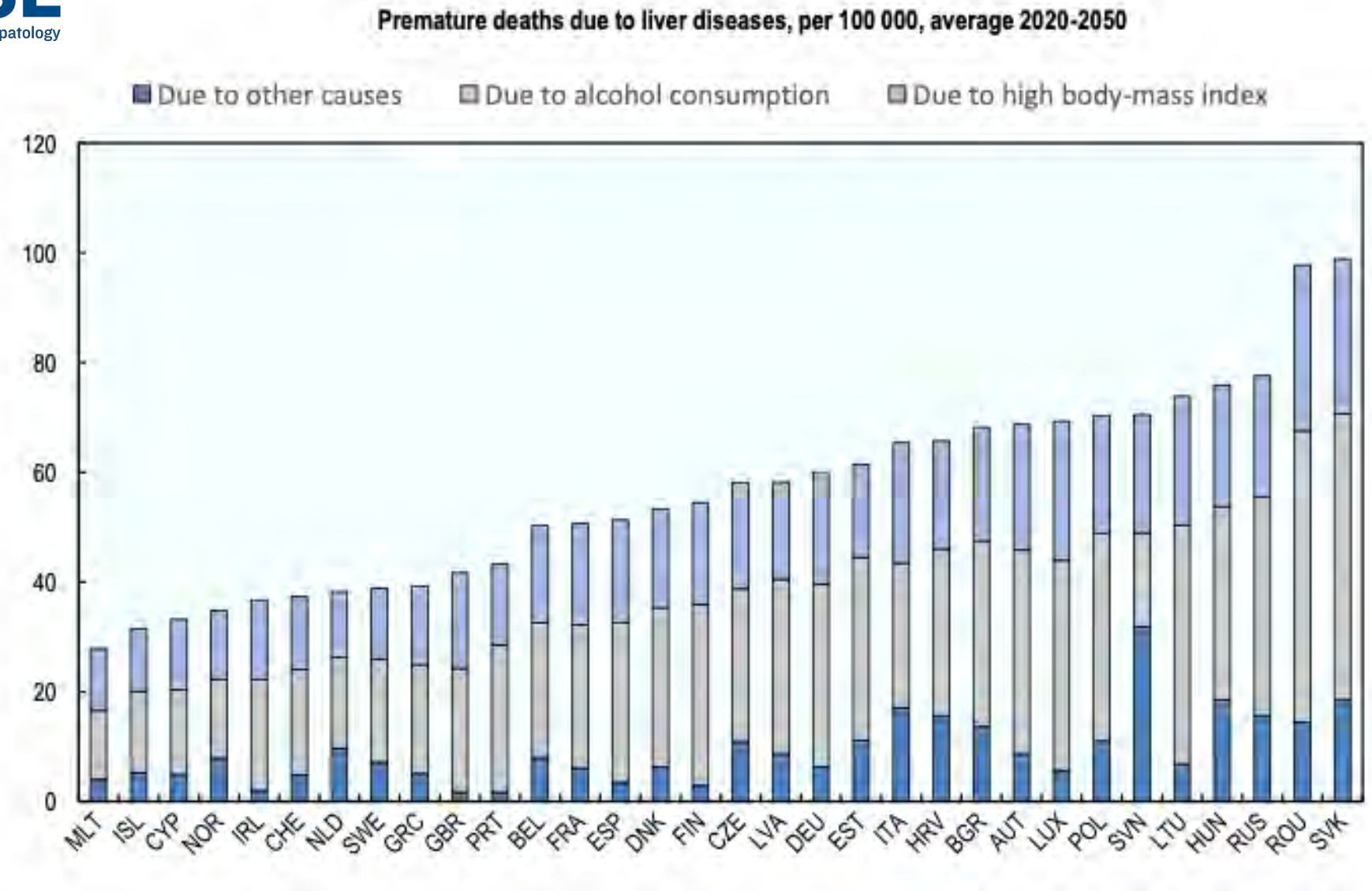
Outline

- Severe alcohol-related hepatitis
- Metabolic dysfunction-associated steatotic liver disease
- Acute-on-chronic liver failure
- Transplant oncology
- Novel approaches

Risk factors for liver disease in Europe



Karlsen, Burra, Manns – The Lancet 2021



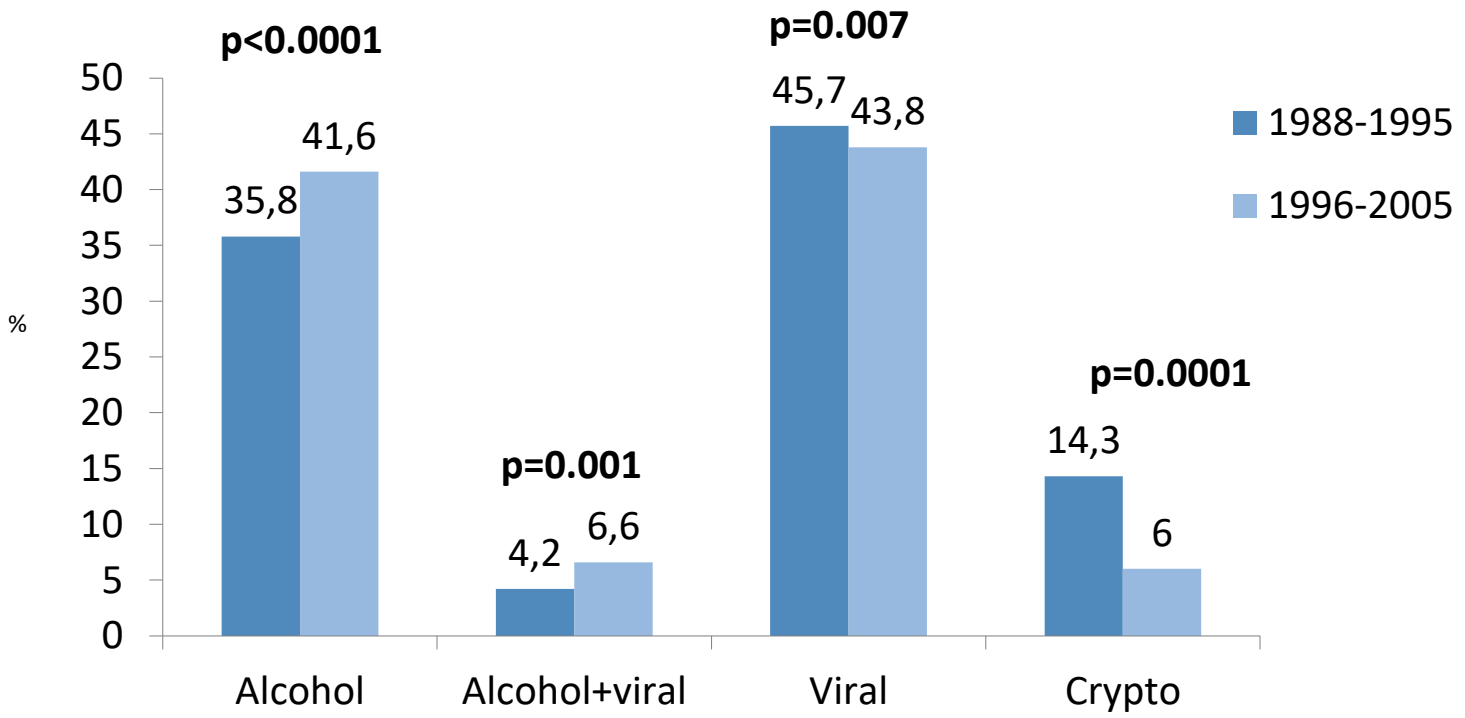
Karlsen, Burra, Manns – The Lancet 2021

American Journal of Transplantation 2010; 10: 138–148
Wiley Periodicals Inc.

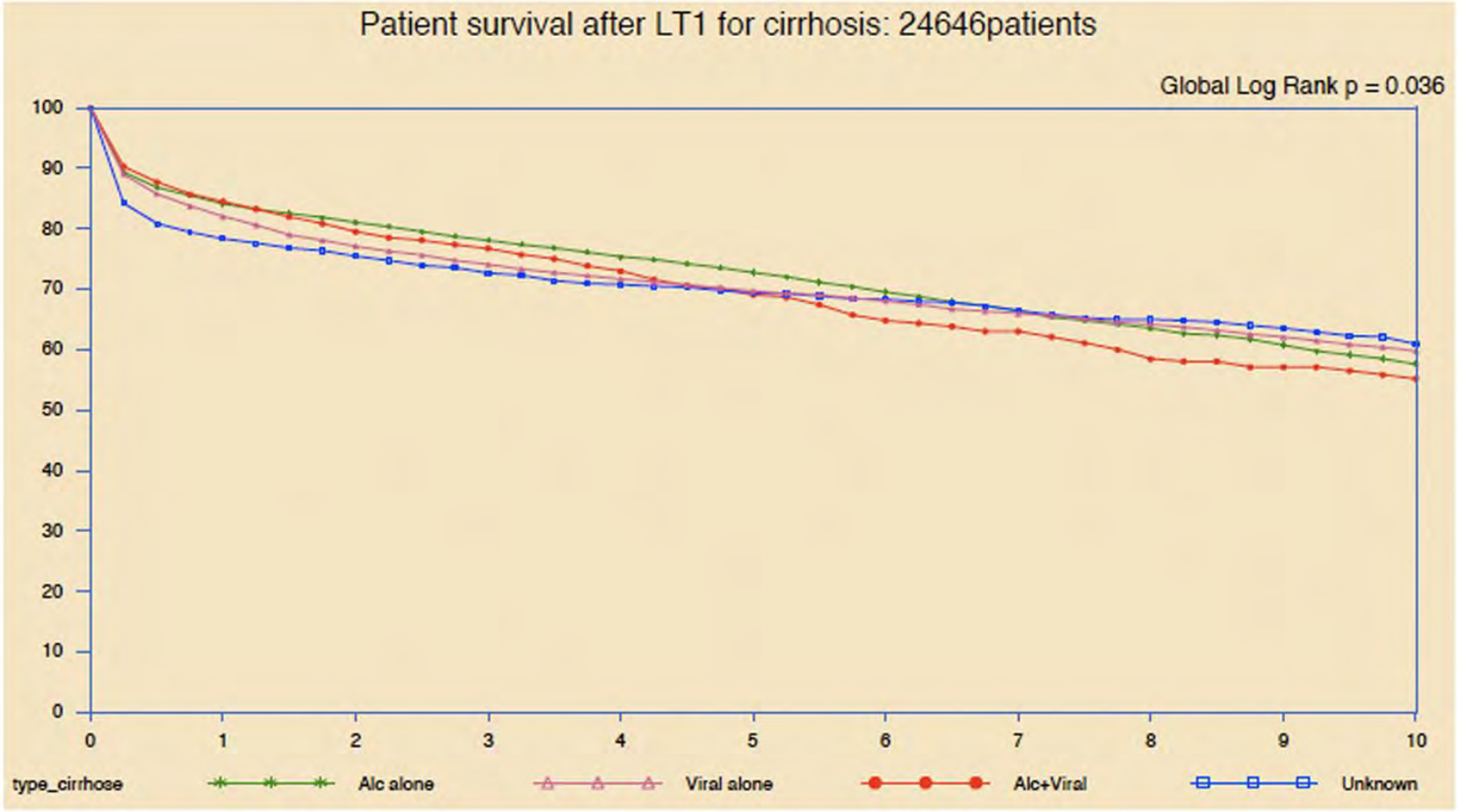
doi: 10.1111/j.1600-6143.2009.02869.x

Liver Transplantation for Alcoholic Liver Disease in Europe: A Study from the ELTR (European Liver Transplant Registry)

P. Burra[a,*], M. Senzolo[a], R. Adam[b], V. Delvart[b], V. Karam[b], G. Germani[a], J. Neuberger[c], for ELITA and of behalf of ELTR Liver Transplant Centers[d]



Patient survival after liver transplantation according to liver disease in Europe (ELTR-ELITA data)



Burra P. Am J Transpl 2010

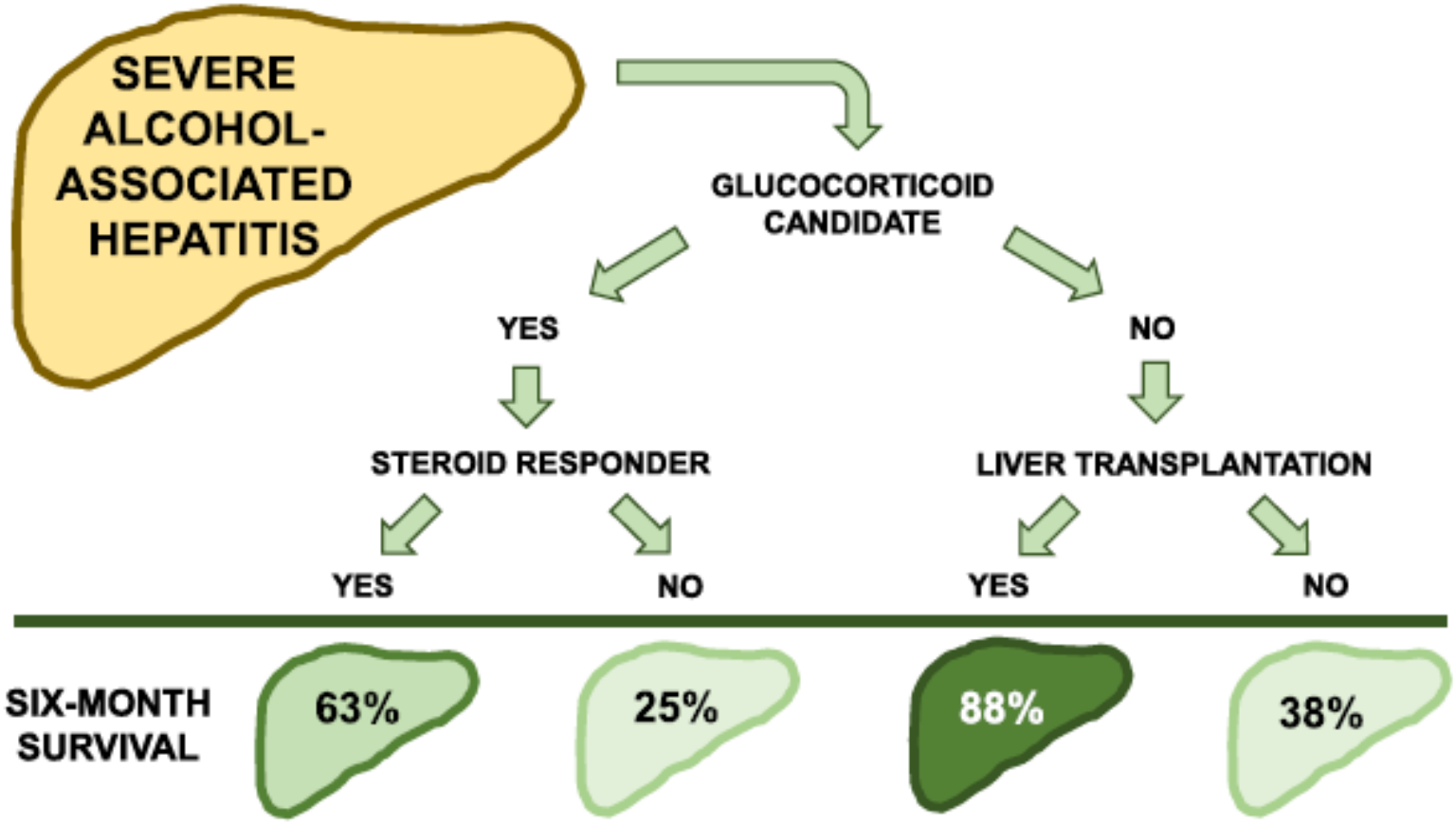
Medical management of severe alcohol-related hepatitis

Minimal progress has been made in the medical management of these patients.

Abstinence, nutrition, prevention/treatment of infections and corticosteroids remaining the mainstay of therapy since the 1970s.

Ramirez-Cadiz et al. *Alimentary Pharmacology & Therapeutics 2024*

Differential 6-month survival in severe alcohol-related hepatitis



Horwich, Clinical Liver Disease 2023

Selecting the patient for early-liver transplantation

- Stringent patient selection criteria:
  - Maddrey's discriminant function of at least 32
  - Steroid non-response, according to the Lille score of 0.45 or more at day 7 or a continuous increase in the MELD score patient's first decompensating event
  - Presence of close, supporting family members
  - Absence of psychiatric disorders
  - Agreement of the patient to adhere to lifelong abstinence from alcohol use

Mathurin et al. N Engl J Med. 2011

The 2022 QuickTrans:
Scoring algorithm to select candidates for early liver transplantation

It contains:

- somatic criteria (severe comorbidities and prior liver decompensation)

- global evaluation by addiction specialists (assessment of psychiatric disease, family support)

- evaluation by the liver team (patient motivation, medical adherence, insight, support system, alcohol problems in relatives, questions asked by relatives)

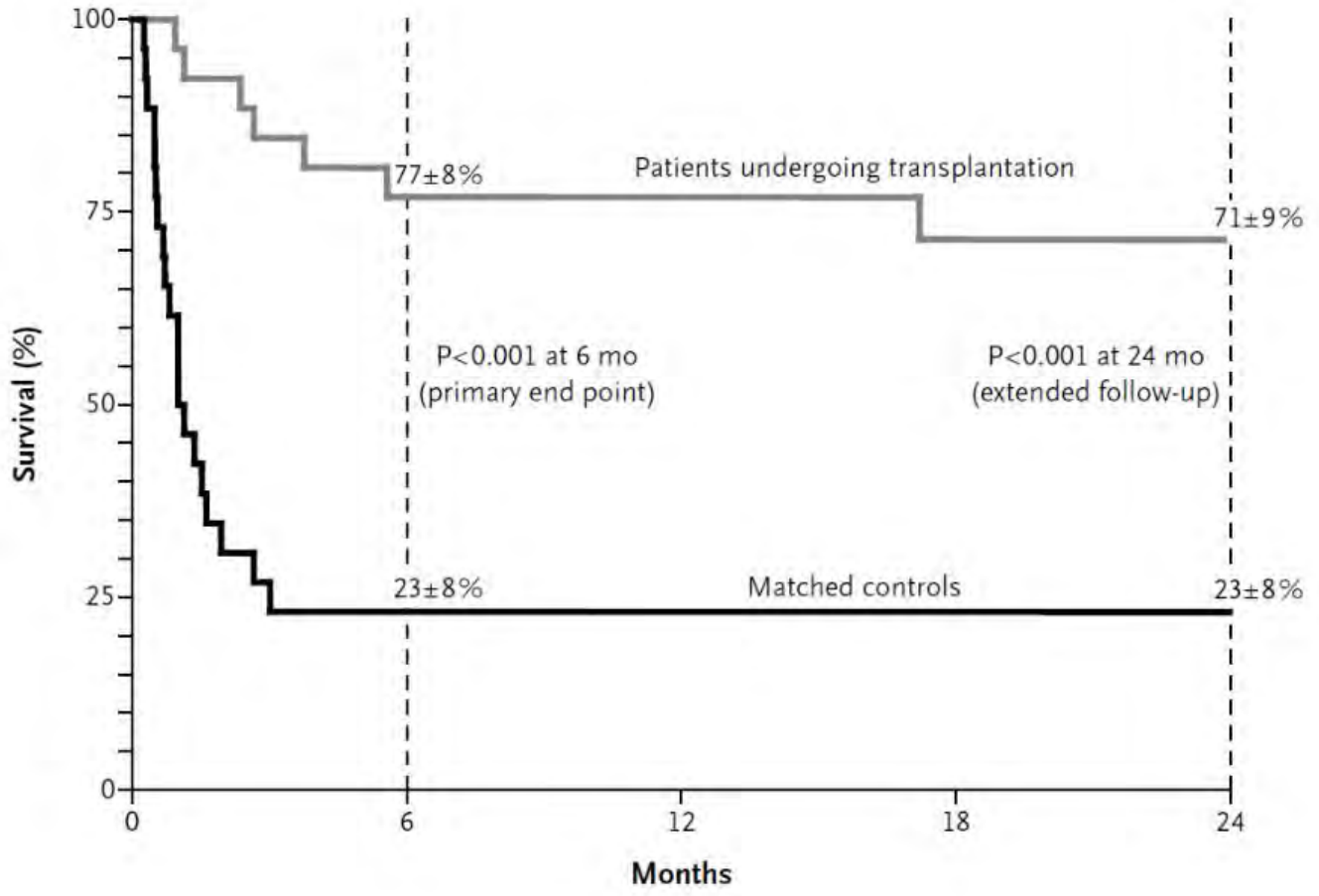
- subjective evaluation of the adaptability of the candidate

Scores range from 0–250

Patients receiving scores between 220–250 eligible for early liver transplantation

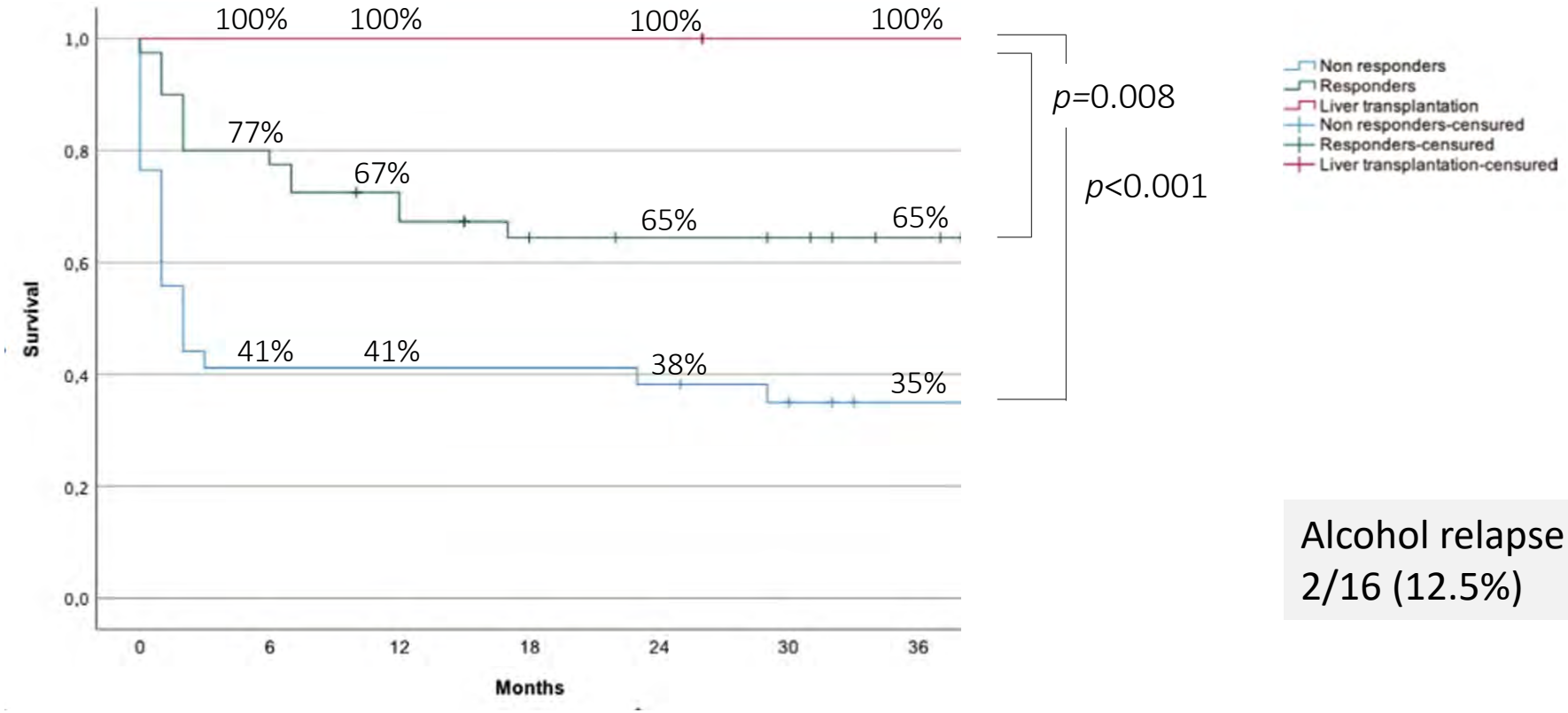
Louvet et al. Lancet Gastroenterol Hepatol. 2022

Early Liver Transplantation for Severe Alcohol-related Hepatitis



Mathurin P, et al. N Engl J Med 2011;365:1790

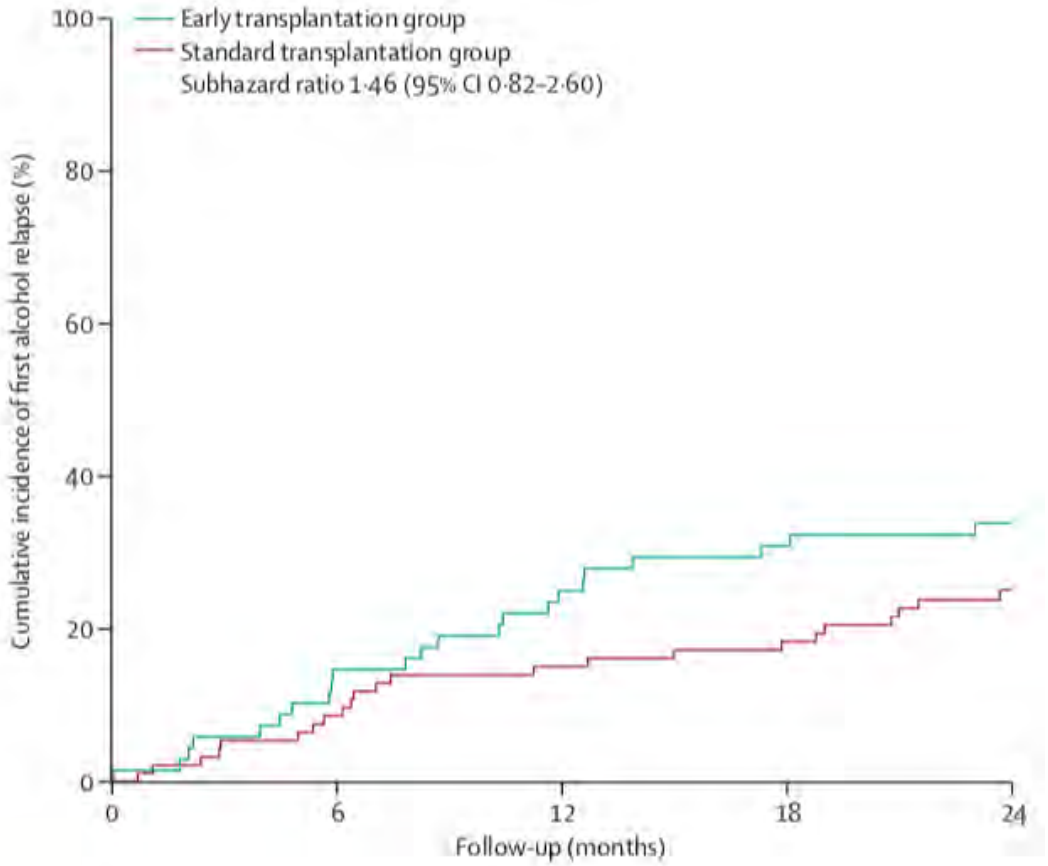
93 referred patients, with severe alcohol-related hepatitis, 16 transplanted: estimates of survival among the transplanted vs non transplanted according to the response to medical therapy



Alcohol relapse rate 2/16 (12.5%)

Germani G, et al. *Am J Transpl* 2022;22:1191

2-year cumulative incidence of first alcohol relapse after liver transplantation in the early transplantation (LT) group and standard transplantation group



Alcohol relapse rate:

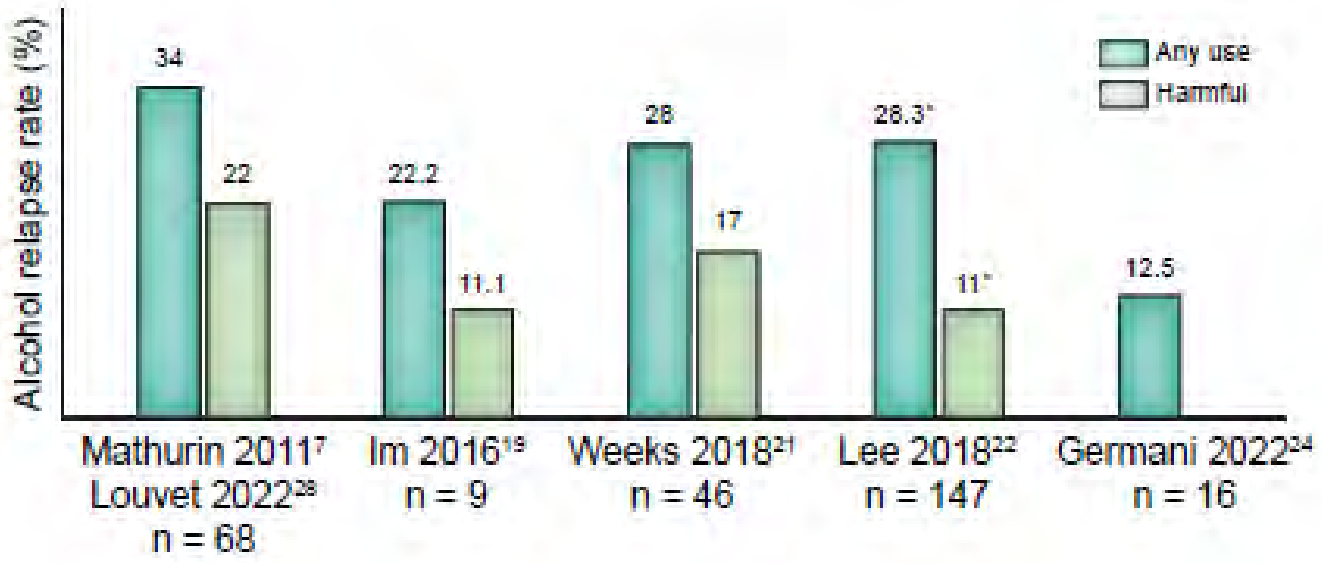
Early LT: 23/68 (34%) patients

Standard LT: 23/93 (25%) patients

Absolute difference of 9.1% (95% CI –∞ to 21)

Louvet A, et al. *Lancet Gastroenterol Hepatol* 2022;7:416

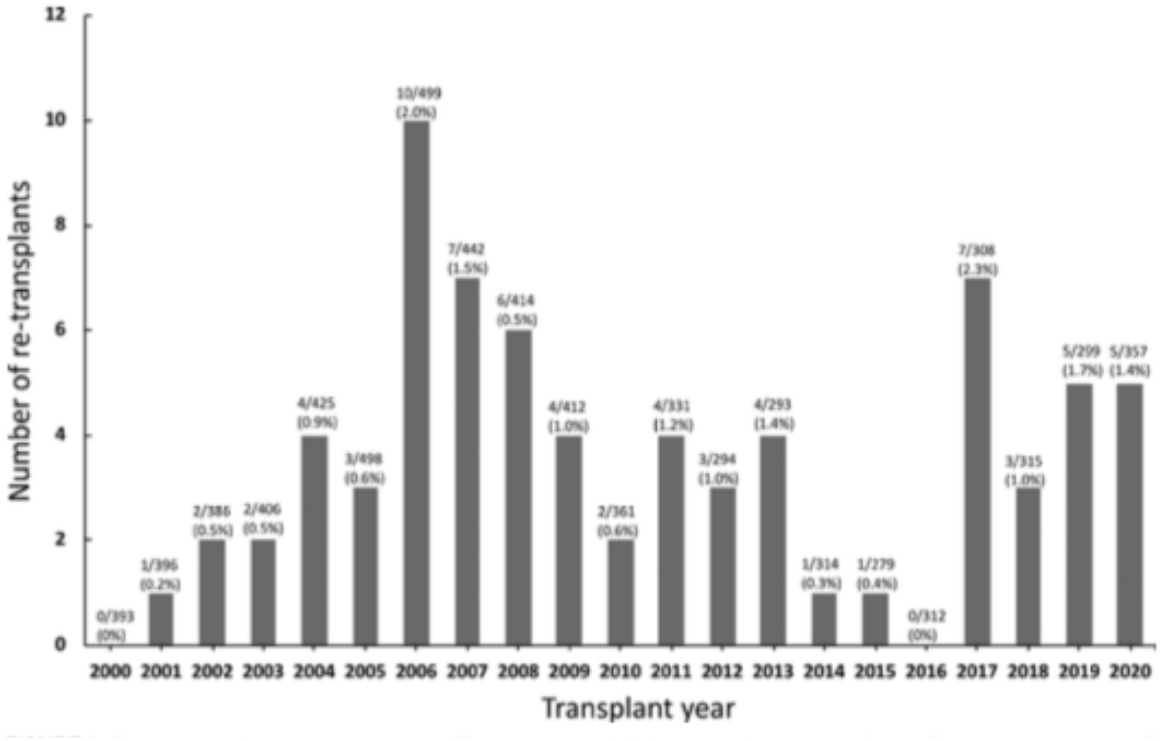
Rates of return to alcohol use in studies on early liver transplantation for severe alcohol-related hepatitis



Germani G, Mathurin P, Lucey MR, Trotter J, Journal of Hepatology 2023

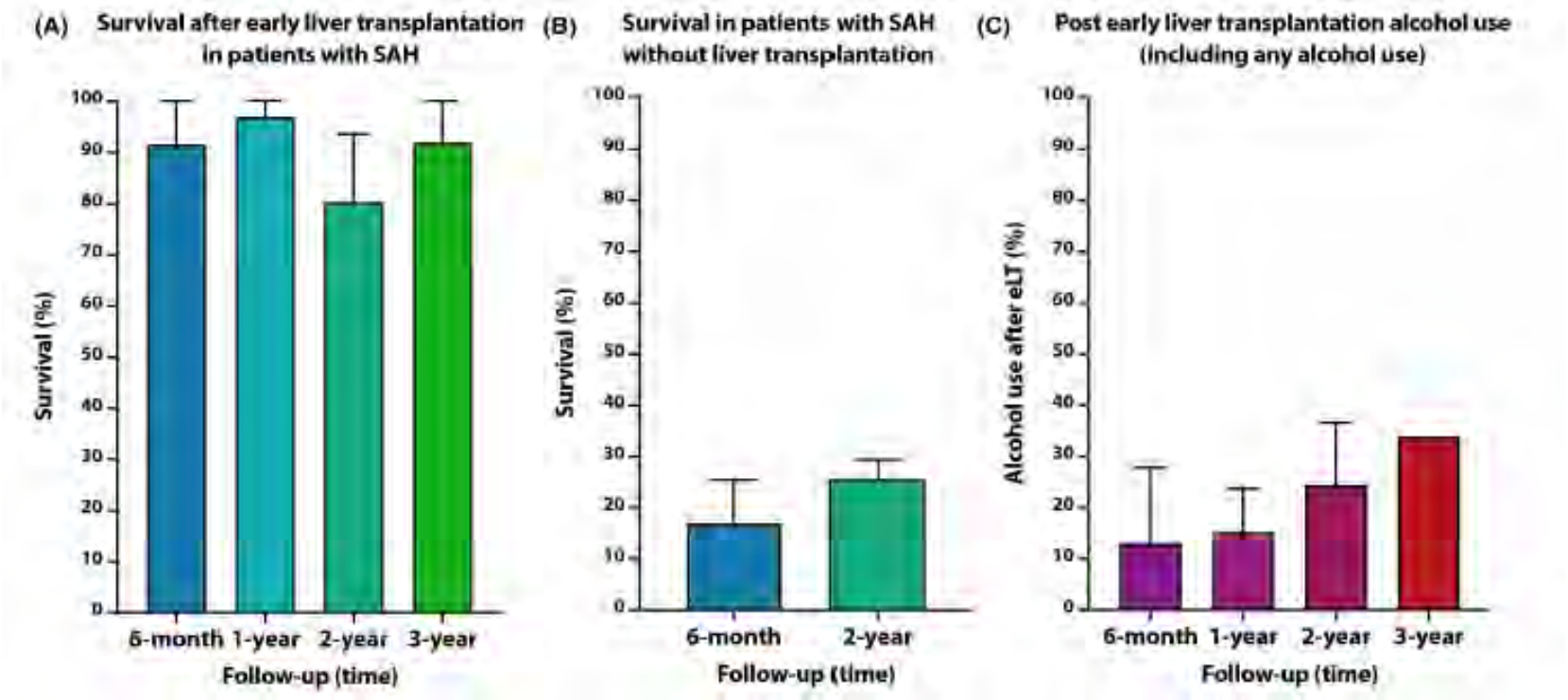
The Practice of Retransplantation for Recurrent Alcohol-associated Liver Disease (ALD) in the United States Is Uncommon With Acceptable Outcomes

- US national transplant registry (2000-2020)
- 74 retransplantation (1.0% of all retransplants) for recurrent ALD
- Patient survival was similar between patients who underwent retransplantation for ALD and non-ALD (63% versus 59% 5-y, *P*=0.58)
- The practice is uncommon in the US



Cotter Transplantation Direct 2022

Early liver transplantation for severe alcohol-related hepatitis: excellent outcomes



Ramirez-Cadiz et al. *Alimentary Pharmacology & Therapeutics 2024*

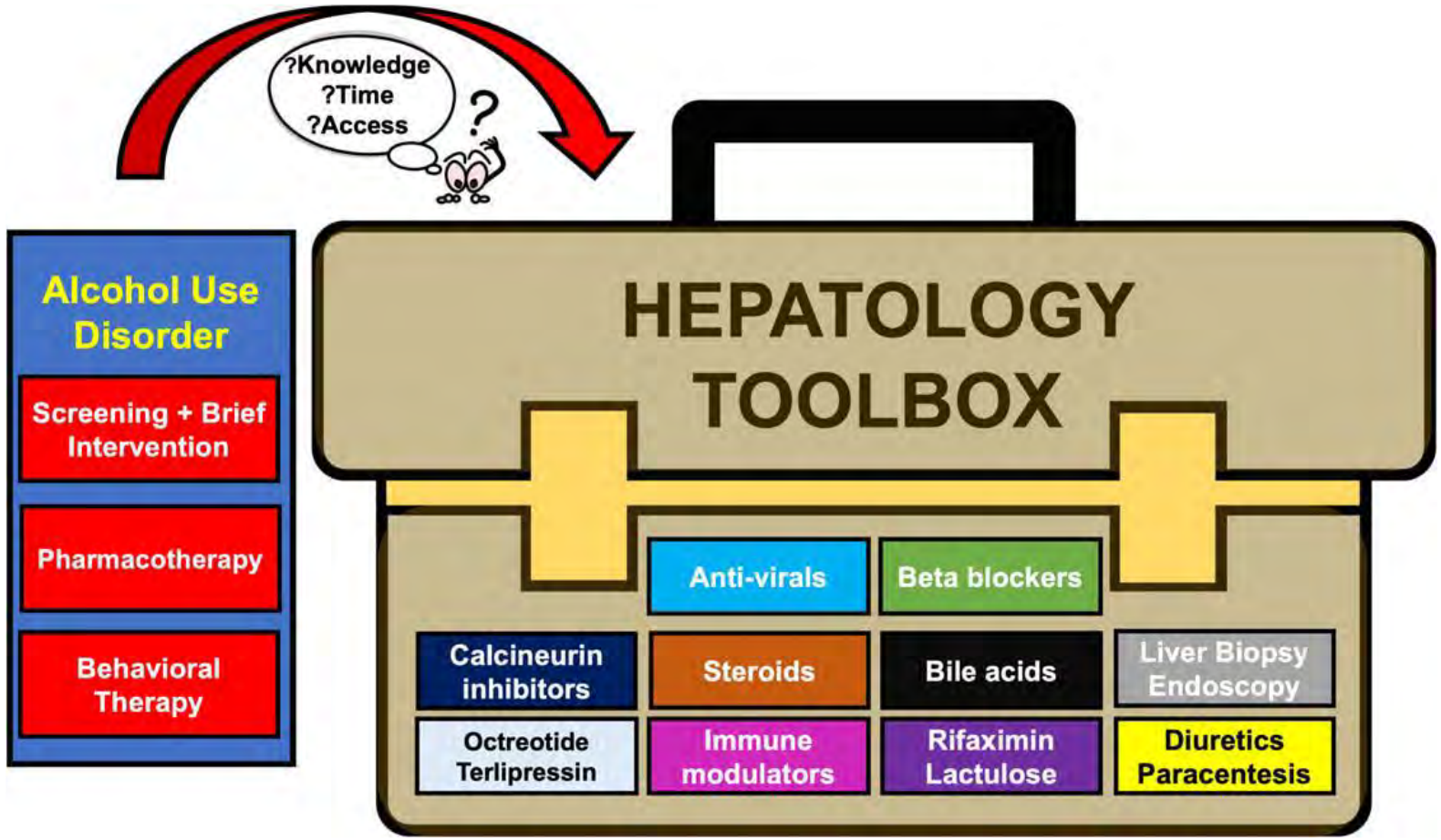
General population measured attitudes towards early liver transplantation for severe alcohol-related hepatitis

- Online survey in the U.S.
- 503 respondents
- 81.5% were at least neutral towards early transplantation for these patients
- Public opinion may not be as large of a barrier as originally thought

Stroh et al. Am J Transplant. 2015

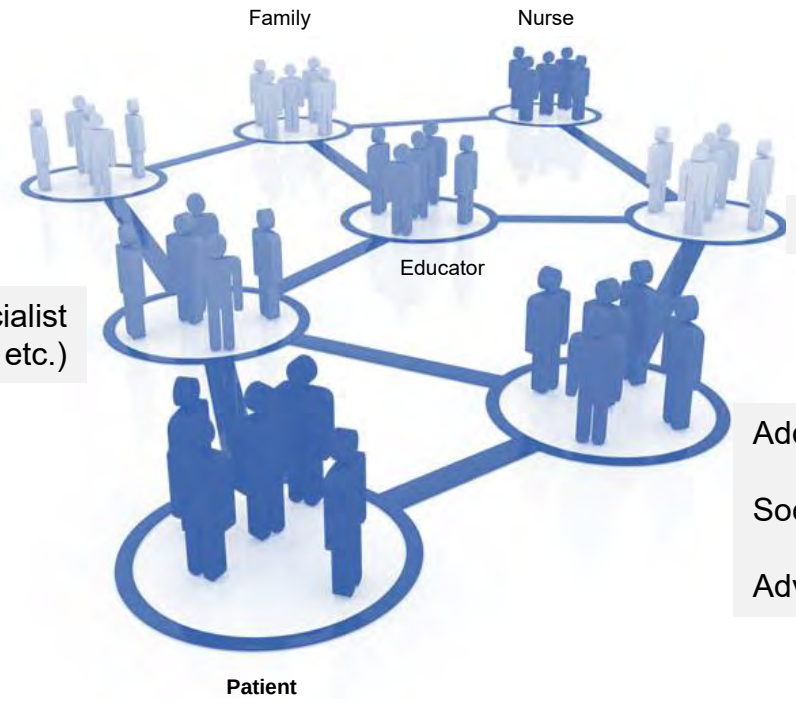
The hepatology toolbox—how do we include alcohol use disorder treatment?

When it comes to the management of alcohol use disorder in the setting of alcohol-associated liver disease, Hepatology seems to have made an exception.



Sedarous M, Flemming JA. Clinical Liver Disease 2023

Multidisciplinary and integrated approach before and after liver transplantation for alcohol-related liver disease



Psychologist / Psychiatrist

Transplant specialist (hepatologist, surgeon, anesthesist, etc.)

Addiction specialist

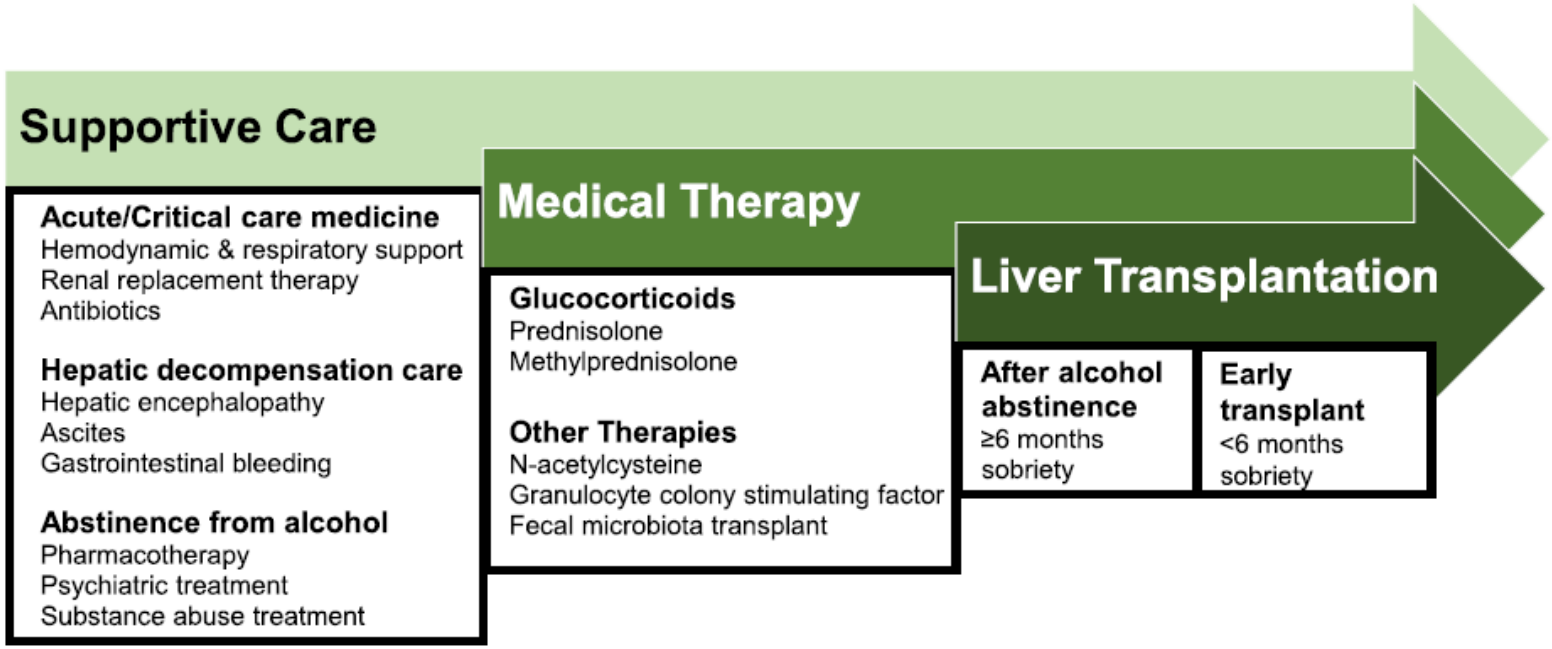
Social worker

Advanced practice providers

Shroff H. and Gallegher H. Clinical Therapeutics 2023

Germani G, Degré D, Moreno C, Burra P. UEGJ 2024

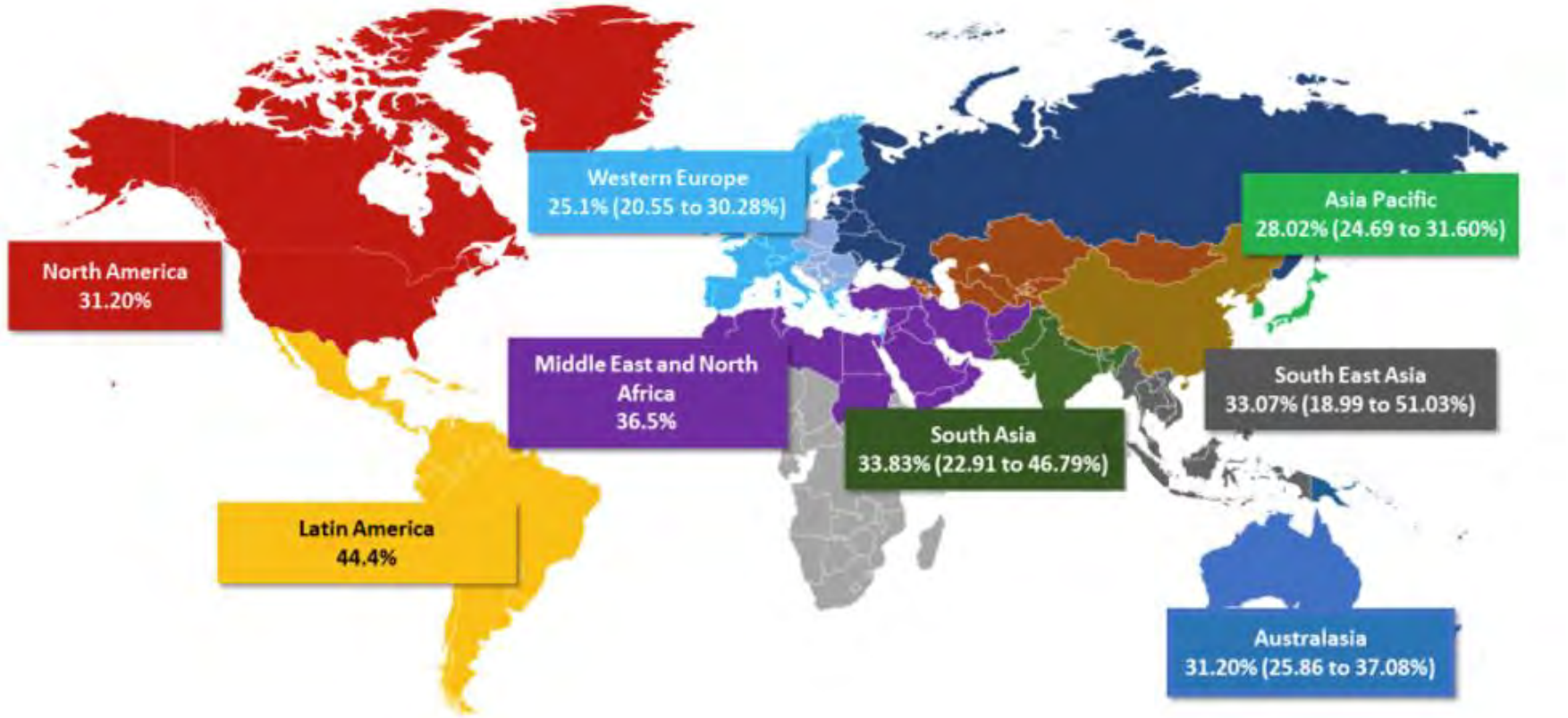
Shifting paradigm in management of alcohol-related hepatitis



Horwich, Clinical Liver Disease 2023

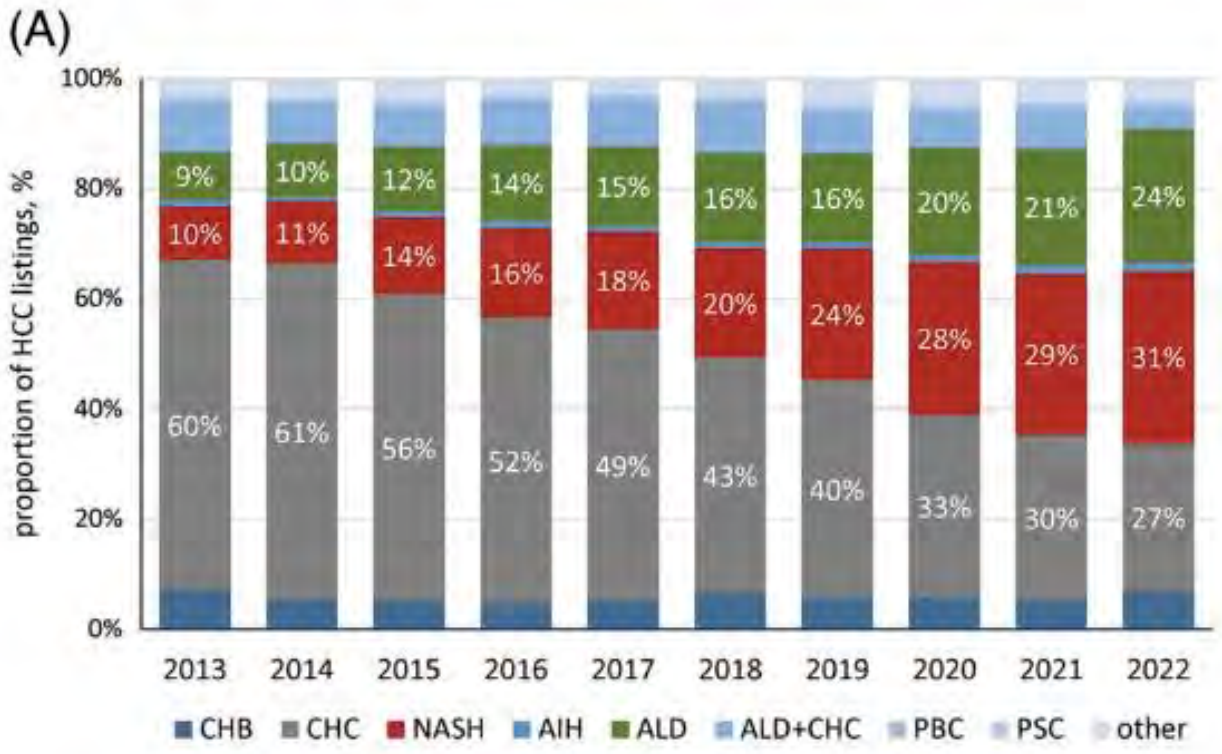
Global pooled prevalence of MASLD: 30.5%

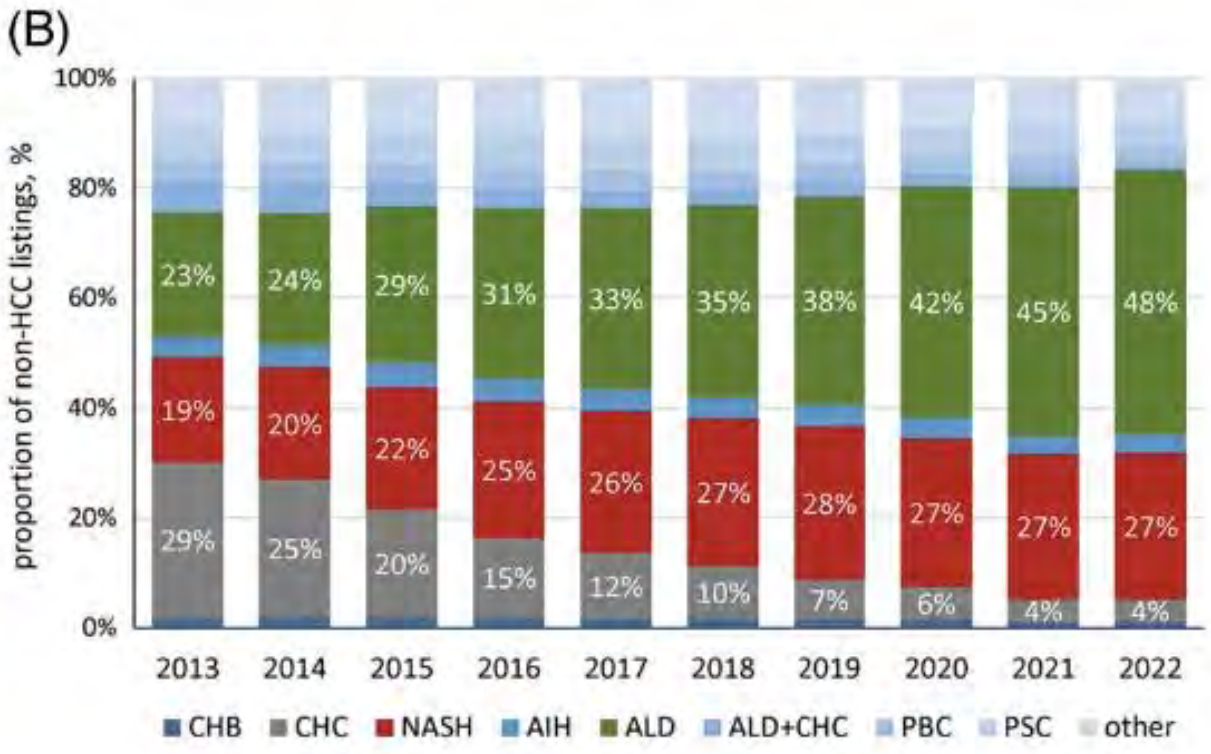
Allen, Lazarus and Younossi J Hepatol 2023



The name chosen to replace NAFLD is metabolic dysfunction-associated steatotic liver disease (MASLD)
J Hepatol 2023

The changing epidemiology of adult liver transplantation in the United States in 2013-2022
The dominance of metabolic dysfunction–associated steatotic liver disease and alcohol- associated liver disease (at listing)





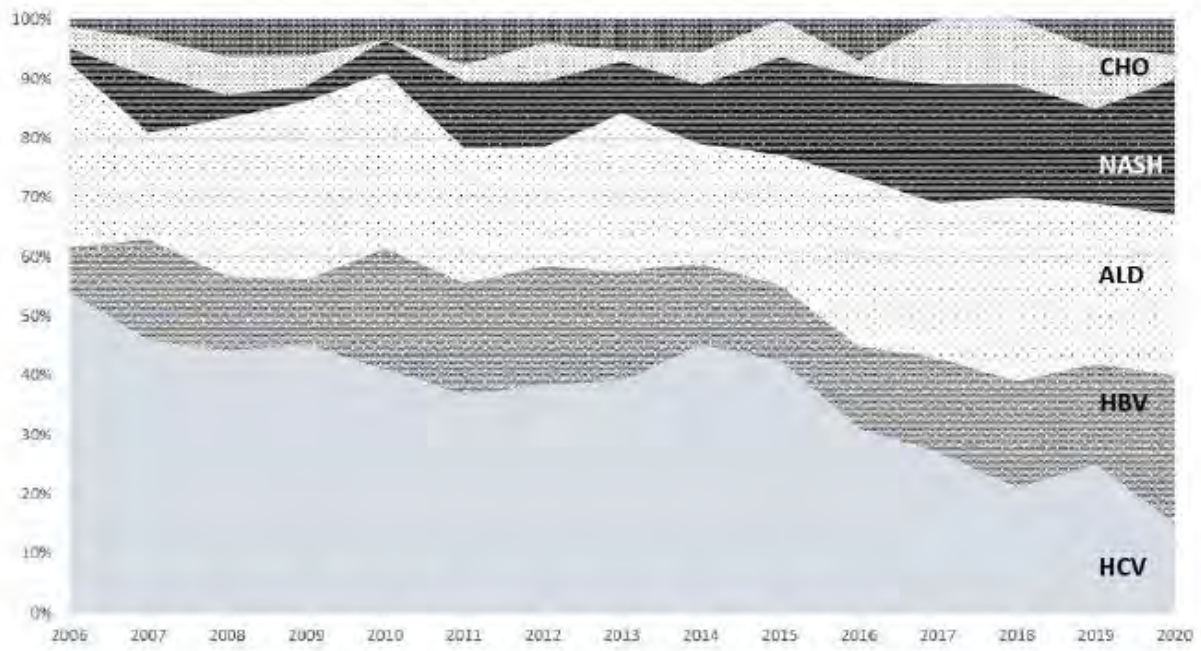
(A) Proportion of HCC
HCV 60% (2013) to 27% (2022)
MASH 10% (2013) to 31% (2022)
ALD 9% (2013) to 24% (2022)

(B) Proportion of non-HCC

Younossi Hepatology Communications 2024

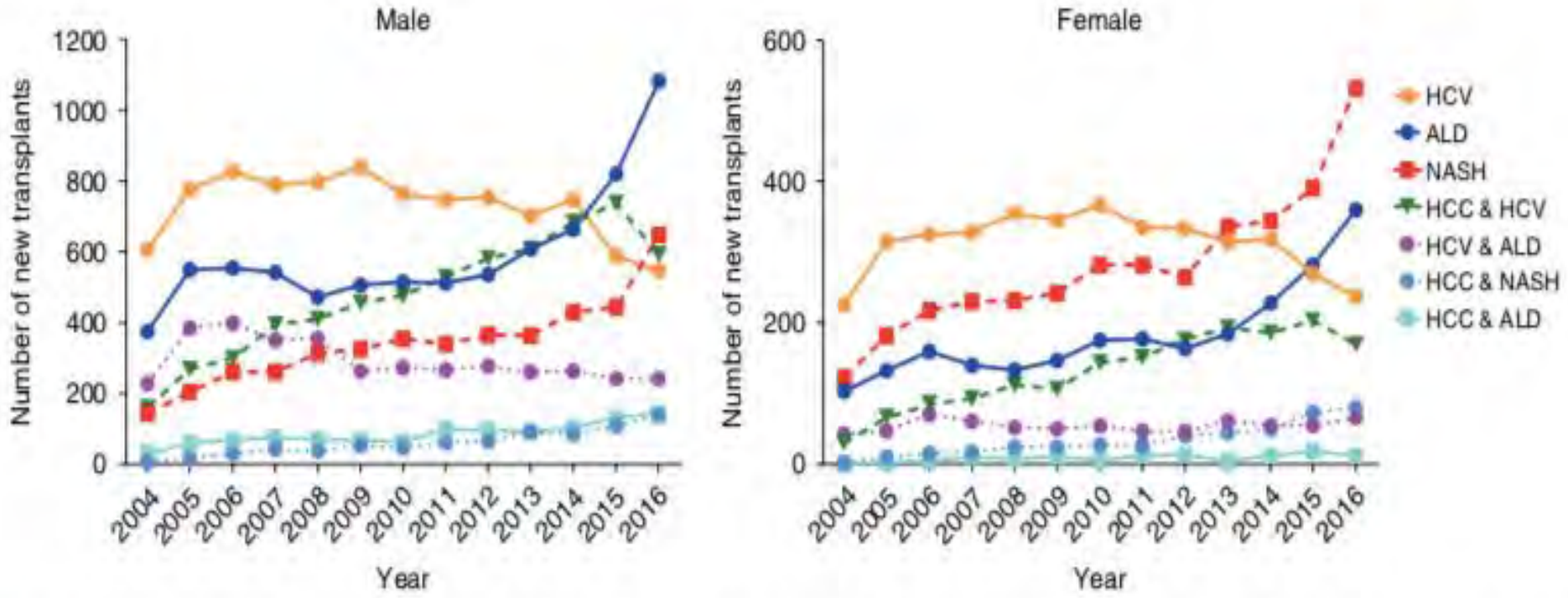
How the Waiting List Is Changing for Liver Transplantation: A Single Center Experience from Italy

- NASH patients accounted for **12%** of 1491 registrations (January 2006-June 2020).
- An increasing trend over time from **2.5% in 2006 to 23% in 2020** was seen.
- This trend was confirmed both for patients with decompensated cirrhosis - from **1.8% to 18%** - and HCC - from **4% to 30%.**



Ferrarese Medicina 2022

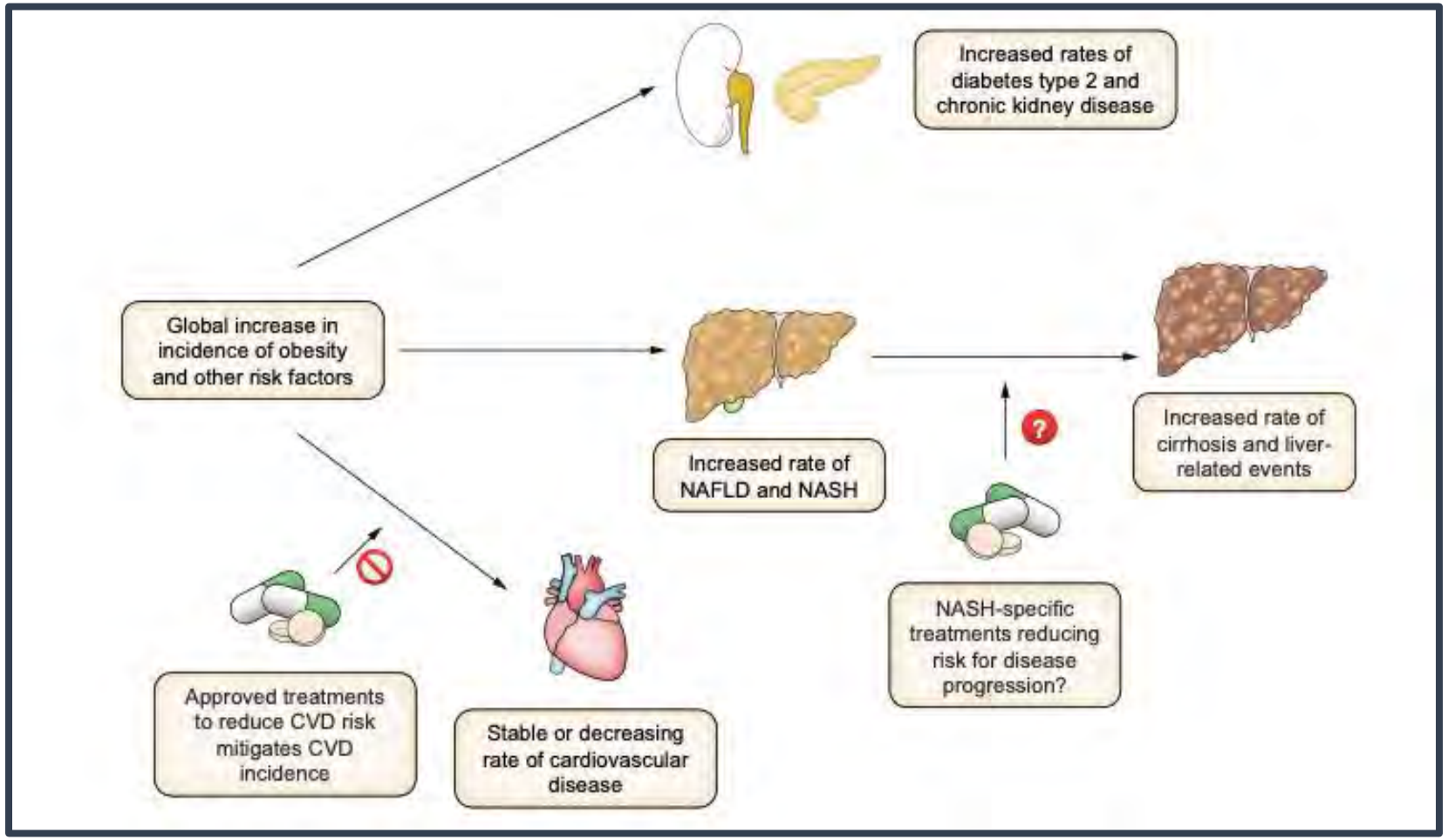
MASH leading cause of liver transplantation in U.S.



Number of liver transplants by indication and gender. Left side shows number of liver transplants by disease category in males while the right side shows this number in females. HCV hepatitis C virus, ALD alcoholic liver disease, NASH nonalcoholic steatohepatitis, HCC hepatocellular carcinoma

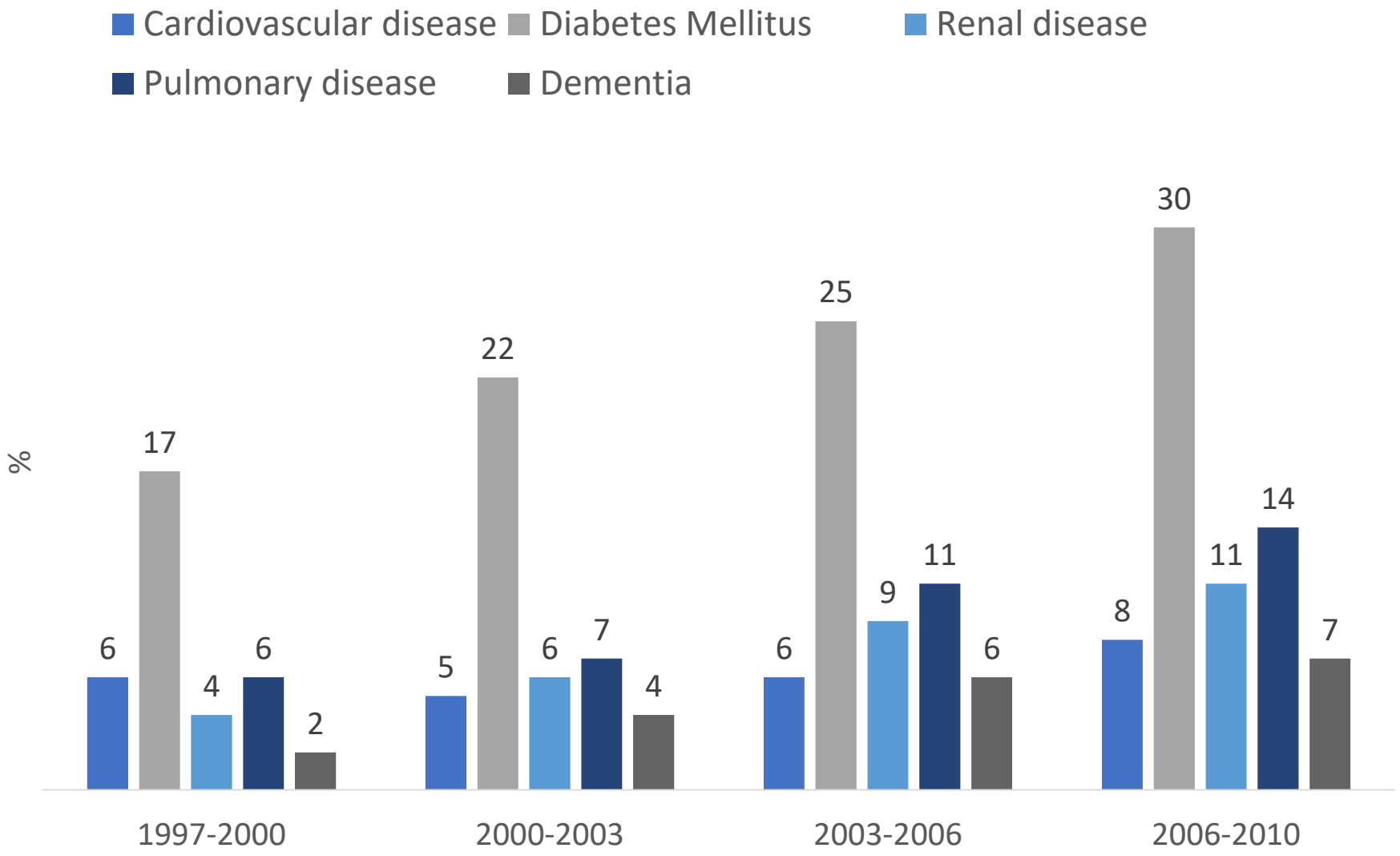
Mazen Noureddin AJG 2018

Implications of an increase in the prevalence of MASLD on clinical outcomes



Wong, Ekstedt, Grace, Wong, Hagström J Hepatol 2023

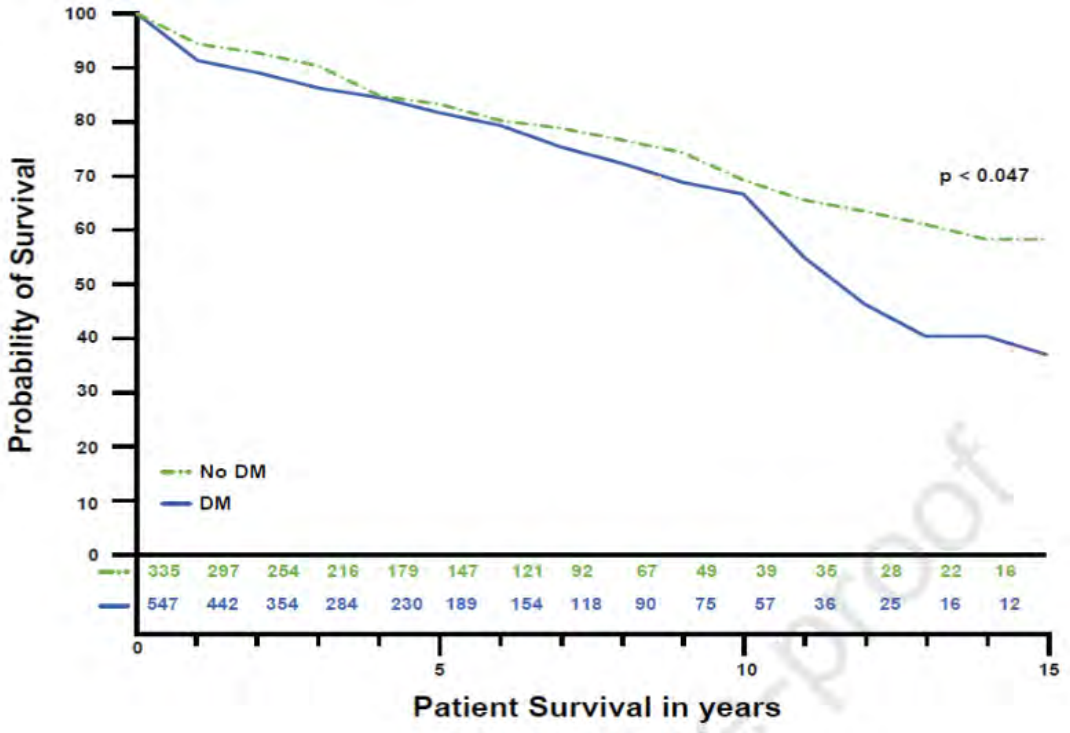
Prevalence individual comorbidity in liver transplant patients by era of transplantation



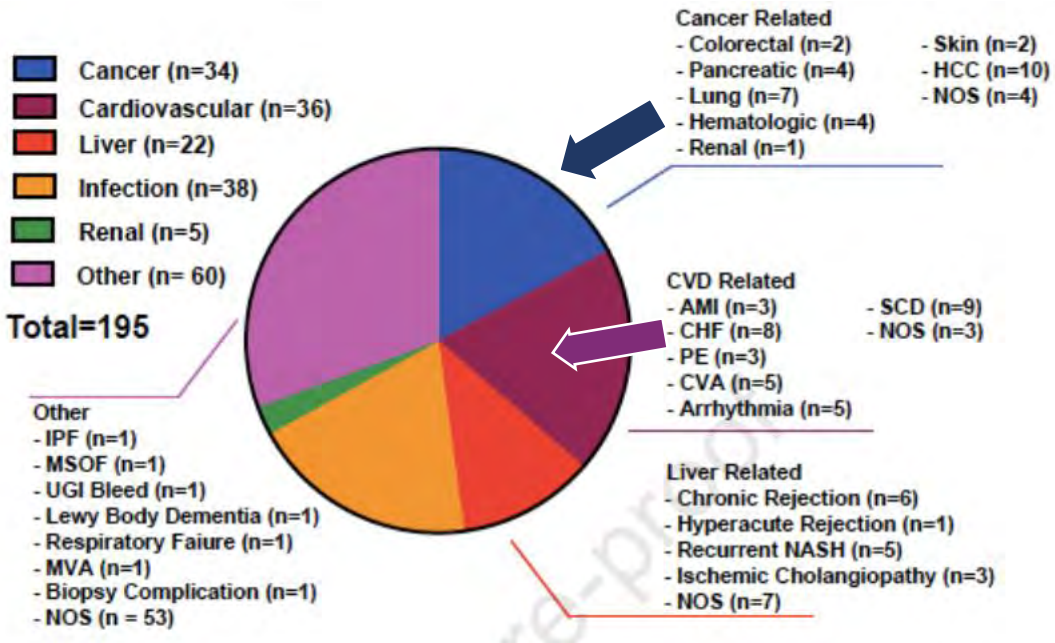
Tovikkai BMJ Open 2015

Survival in patients transplanted for NASH cirrhosis (U.S. 1997-2017)

By diabetes (DM) status before transplantation

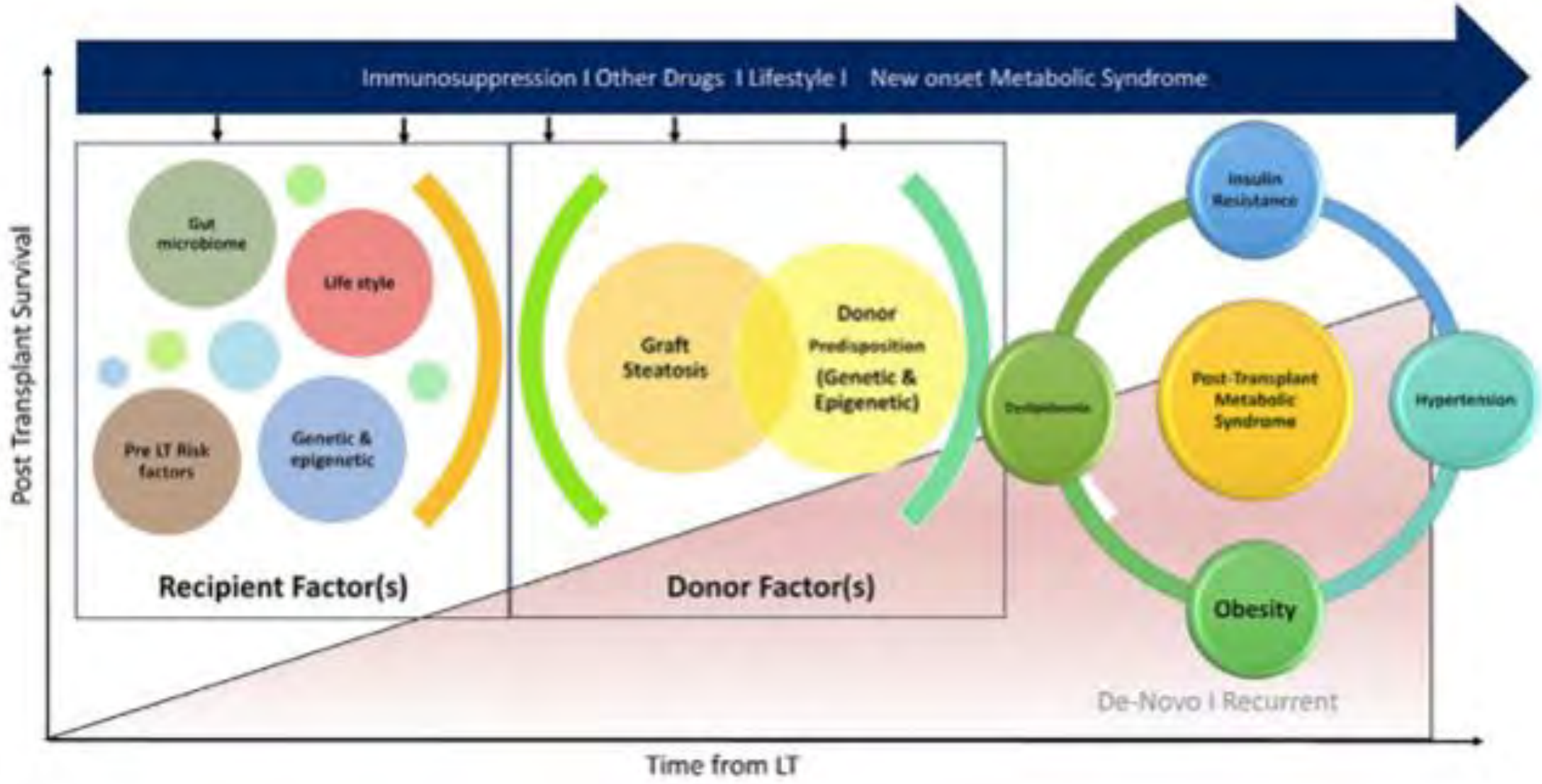


Causes of death after transplantation



Rinella Clin Gastroenterol Hepatol 2022

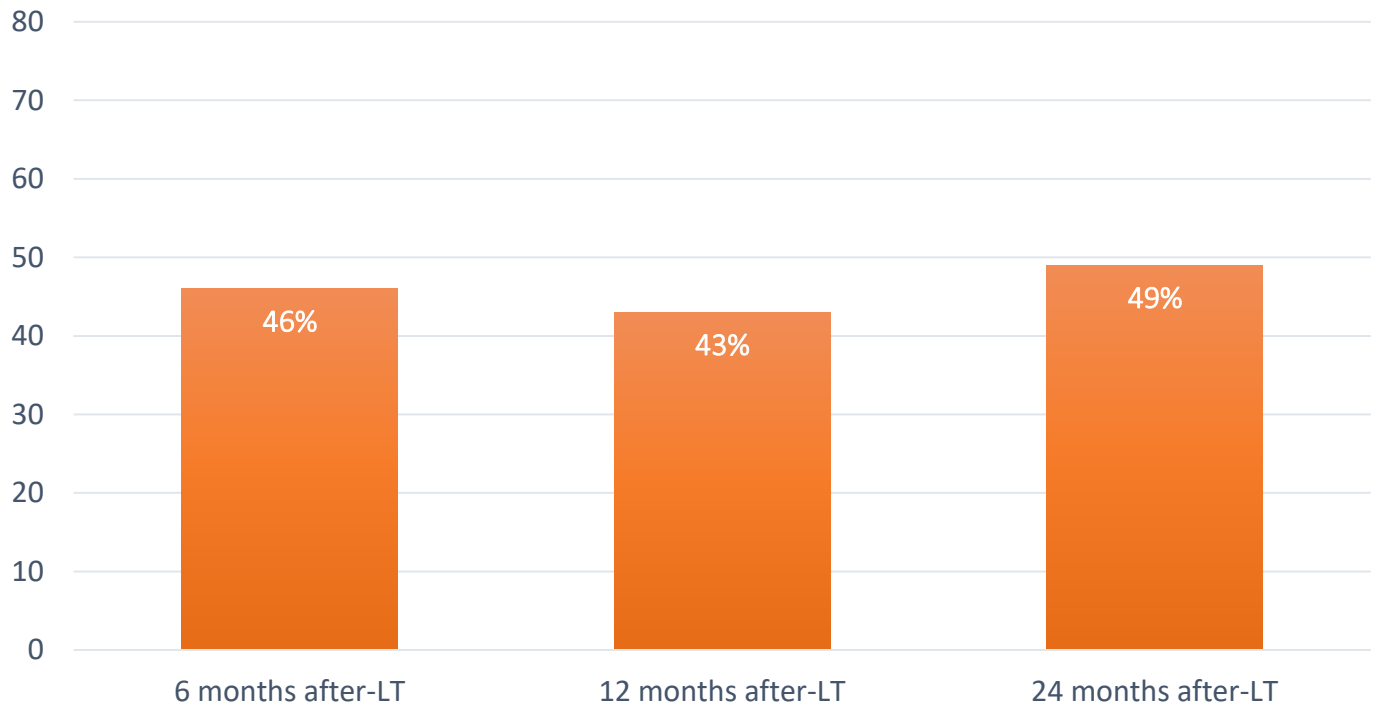
Risk factors of Post-Transplant Metabolic Syndrome: pre transplant elements of both donors and recipient as well as post-transplant components of recipients



Ashok Choudhury JOURNAL OF CLINICAL AND EXPERIMENTAL HEPATOLOGY 2024

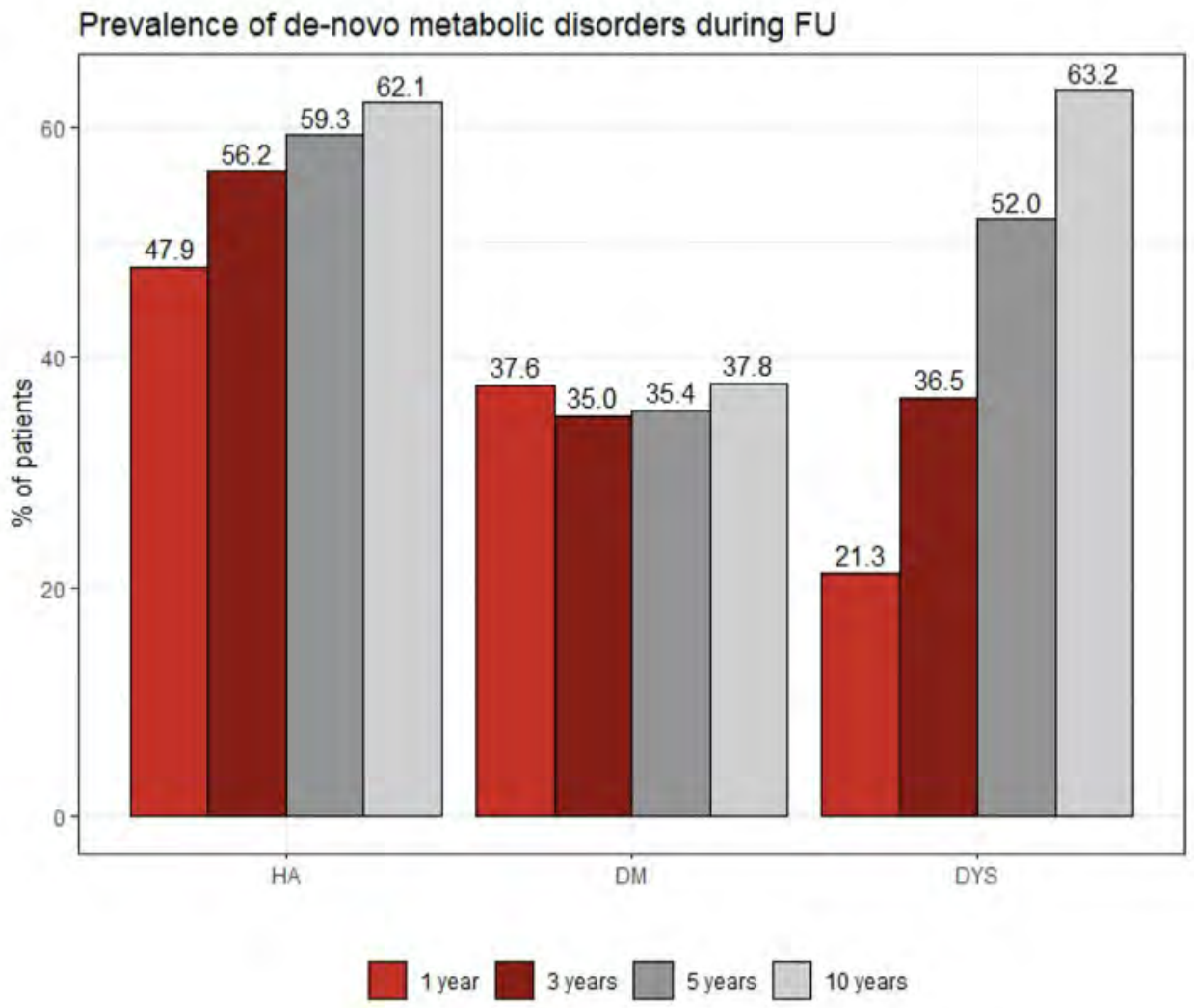
A prospective longitudinal assessment of *de novo* metabolic syndrome after liver transplantation

63 liver transplanted patients (2013-2017)
with 24-month complete follow-up at Multivisceral Transplant Unit Padua Italy



Becchetti, Burra, Germani Clin Transpl 2022

MASH Continues as a Significant Burden on Metabolic Health of Liver Recipients



Kinga Czarnecka Transplantation Proceedings 2024

Immunosuppressive drugs and metabolic syndrome

DRUG	HTA	DIABETES	LIPIDS	OBESITY	METABOLIC SYNDROME
Tacrolimus					
Cyclosporine					
Corticosteroids					
Everolimus					
MMF					
Anti-IL2-R					

No/marginal influence Moderate influence Strong influence

Adapted from Charlton Transplantation 2018

A prospective longitudinal assessment of *de novo* metabolic syndrome after liver transplantation: risk factors of diabetes

DM II after-LT	Multivariate analysis		
	HR	95% CI	p value
Age, years	1.02	0.96-1.09	0.51
IFG pre-LT	1.02	1.01-1.03	0.001
DM II pre-LT	2.56	0.97-6.76	0.06
MMF	0.18	0.04-0.87	0.03

Becchetti, Burra, Germani Clin Transpl 2022

IFG: impaired fasting glucose
MMF: Mycophenolate mofetil

Life style intervention

Higher than 10%, 0-5-1kg/week (IA)

Weight loss

Mediterranean diet, no fructose (IIaB)

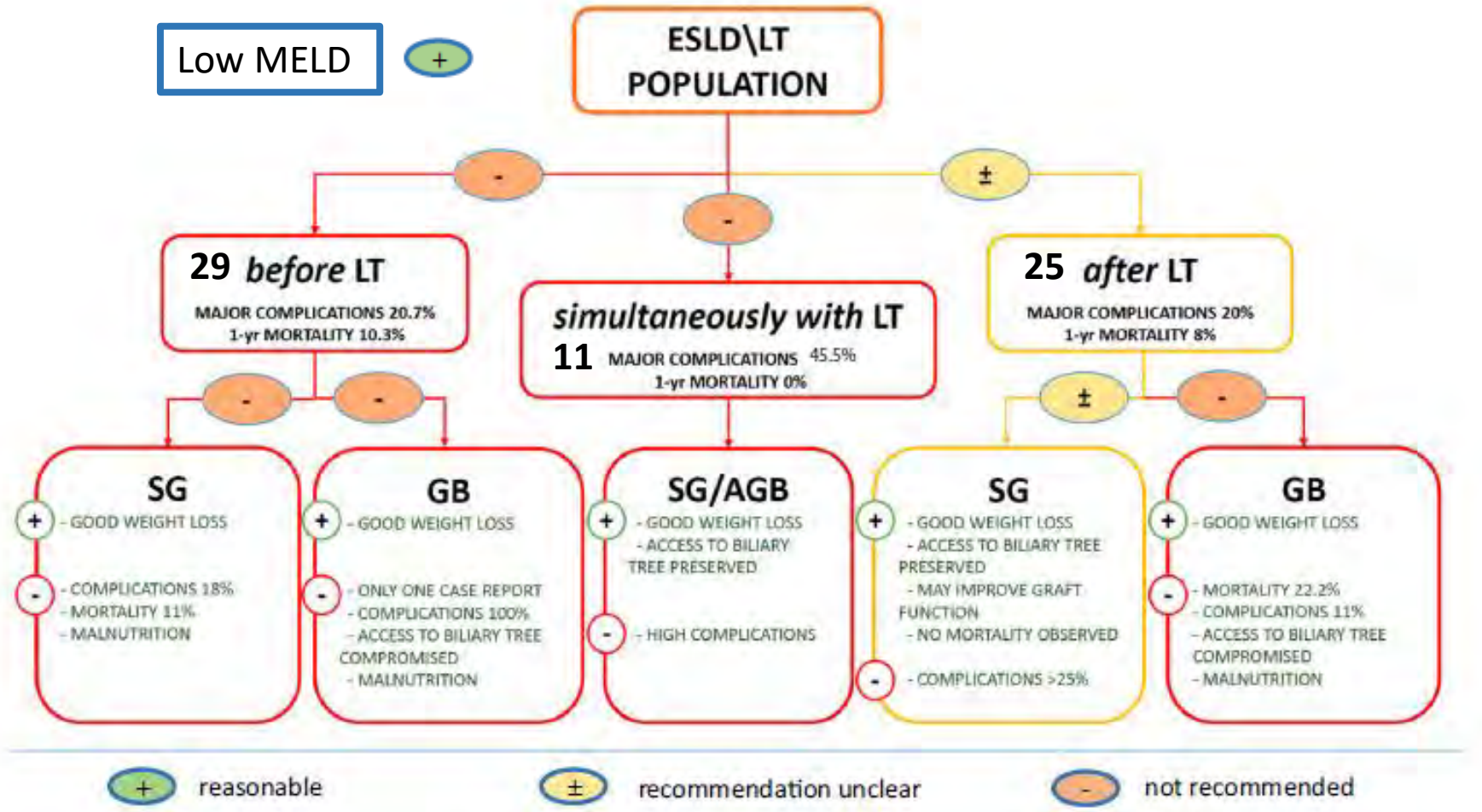
Dietary changes

Physical exercise

30 min/5 days a week (IB)

Cognitive-behaviour therapy

Bariatric surgery in patients with severe morbid obesity

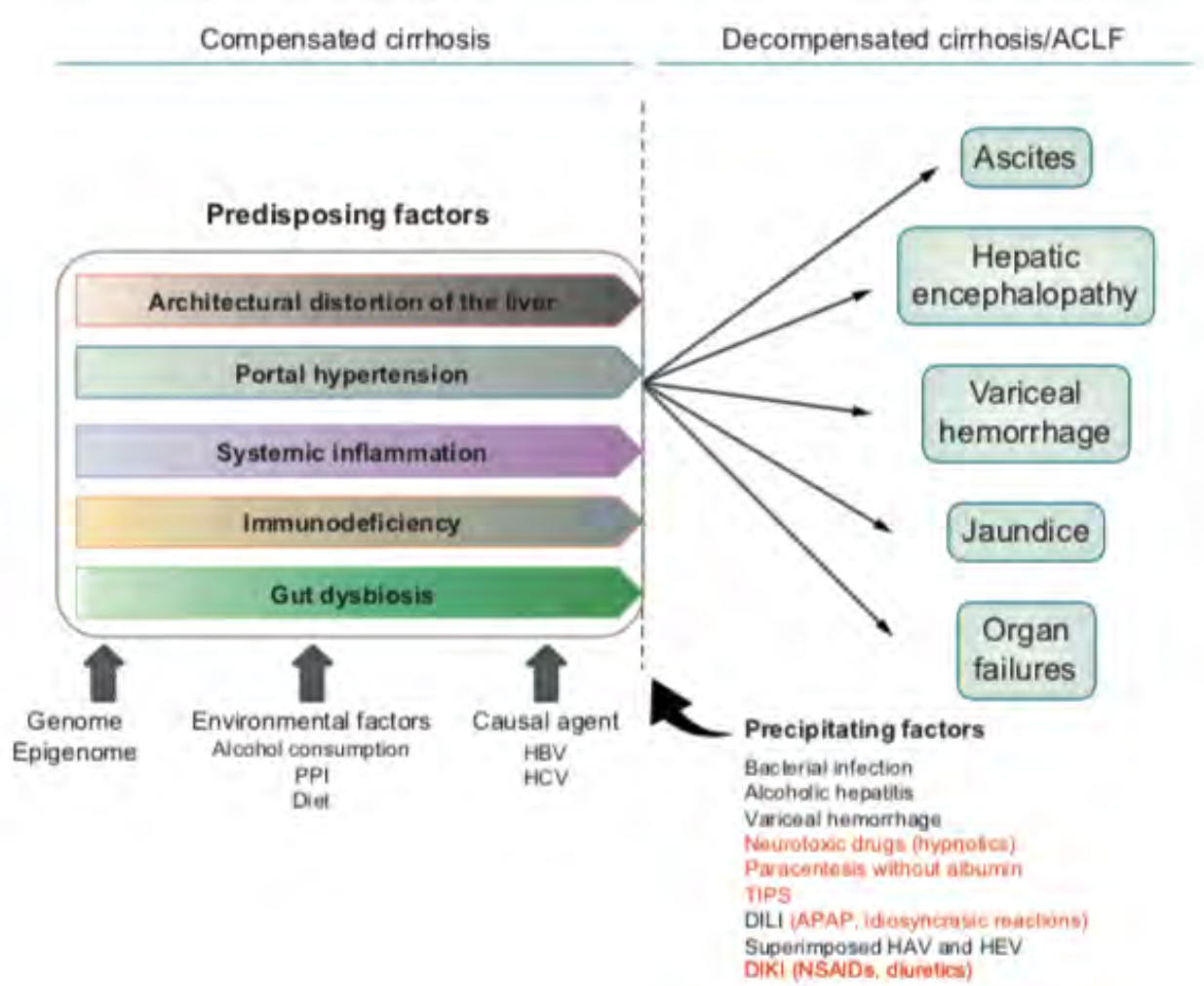


ESLD: end-stage liver disease
SG: Sleeve gastrectomy
GB: gastric bypass
AGB: adjustable gastric bandings

Dziodzio Obesity, 2017

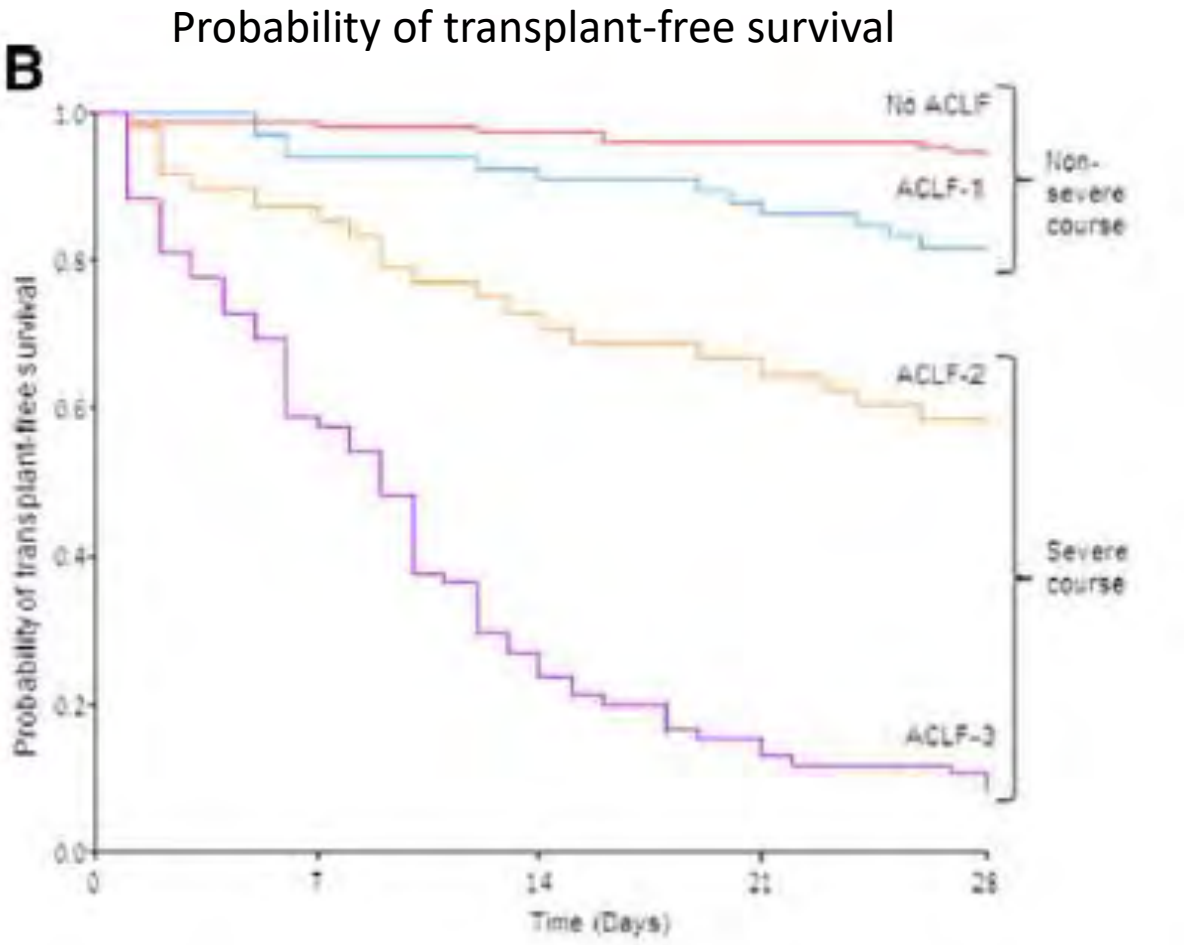
Transition to decompensation and acute-on-chronic liver failure: Role of predisposing factors and precipitating events

Thierry Gustot, Vanessa Stadlbauer, Wim Laleman, Carlo Alessandria, Mark Thursz
Journal of Hepatology 2021



APAP, acetaminophen; DIKI, drug-induced kidney injury; DILI, drug-induced liver injury; PPI, proton pump inhibitor; TIPS, transjugular intrahepatic portosystemic shun

Role of liver transplantation (LT) in patients with ACLF3



Initial data from the CANONIC study revealed 1-year post-LT survival of 75% among 25 patients transplanted with ACLF, of whom 9 had ACLF-3 and none had respiratory failure.

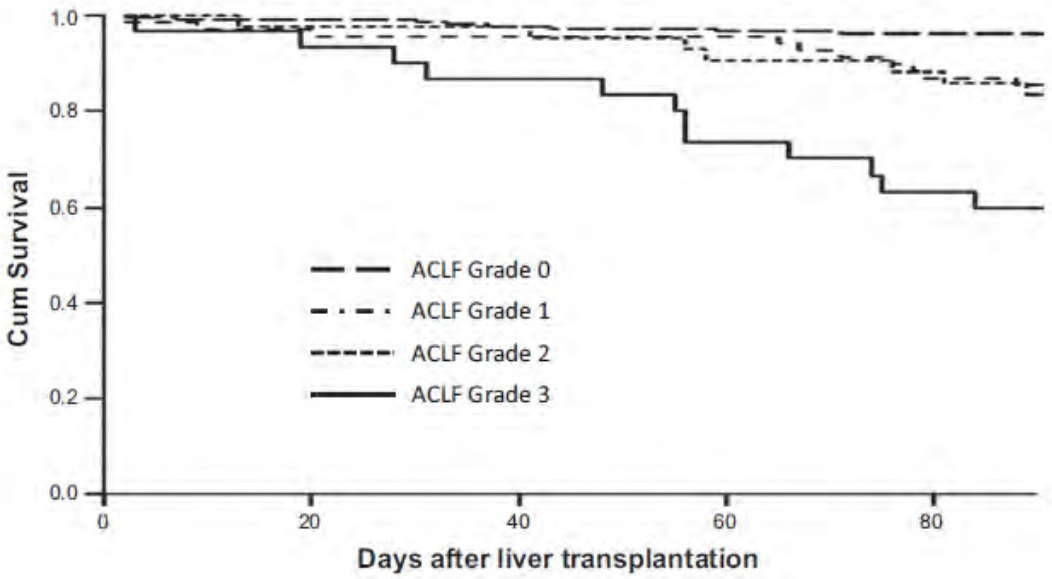
Improvement or worsening of ACLF occur very rapidly.

Gustot & Fernandez, Hepatology 2015

ACLF: acute-on-chronic-liver-failure

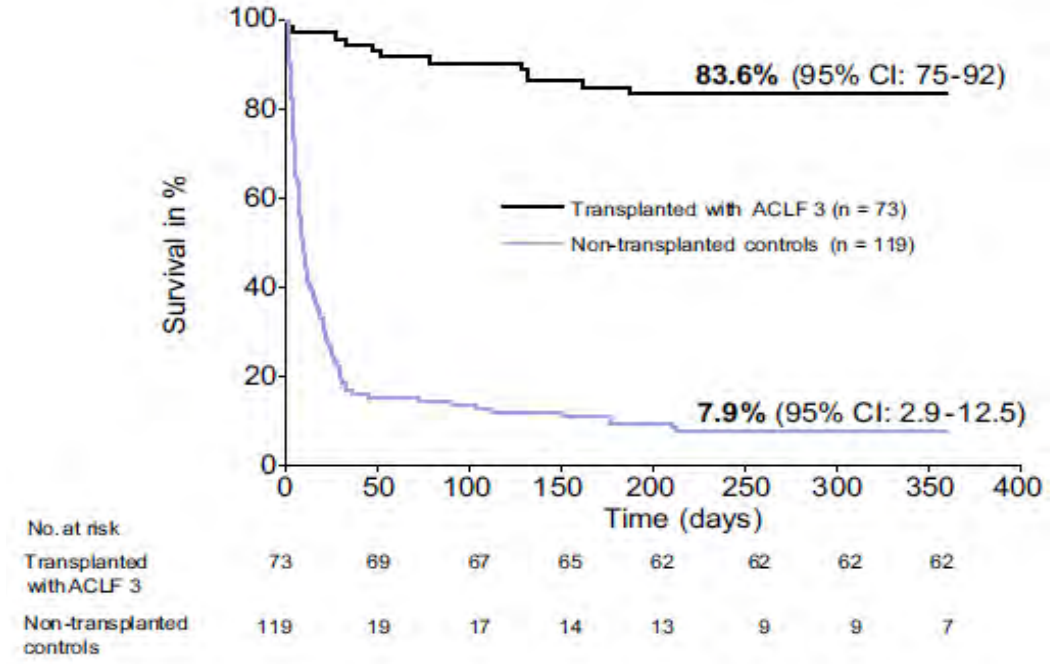
Survival after liver transplantation (LT) in patients with ACLF3

90-day post-LT survival in ACLF-3=60%



Levesque Liver International 2017

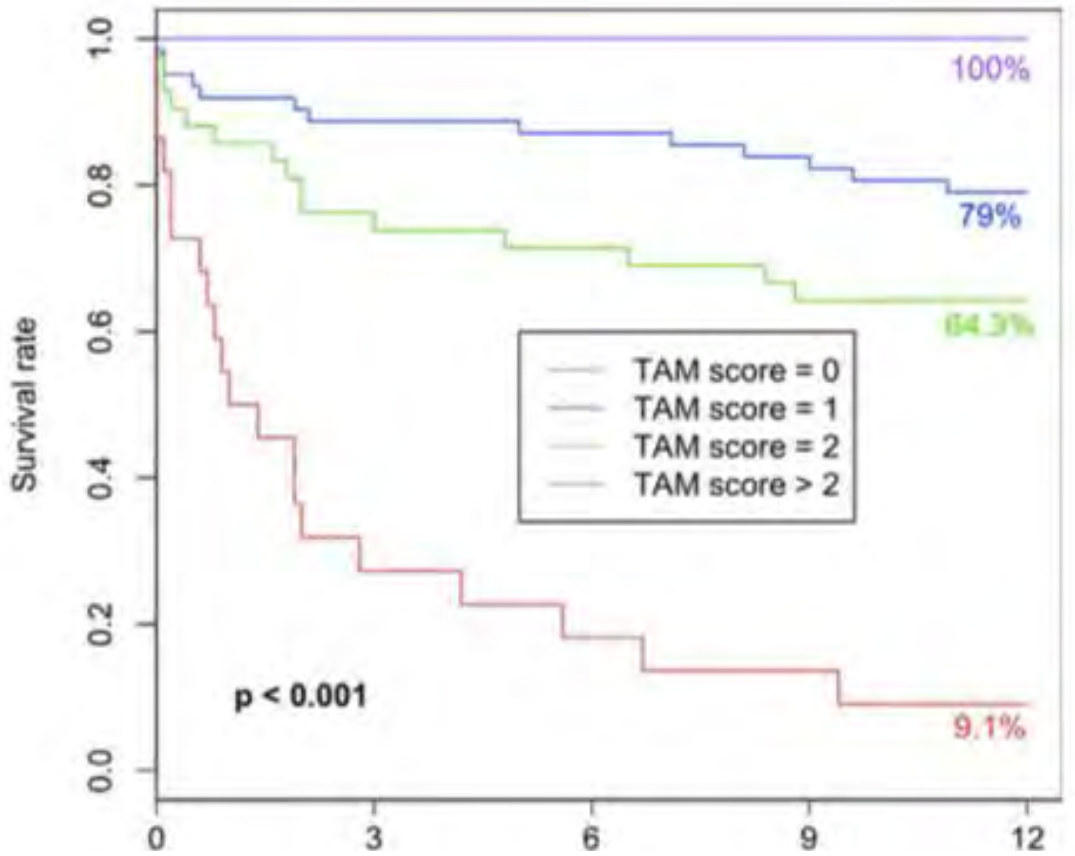
1-year post-LT survival in ACLF-3=84%



Artru J Hep 2017

Survival rate after liver transplantation in the entire cohort depending on the transplantation for ACLF-3 TAM score

	Points
Arterial lactate level (mmol/l)	
<4	0
≥4	1
Mechanical ventilation with PaO_2/FiO_2 ratio ≤ 200 mm Hg	
No	0
Yes	1
Age (years)	
<53	0
≥53	1
Leukocyte counts (G/l)	
>10	0
≤10	1
TAM score	= Σ



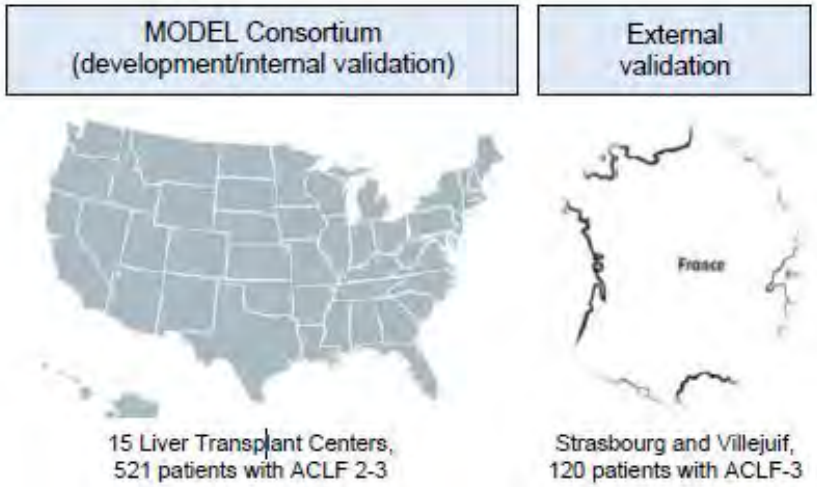
The score can help stratify post-transplant survival and identify an optimal transplantation window for patients with ACLF-3

Artzner AJT 2020

The novel SALT-M score predicts 1-year post-transplant mortality in patients with severe acute-on-chronic liver failure

Ruben Hernaez[1,2,3,*,#], **Constantine J. Karvellas**[4,#], Yan Liu[2,3], Sophie-Caroline Sacleux[5,6], Saro Khemichian[7], Lance L. Stein[8], Kirti Shetty[9], Christina C. Lindenmeyer[10], Justin R. Boike[11], Douglas A. Simonetto[12], Robert S. Rahimi[13], Prasun K. Jalal[3], Manhal Izzy[14], Michael S. Kriss[15], Gene Y. Im[16], Ming V. Lin[17], Janice H. Jou[18], Brett E. Fortune[19], George Cholankeril[3], Alexander Kuo[20], Nadim Mahmud[21], Fasiha Kanwal[1,2,3], Faouzi Saliba[5], Vinay Sundaram[20,‡,†], Thierry Artzner[22,‡], Rajiv Jalan [23,24,25,‡], for the Multi-Organ Dysfunction and Evaluation for Liver Transplantation (MODEL) Consortium[§]

Journal of Hepatology, **September 2023**. vol. 79 | 717–727



Tool: logistic regression using clinically meaningful variable selection in addition to modern selection techniques. Adequate power for 5 predictors. Used median regression to estimate median length of stay using the same principles.

- ✓ Age 50+
- ✓ Diabetes mellitus
- ✓ Body mass index (continuous)
- ✓ Circulatory failure (one or 2+ inotropes)
- ✓ Respiratory failure

Predictors in the final model

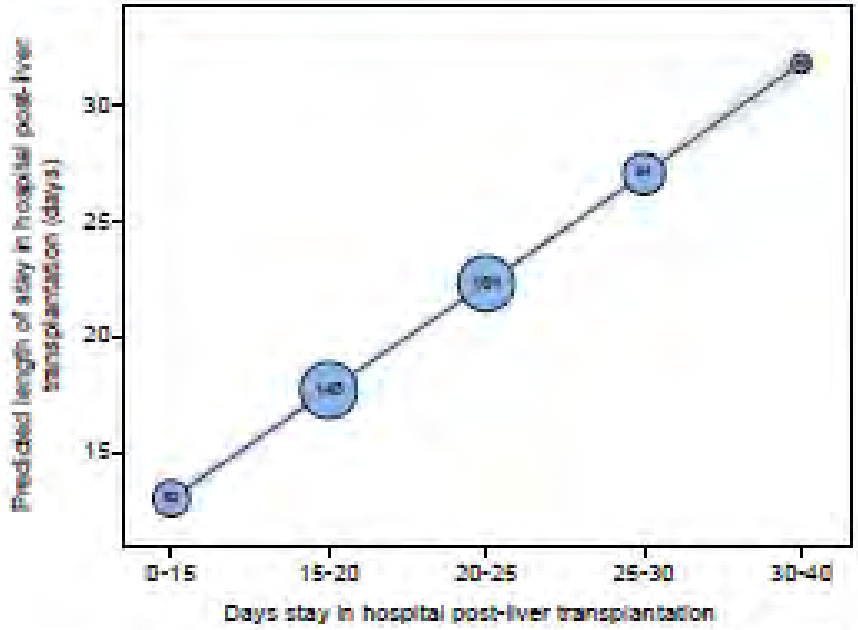
The aim was:

1) to develop and externally validate a model to predict 1-year mortality after liver transplantation in patients with ACLF-grade 2 or 3
2) to estimate the median length of stay after transplant

Sundaram ACLF-LT (SALT)-Mortality score predicts 1-year mortality probability post-LT

AUROC 0.72 (development)
AUROC 0.80 (external validation)

Able to assess median length-of-stay in days post LT



Adjusted for age, body mass index, diabetes use of inotropes, respiratory failure, prior history of MDRB, RRT and WBC at LT

ACLF 2/3 & LT candidate?
→ The Sundaram score can help in the discussions of LT in these patients

MDRB, multidrug resistant bacteria; RRT, renal replacement therapy; WBC, white blood cell count

- Age, BMI, and the presence of diabetes, respiratory failure, and/or circulatory failure predicted death within 1 year with reasonable accuracy.
- In addition, the prior presence of infection, use of renal replacement therapy, and leukocyte count at liver transplantation also influenced the median length of stay.

Journal of Hepatology, **September 2023**. vol. 79 | 717–727

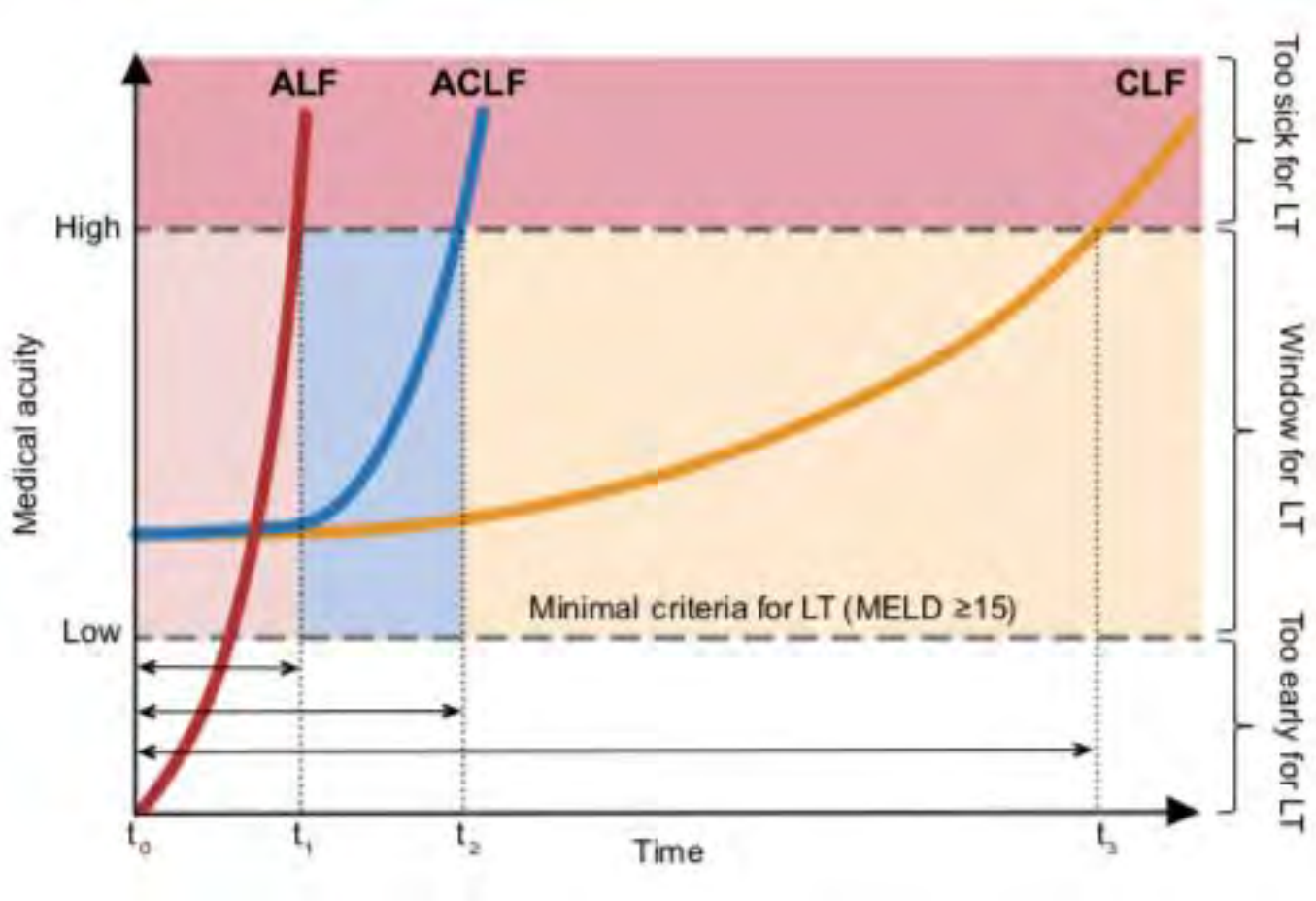
Impact and implications

This score can help in discussions with patients and care teams when patients are considered “too sick” for liver transplantation.

Nevertheless, the score is far from perfect and other factors, such as patient’s preference and center-specific factors, need to be considered when using these tools.

Journal of Hepatology, **September 2023**. vol. 79 | 717–727

Principle courses of three types of liver failure (ALF, ACLF, and CLF) plotted as function of medical acuity over time



The rapid onset of sequential organ failure as it occurs in ALF and ACLF leads to a short window of opportunity for liver transplantation.

Linecker J Hep 2018

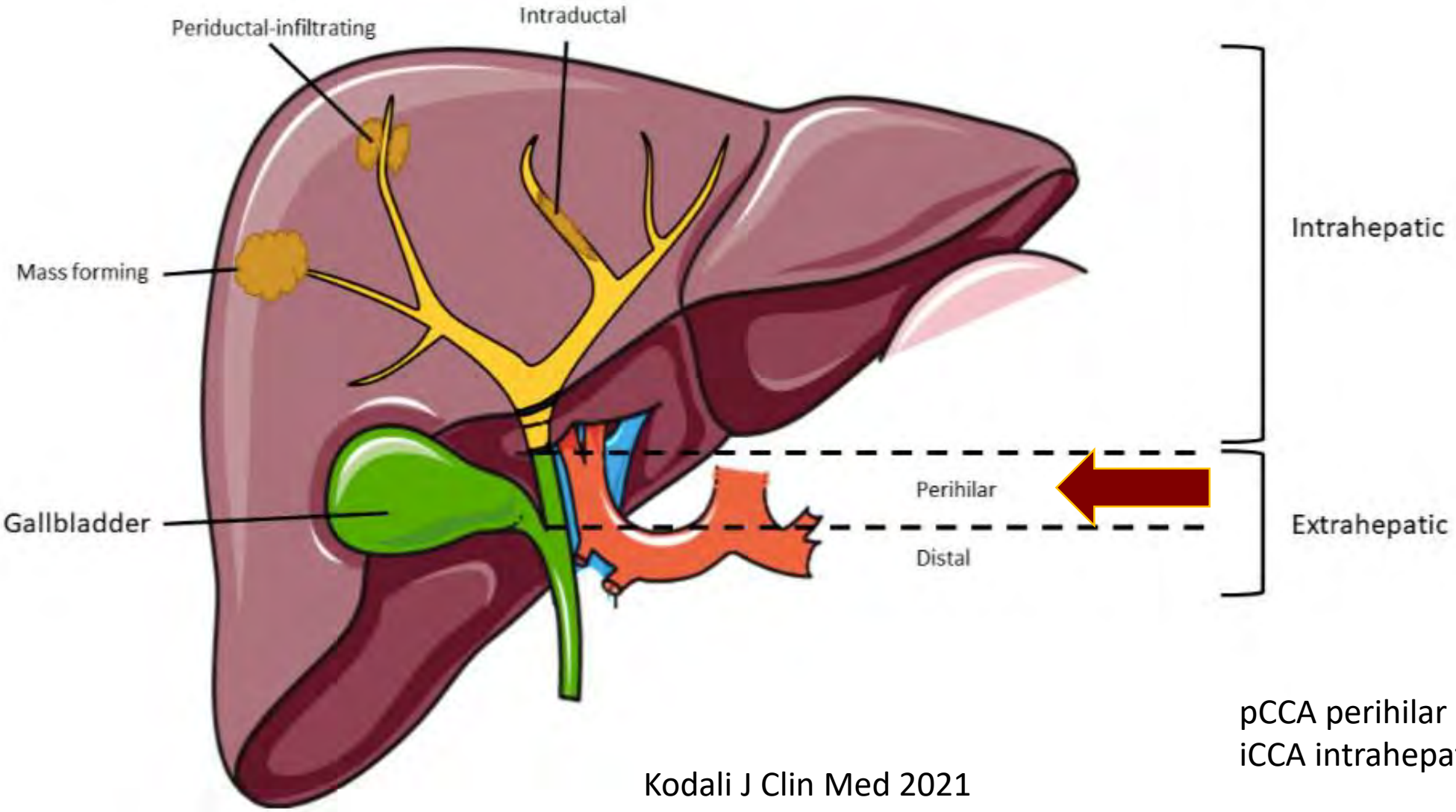
Should patients with acute-on-chronic liver failure grade 3 receive higher priority for liver transplantation?

- 62-year-old male, decompensated alcohol-associated cirrhosis, recurrent ascites and hepatic encephalopathy
- Type 2 diabetes, arterial hypertension, BMI 31 kg/m2
- Admitted to ICU, on mechanical ventilation, on norepinephrine
- MELD-Na 31
- Massive variceal bleed with hypovolemic shock
- Intubated, on renal replacement therapy, lactate 3.1 mmol/L
- ACLF-3, with 5 organ failures (liver, kidney, coagulation, circulation, and respiration)

Is it appropriate to perform liver transplantation in such a patient?

Florent Artru, David Goldberg, Patrick S. Kamath J Hep 2022

Classification of cholangiocarcinoma (CCA) by anatomic location



Kodali J Clin Med 2021

pCCA perihilar CCA
iCCA intrahepatic CCA

pCCA: LIVER TRANSPLANTATION

European experience

Spain experience
36 patients,
1988 – 2001

Overall survival:
82% at 1 year
53% at 2 years
30% at 3 years

Annals of Surgery 2004; 239:265

Germany experience
16 patients,
1992 – 1998

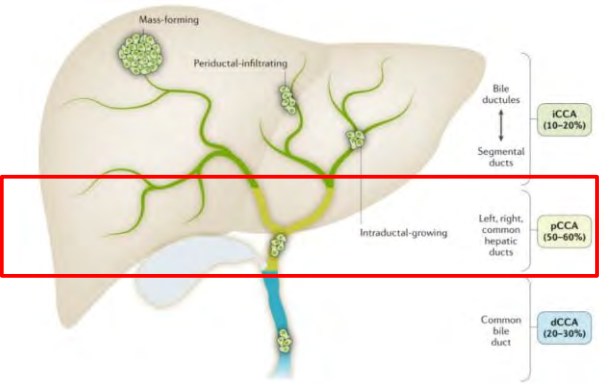
Overall survival:
63% at 1 year,
40% at 3 years,
38% at 5 years

Liver Transplantation 2009; 15:1499

France experience
97 patients,
1985 – 2008

Overall survival:
75% at 1 year,
38% at 3 years,
29% at 5 years

HPB 2010; 12(suppl 1) PL-03



Liver transplantation for pCCA - Mayo Clinic selection criteria and treatment

MAYO CLINIC

- Malignant appearing stricture AND at least 1 of the following:
  - Malignant cytology or histology
  - Ca 19-9 > 130 U/mL without cholangitis
  - Mass on cross-sectional imaging (radial diameter ≤ 3 cm)
  - No extrahepatic disease
- Cancer located above the cystic duct
- Unresectable cancer (*de novo* CCA) or cancer arising in the context of PSC (two distinct patient populations)

Extended beam radiation
- 4,500 cGy, 2 fractions/day ×15 days
- Protracted venous infusion of 5-FU, 225 mg/m^2/day

↓

Brachytherapy
- 2,000 cGy

↓

Capecitabine
- 1,000 mg/m^2/day in two divided doses
- 2 out of every 3 weeks

↓

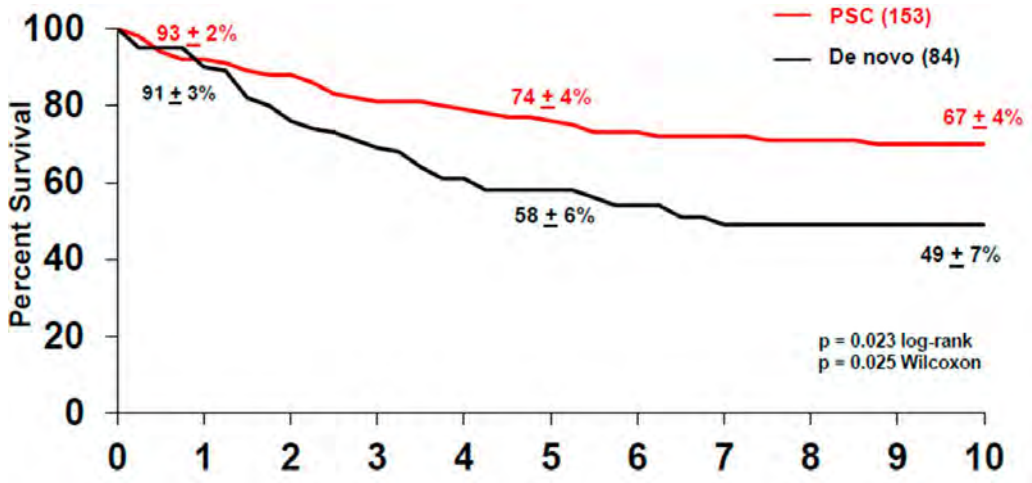
Operative staging

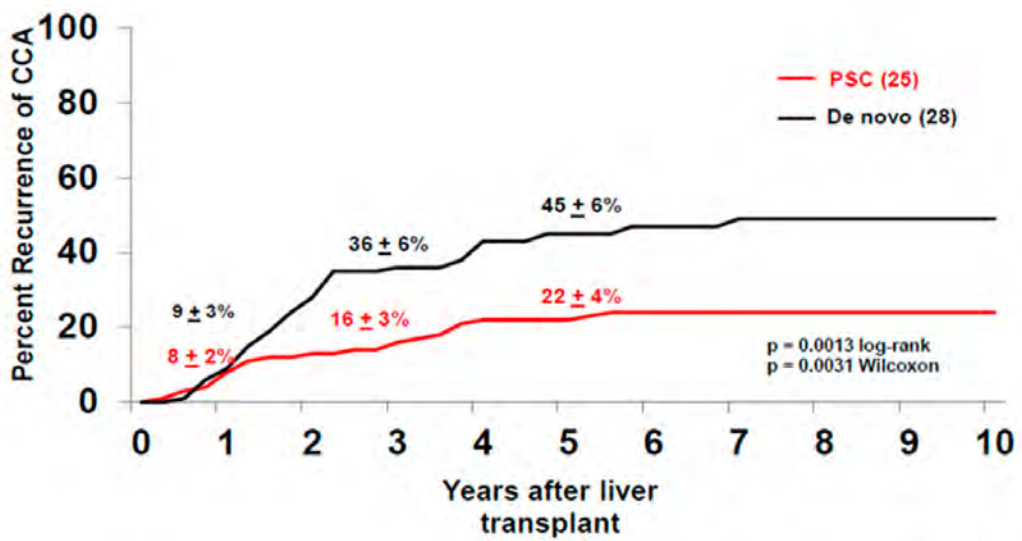
↓

Liver transplantation

Zamora-Valdes and Heimbach Gastroenterol Clin N Am 2018

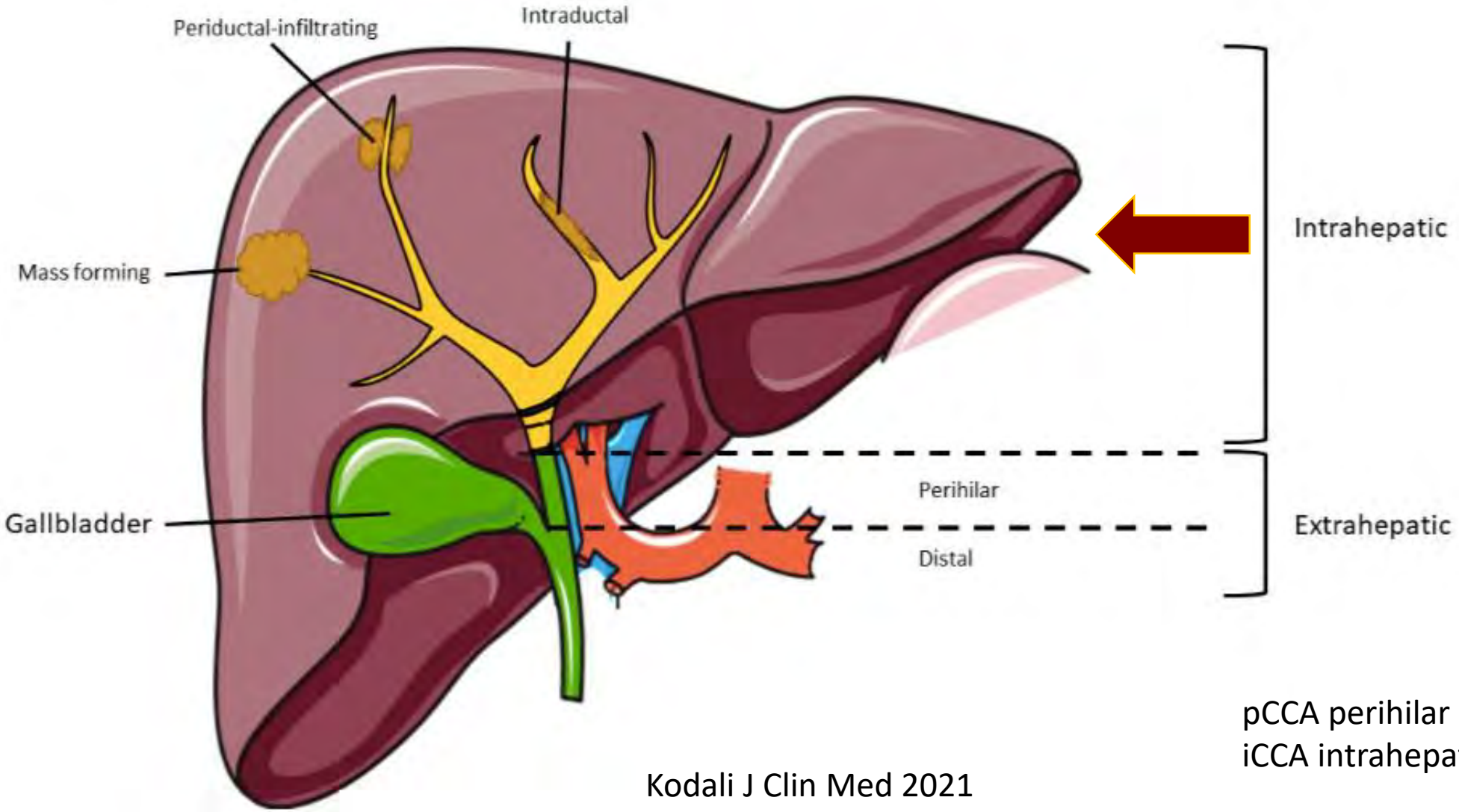
Mayo Clinic experience: 10-year survival





Azad AI et al Cancers 2020

Classification of cholangiocarcinoma (CCA) by anatomic location



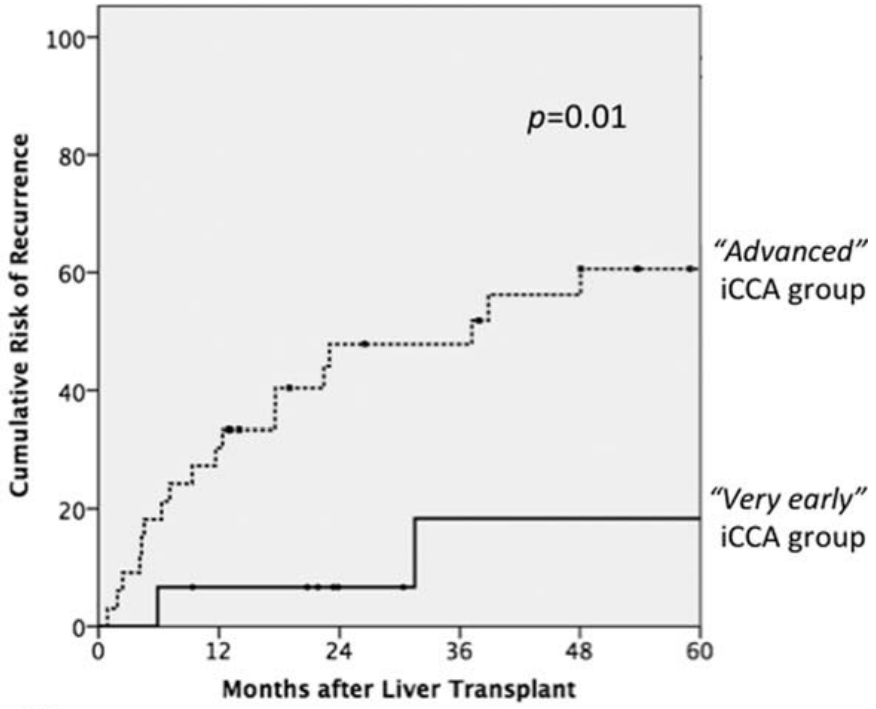
Kodali J Clin Med 2021

pCCA perihilar CCA
iCCA intrahepatic CCA

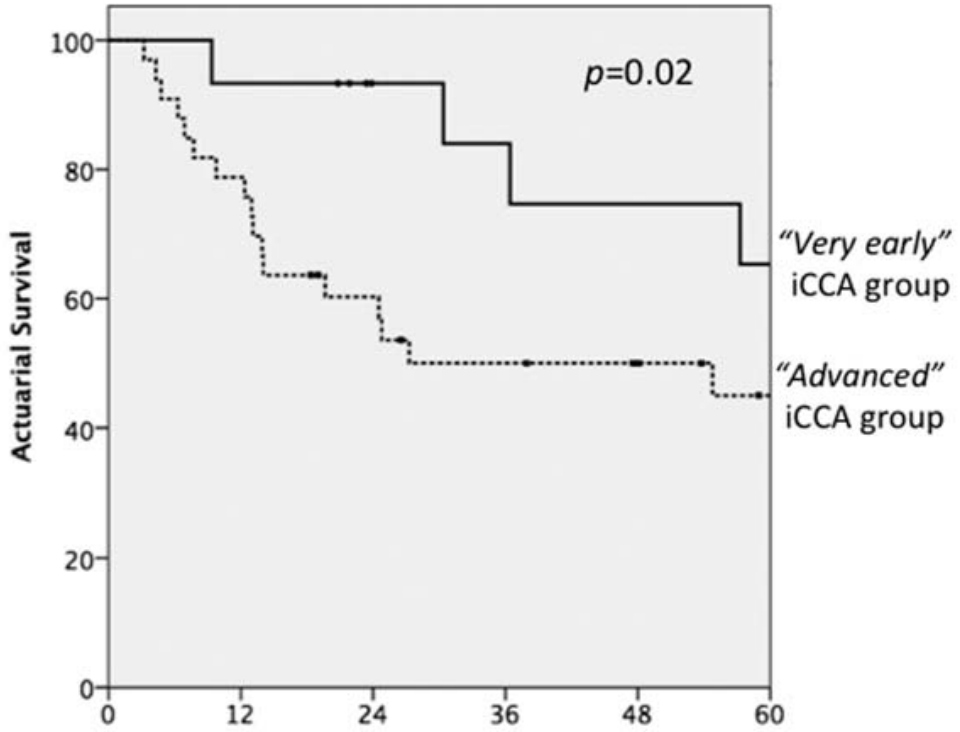
Liver transplantation in 48 very early iCCA (single tumor ≤ 2 cm)

5-years recurrence 18% and 5-year survival 65%

International retrospective study



Patients at risk						
"Very Early"	15	13	9	7	7	7
"Advanced"	33	23	14	13	10	6



Patients at risk						
"Very Early"	15	14	10	9	8	7
"Advanced"	33	26	18	14	12	8

Sapisochin G et al. Hepatology 2016

Liver Transplantation for Intrahepatic Cholangiocarcinoma: Ready for Prime Time?

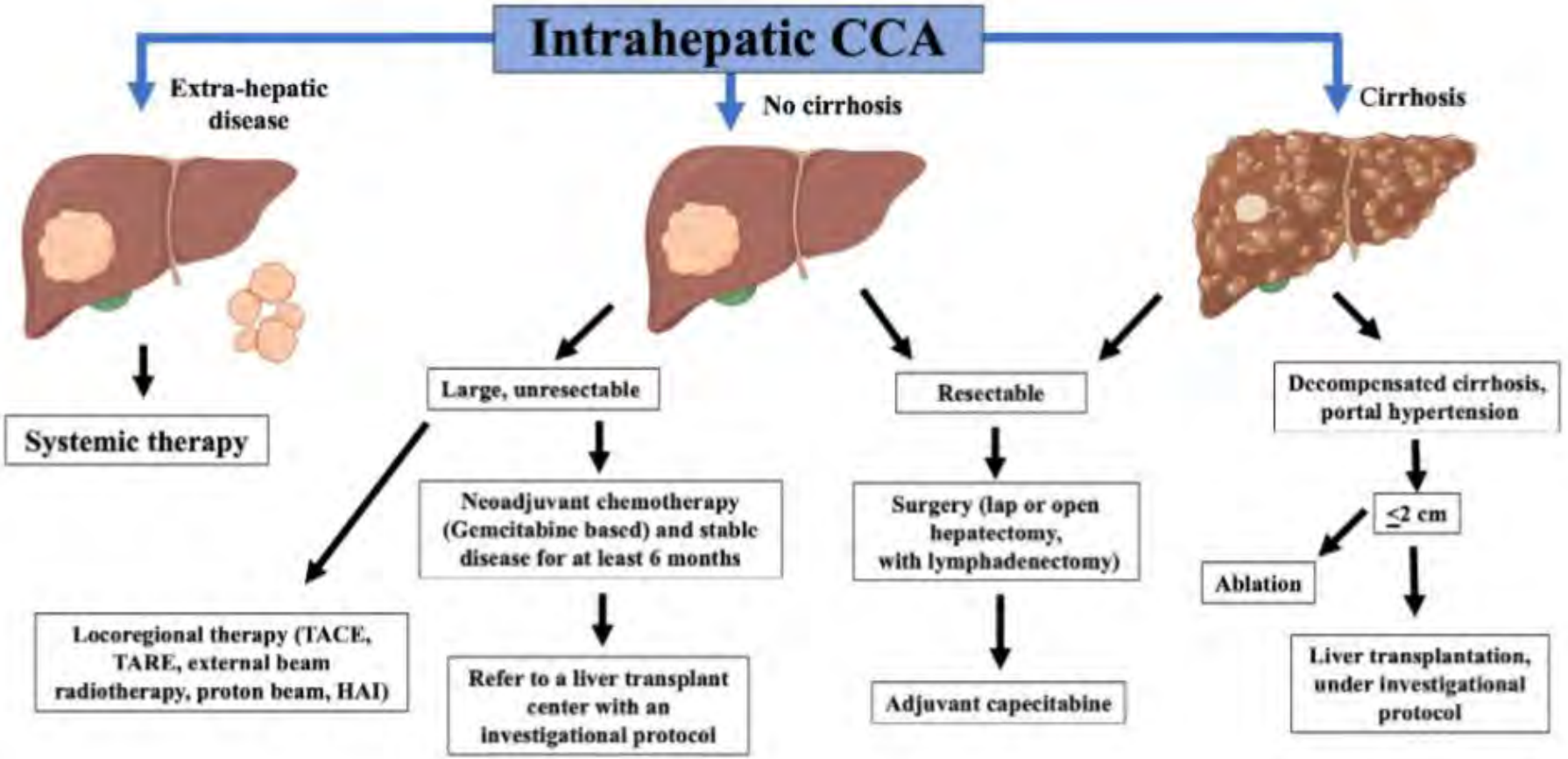
Gonzalo Sapisochin[1] | Tommy Ivanics[1,2,3] | Julie Heimbach[4]

Recent analyses of outcomes of liver transplantation for iCC have suggested that iCC may be a potentially feasible option for highly selected patients:

- Very early disease (single tumor, ≤2 cm) with cirrhosis not candidates for liver resection.
- Locally advanced iCC, but where the extent of liver resection would be too extensive to be feasible.

Hepatology. 2022;75:455–472.

Proposed treatment approach to patients with iCC and the role of liver transplant



Sapisochin Hepatology 2022

Updates in Surgery 2021
https://doi.org/10.1007/s13304-021-01064-w

LETTER TO THE EDITOR

Liver transplantation for unresectable intrahepatic cholangiocarcinoma: an Italian experience

Salvatore Gruttadauria[1,2] · Marco Barbara[3] · Rosa Liotta[4]

14 liver transplantations for iCCA.

12/14 cases incidentally diagnosed on pathologic examination

11/12 on cirrhotic livers

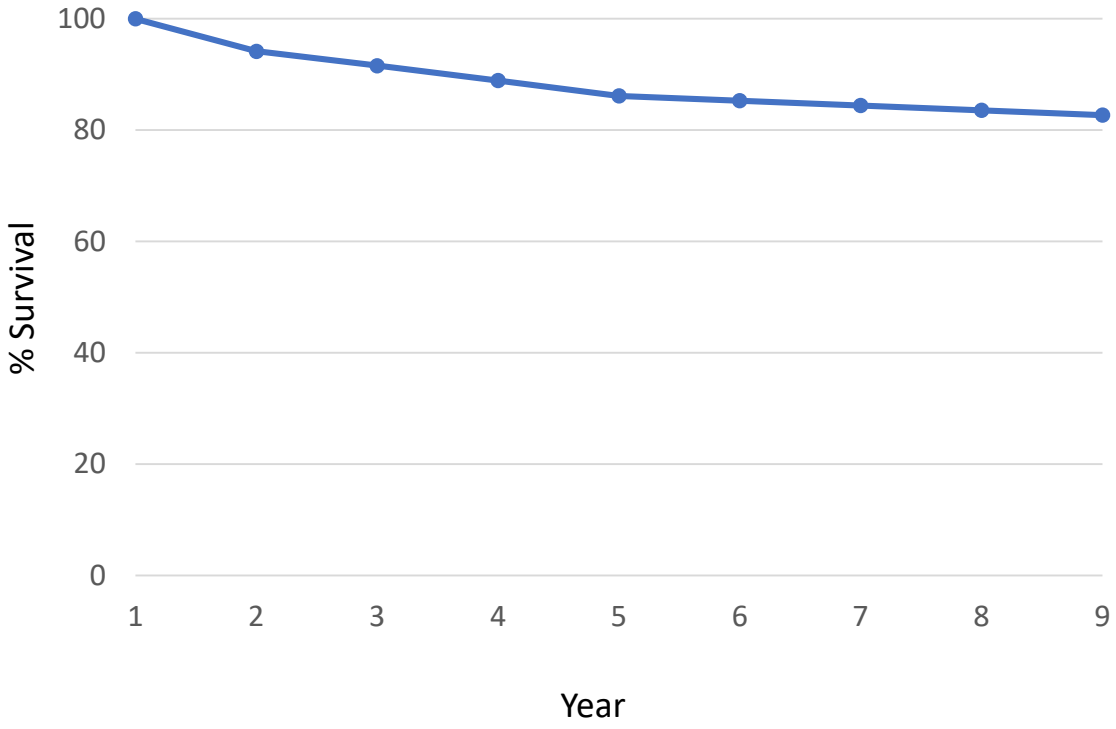
9/12 mixed form of iCCA and HCC

2/14 locally advanced unresectable iCCA, neoadjuvant treatment, 1–3 months of follow-up, and then liver transplant within 3 months

Overall survival for the incidentally diagnosed group: 69.4% at 5 years

2 non-incidental cases are alive after 19 and 2 months

Overall patient survival



81/411 (20%) PSC recurrence (rPSC)
66/411 (16%) mortality

24 (36%) <1 year
- Surgical complications (50%)
- Infections (25%)

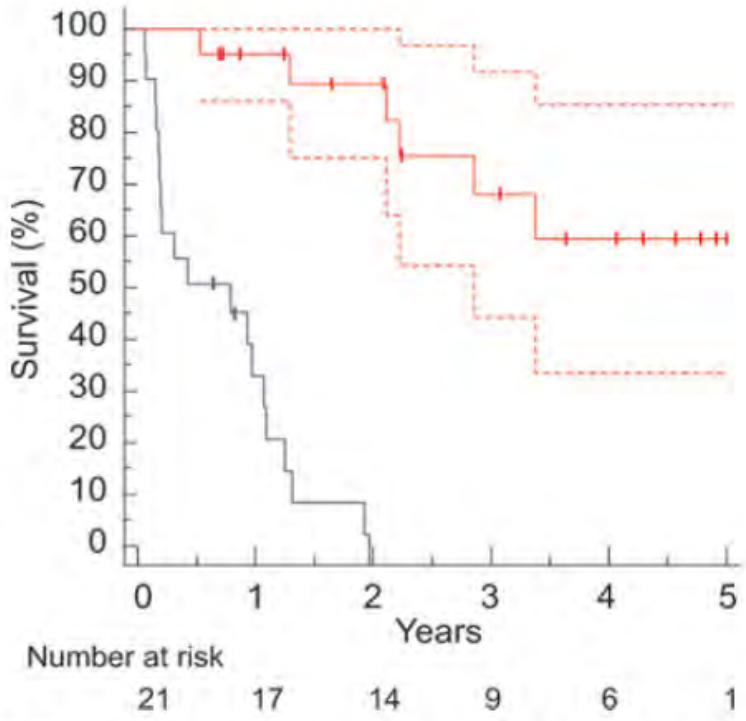
33 (50%) 1-5 years
- rPSC (36%)
- **CCA recurrence (21%)**

9 (14%) >5 years
- Colon cancer (60%)
- rPSC (40%)

Morelli, Burra et al DLD 2023

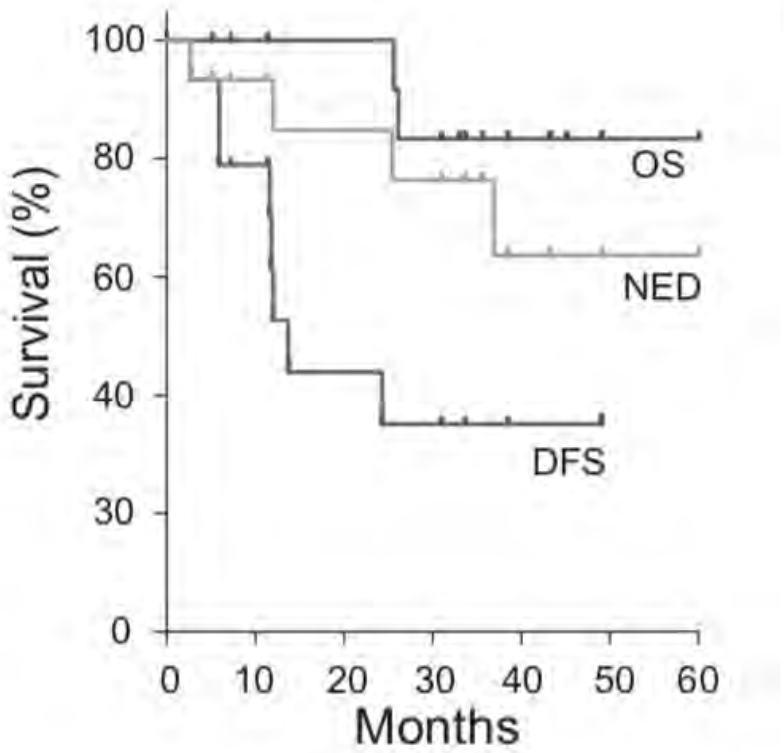
Survival Following Liver Transplantation for Patients With Nonresectable Liver-only Colorectal Metastases

Liver transplantation in 21 cases provided an overall survival of 60% in SECA-I study.



1-year 95%
3-year 68%
5-year 60%

15 patients included in the SECA-II study had better prognostic factors than the previous SECA-I study.

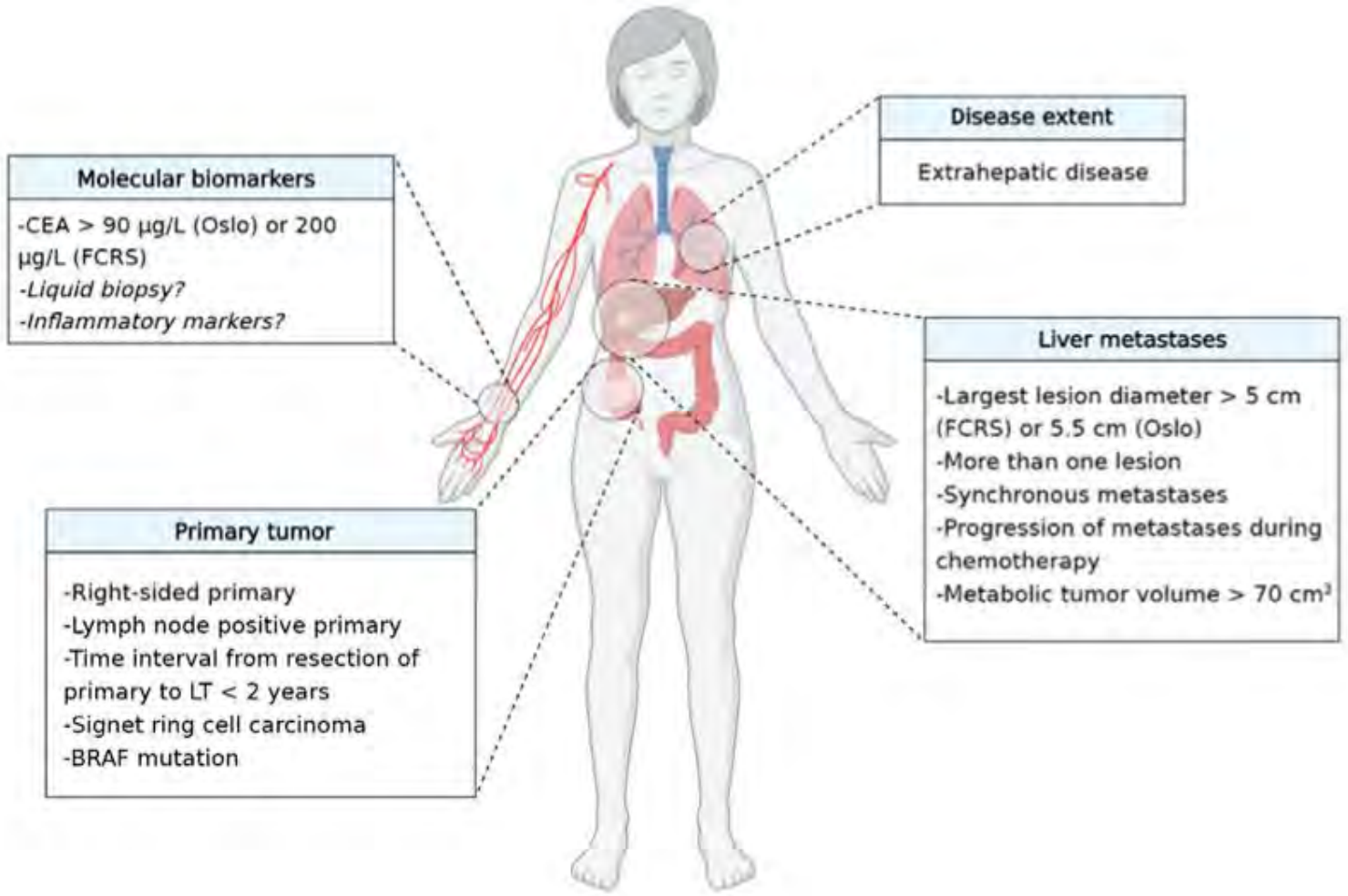


1-year 100%
3-year 83%
5-year 83%

OS: Overall survival
NED: No evidence of disease
DFS: Disease free survival

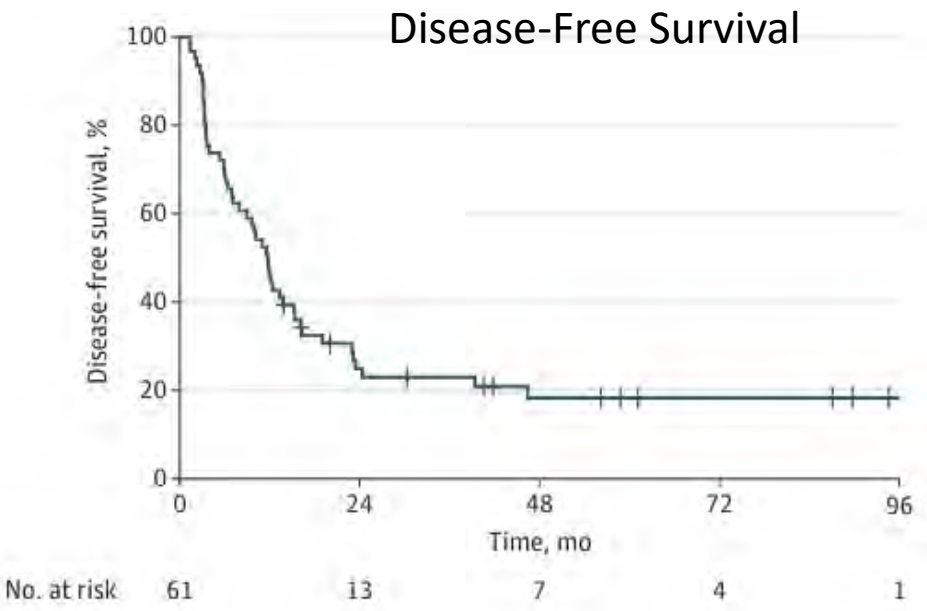
Hagness, Annals of Surgery, 2013; Dueland Ann Surg 2020

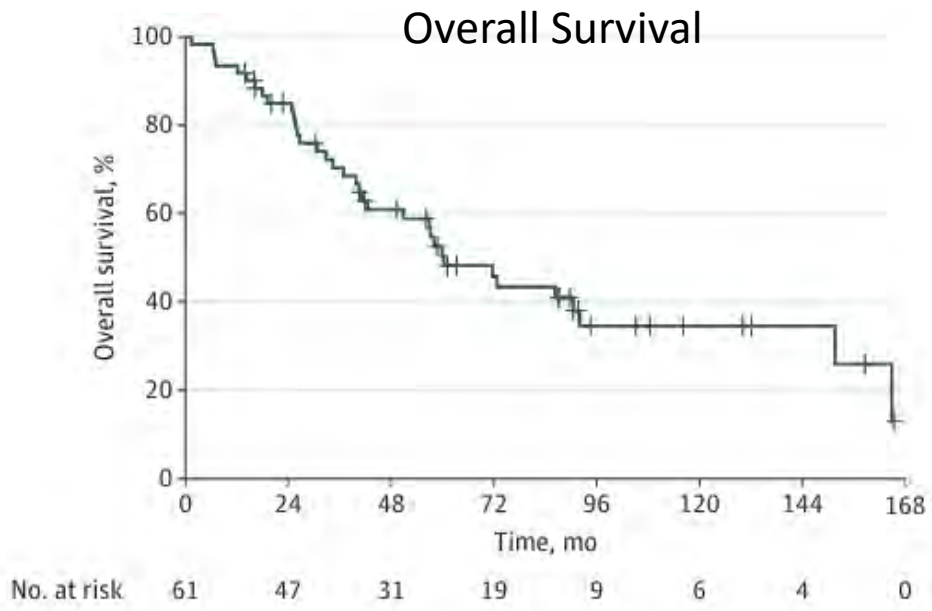
Established and potential risk factors associated with poor prognosis after liver transplantation for colorectal liver metastases



Maspero & Mazzaferro Cancers 2023

Long-Term Survival, Prognostic Factors, and Selection of 61 Patients With Colorectal Cancer for Liver Transplant





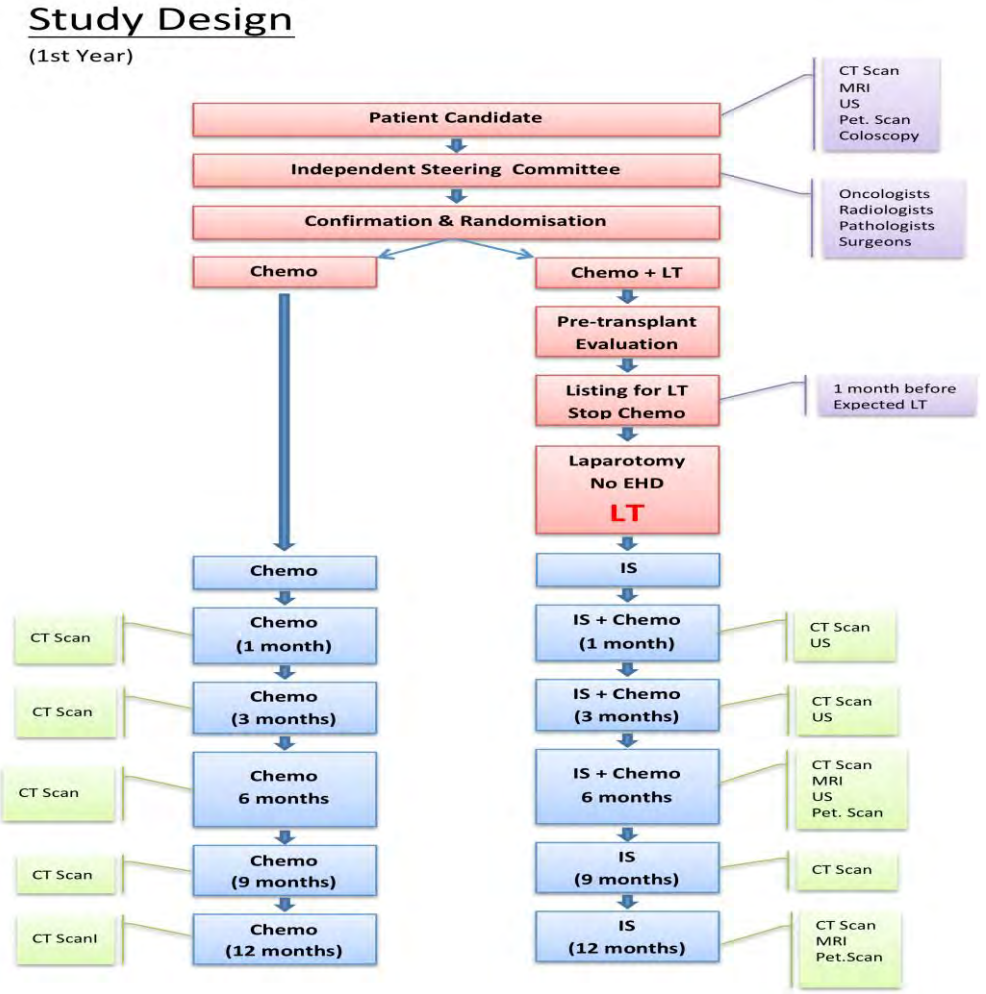
Some of the negative predictive factors

- largest tumor size greater than 5.5 cm
- progressive disease while receiving chemotherapy
- plasma carcinoembryonic antigen values greater than 80 µg/L
- 9 or more liver lesions

Svein Dueland & Pål-Dag Line JAMA Surg. 2023

TRANSMET
European Randomised Multicentric Trial:
Liver Transplantation vs Chemotherapy
in patients with liver metastases from colorectal cancer

- Primary End Point: 5-year survival
- 80 patients, 40 in each group
- 17 European centers (10 from France)



Preliminary insights from the

TransMet Randomized Clinical Trial

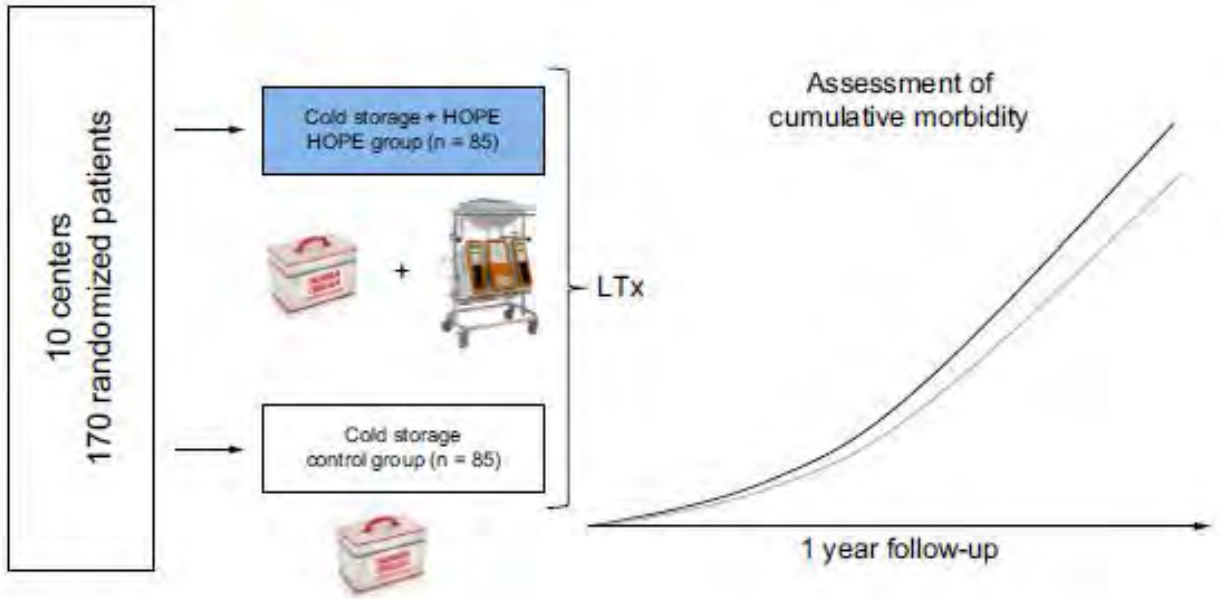
2024 Submitted

Courtesy from Rene' Adam

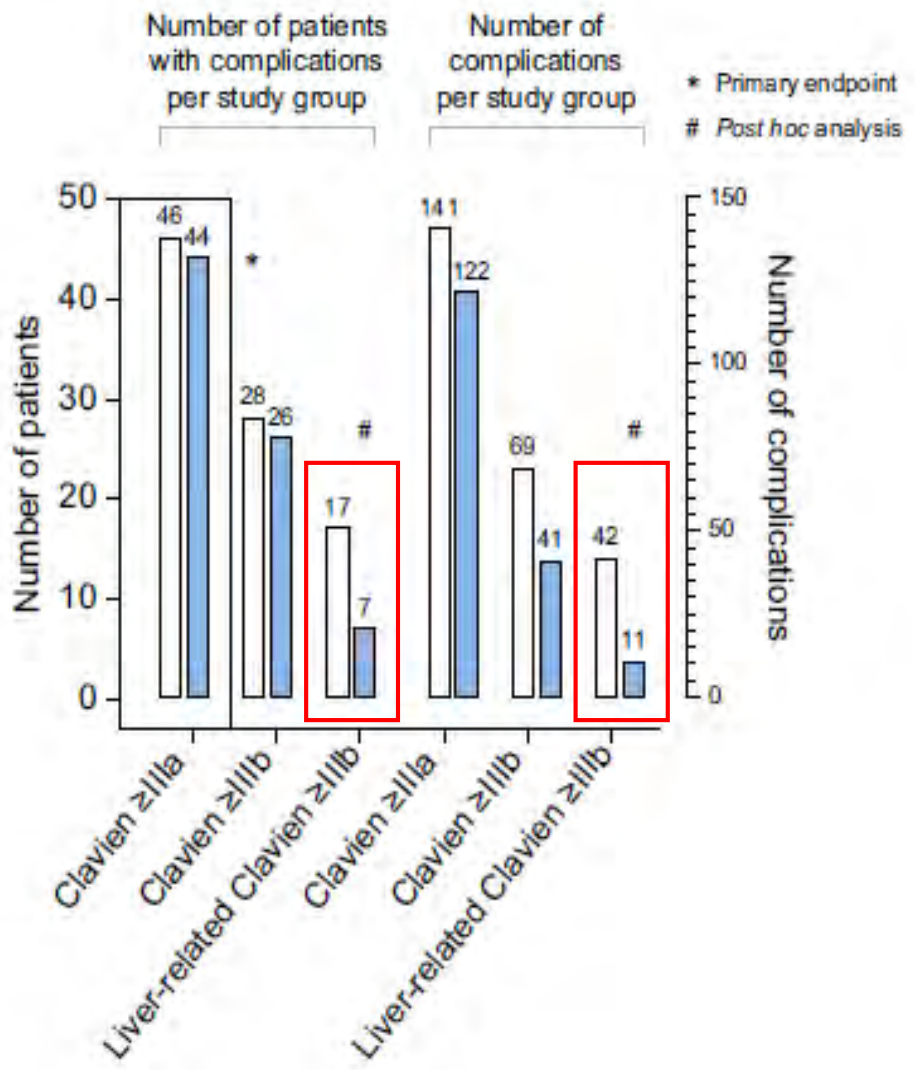
A multicenter randomized-controlled trial of hypothermic oxygenated perfusion (HOPE) for human liver grafts before transplantation

Andrea Schlegel[1,2], Matteo Mueller[1], Xavier Muller[1,3], Janina Eden[1], Rebecca Panconesi[4], Stefanie von Felten[5], Klaus Steigmiller[5], Richard X. Sousa Da Silva[1], Olivier de Rougemont[1], Jean-Yves Mabrut[3], Mickaël Lesurtel[3], Miriam Cortes Cerisuelo[6], Nigel D. Heaton[6], Marc Antoine Allard[7], Rene Adam[7], Diethard Monbaliu[8,9], Ina Jochmans[8,9], Martijn P.D. Haring[10], Robert J. Porte[10], Alessandro Parente[2], Paolo Muiesan[2,11], Philipp Kron[1,12], Magdy Attia[12], Dagmar Kollmann[13], Gabriela Berlakovich[13], Xavier Rogiers[14], Karin Petterson[1], Anne L. Kranich[15], Stefanie Amberg[15], Beat Müllhaupt[16], Pierre-Alain Clavien[1,†], Philipp Dutkowski[1,*,†]

Journal of Hepatology, **April 2023**. vol. 78 | 783–793



- Randomized controlled trial, assigning livers donated after brain death for liver transplantation.
- Livers were either conventionally cold stored (control group), or cold stored and subsequently treated by 1-2 h hypothermic oxygenated perfusion (HOPE) before implantation (HOPE group).
- The primary endpoint was the occurrence of at least one post-transplant complication per patient, graded by the Clavien score of ≥III, within 1-year after transplant.



- The number of patients with at least one Clavien ≥ III complication was not significantly different between groups [46/85 (54.1%) in the control group and 44/85 (51.8%) in the HOPE group].

- Severe post-transplant complications (Clavien grade IIIb or more), occurred less frequently in the HOPE-group.

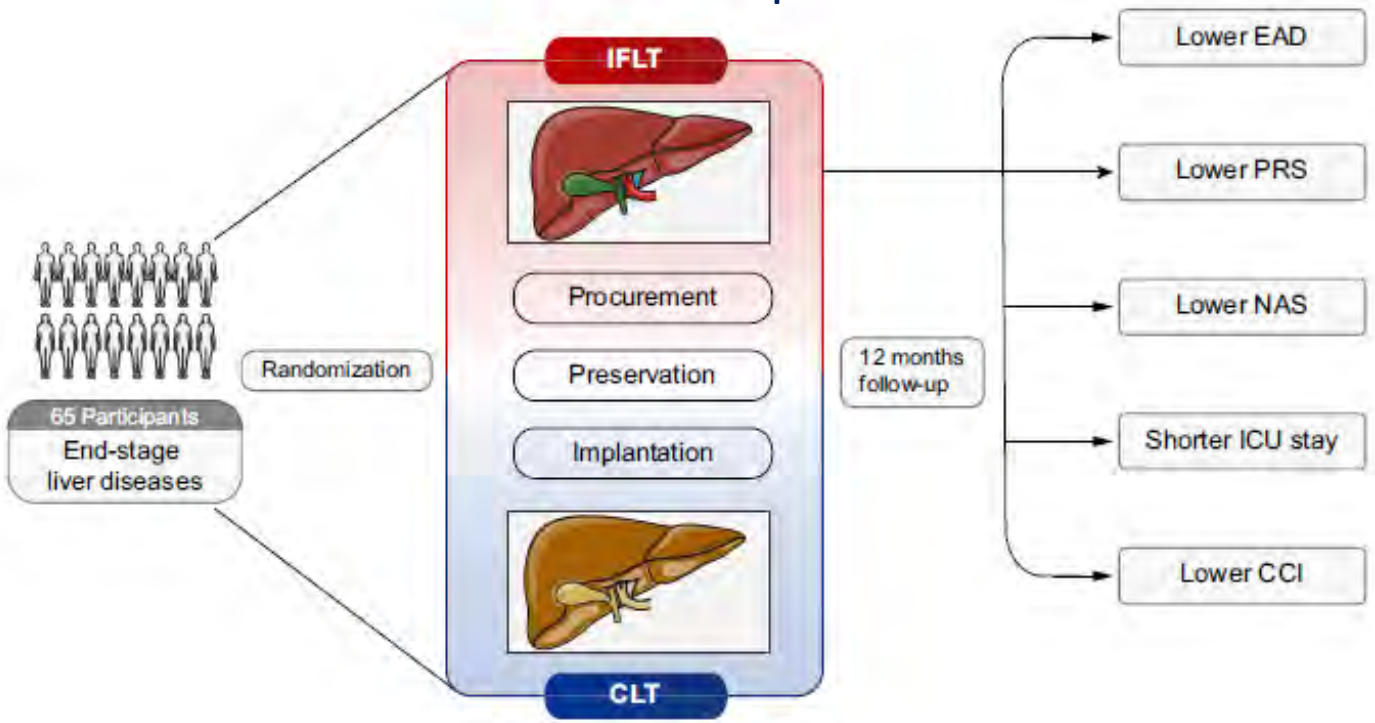
- Overall, it was reported a 3.7-fold lower number of liver-related Clavien ≥ IIIb complications per patient in the HOPE-group.

A randomized-controlled trial of ischemia-free liver transplantation for end-stage liver disease

Zhiyong Guo[1,2,3,4,*,†], **Qiang Zhao**[1,2,3,†], **Zehua Jia**[1,2,3,†], **Changjun Huang**[1,2,3,†], Dongping Wang[1,2,3], Weiqiang Ju[1,2,3], Jian Zhang[5], Lu Yang[6], Shanzhou Huang[1,2,3], Maogen Chen[1,2,3], Xiaofeng Zhu[1,2,3], Anbin Hu[1,2,3], Yi Ma[1,2,3], Linwei Wu[1,2,3], Yinghua Chen[1,2,3], Ming Han[1,2,3], Yunhua Tang[1,2,3], Guodong Wang[1,2,3], Linhe Wang[1,2,3], Lifen Li[7], Wei Xiong[6], Zhiheng Zhang[1,2,3], Yuekun Shen[6], Zhaoxia Tang[7], Caihui Zhu[1,2,3], Xiaoxiang Chen[6], Xiaoguang Hu[7], Yiwen Guo[1,2,3], Honghui Chen[1,2,3], Yihao Ma[1,2,3], Tao Zhang[1,2,3], Shunwei Huang[7], Ping Zeng[1,2,3], Simei Lai[1,2,3], Tielong Wang[1,2,3], Zhitao Chen[1,2,3], Jinlong Gong[1,2,3], Jia Yu[1,2,3], Canhui Sun[8], Chang Li[8], Haiyi Tan[8], Yao Liu[1,2,3], Yuqi Dong[1,2,3], Chengjun Sun[1,2,3], Bing Liao[9], Jun Ren[10], Zhenhai Zhou[10], Schlegel Andrea[11], Nashan Björn[12], Changjie Cai[7], Fengqiu Gong[13], Jian Rong[14], Wenqi Huang[6], Xiangdong Guan[7], Pierre-Alain Clavien[15], Tullius G. Stefan[16], Jiefu Huang[1], Xiaoshun He[1,2,3,*]

Journal of Hepatology, **August 2023**. vol. 79 | 394–402

Ischemia-free liver transplant



Conventional liver transplant

Ischemia-free organ transplantation is a novel approach designed to avoid ischemia-reperfusion injury, with the potential to improve outcomes

Randomized-controlled clinical trial

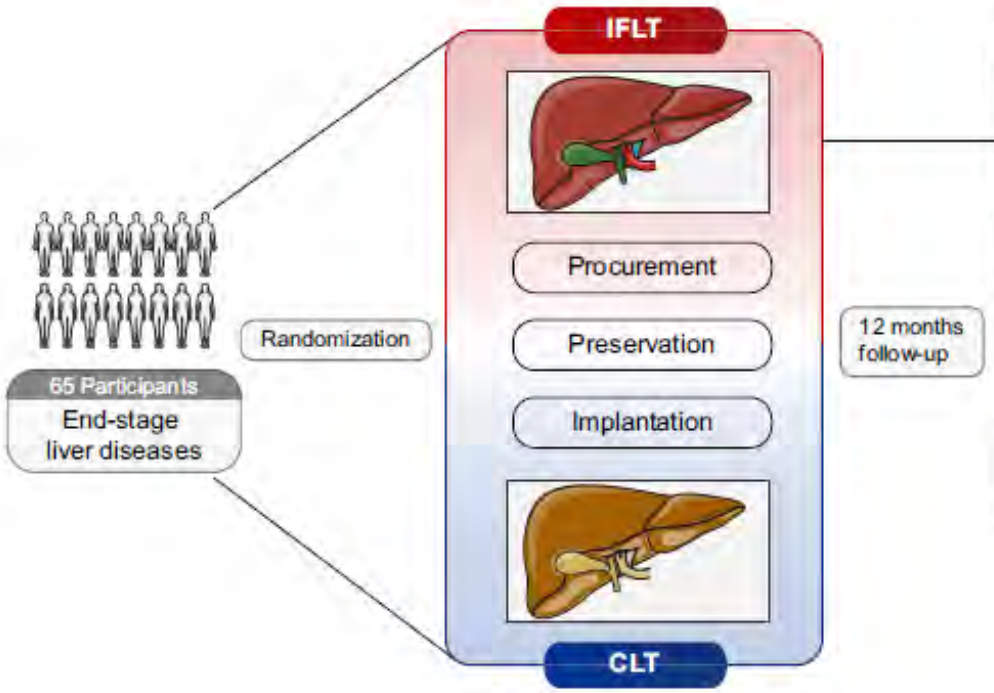
Recipients of livers from donors after brain death were assigned to receive an ischemia-free (32 cases) or a conventional transplant (33 cases)

A randomized-controlled trial of ischemia-free liver transplantation for end-stage liver disease

Zhiyong Guo[1,2,3,4,*,†], **Qiang Zhao**[1,2,3,†], **Zehua Jia**[1,2,3,†], **Changjun Huang**[1,2,3,†], Dongping Wang[1,2,3], Weiqiang Ju[1,2,3], Jian Zhang[5], Lu Yang[6], Shanzhou Huang[1,2,3], Maogen Chen[1,2,3], Xiaofeng Zhu[1,2,3], Anbin Hu[1,2,3], Yi Ma[1,2,3], Linwei Wu[1,2,3], Yinghua Chen[1,2,3], Ming Han[1,2,3], Yunhua Tang[1,2,3], Guodong Wang[1,2,3], Linhe Wang[1,2,3], Lifen Li[7], Wei Xiong[6], Zhiheng Zhang[1,2,3], Yuekun Shen[6], Zhaoxia Tang[7], Caihui Zhu[1,2,3], Xiaoxiang Chen[6], Xiaoguang Hu[7], Yiwen Guo[1,2,3], Honghui Chen[1,2,3], Yihao Ma[1,2,3], Tao Zhang[1,2,3], Shunwei Huang[7], Ping Zeng[1,2,3], Simei Lai[1,2,3], Tielong Wang[1,2,3], Zhitao Chen[1,2,3], Jinlong Gong[1,2,3], Jia Yu[1,2,3], Canhui Sun[8], Chang Li[8], Haiyi Tan[8], Yao Liu[1,2,3], Yuqi Dong[1,2,3], Chengjun Sun[1,2,3], Bing Liao[9], Jun Ren[10], Zhenhai Zhou[10], Schlegel Andrea[11], Nashan Björn[12], Changjie Cai[7], Fengqiu Gong[13], Jian Rong[14], Wenqi Huang[6], Xiangdong Guan[7], Pierre-Alain Clavien[15], Tullius G. Stefan[16], Jiefu Huang[1], Xiaoshun He[1,2,3,*]

Journal of Hepatology, **August 2023**. vol. 79 | 394–402

Ischemia-free liver transplant



Conventional liver transplant

- Lower early allograft dysfunction (6% vs 24%)
- Lower post-reperfusion syndrome (9% vs 64%)
- Lower non-anastomotic biliary strictures (8% vs 36%)
- Shorter intensive care unit (36h vs 44h)
- Lower comprehensive complication index (30.48 vs 42.14)

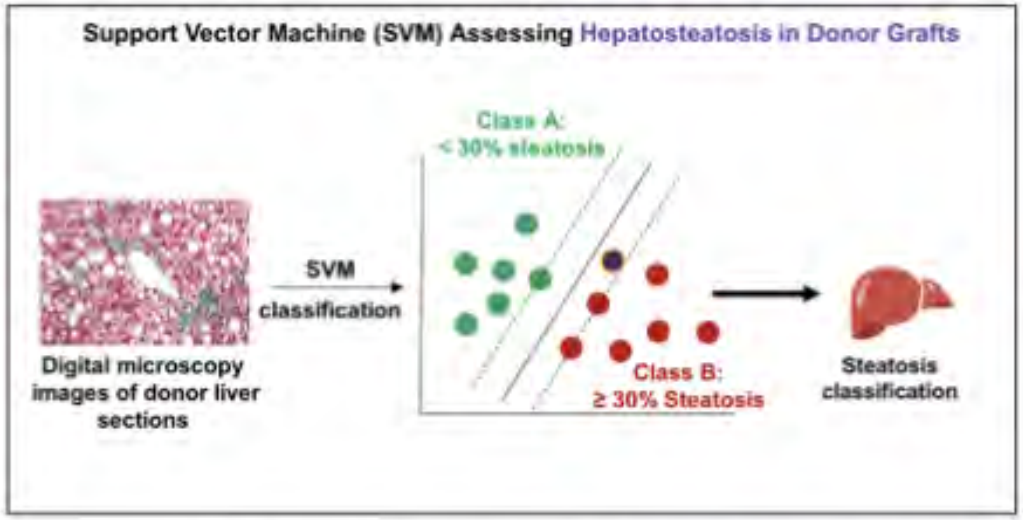
Ischemia-free liver transplantation significantly reduced complications related to ischemia-reperfusion injury compared to a conventional approach

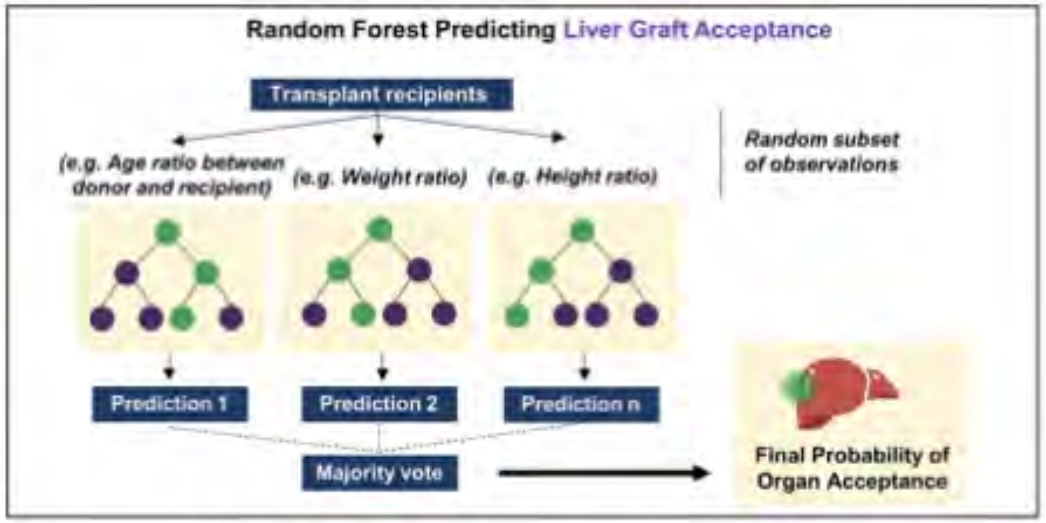
Impact and implications

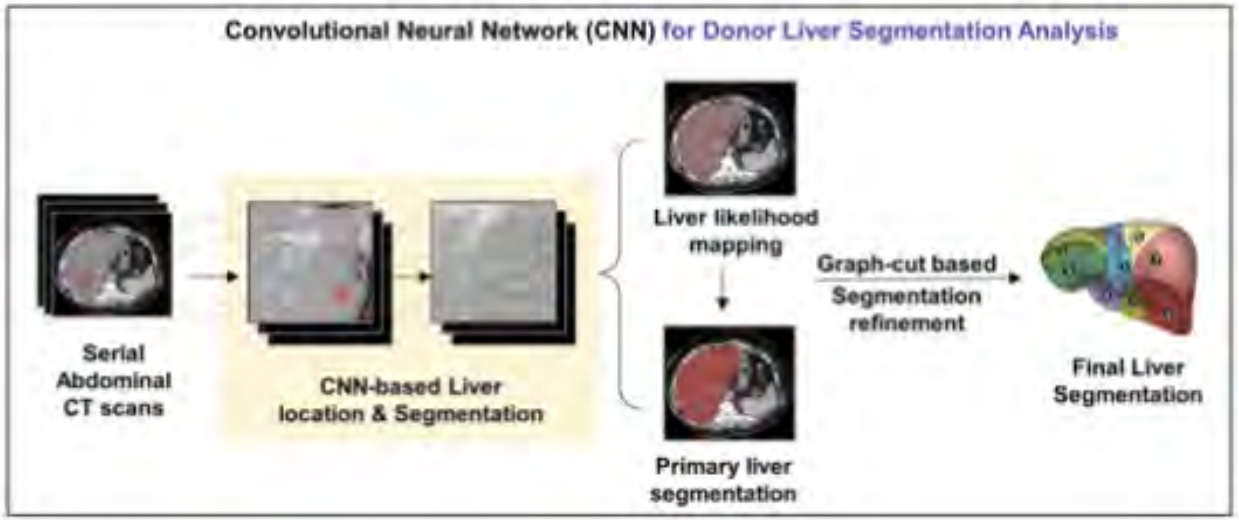
Ischemia-free liver transplantation is a novel approach of transplanting donor livers without interruption of blood supply and avoid graft ischemia reperfusion injury.

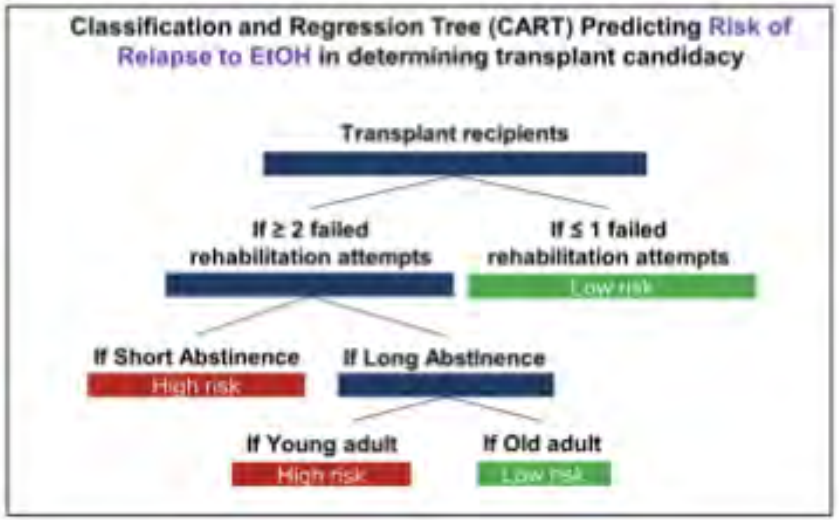
Journal of Hepatology, **August 2023**. vol. 79 | 394–402

Summary of machine learning applications in the pre-liver transplantation setting



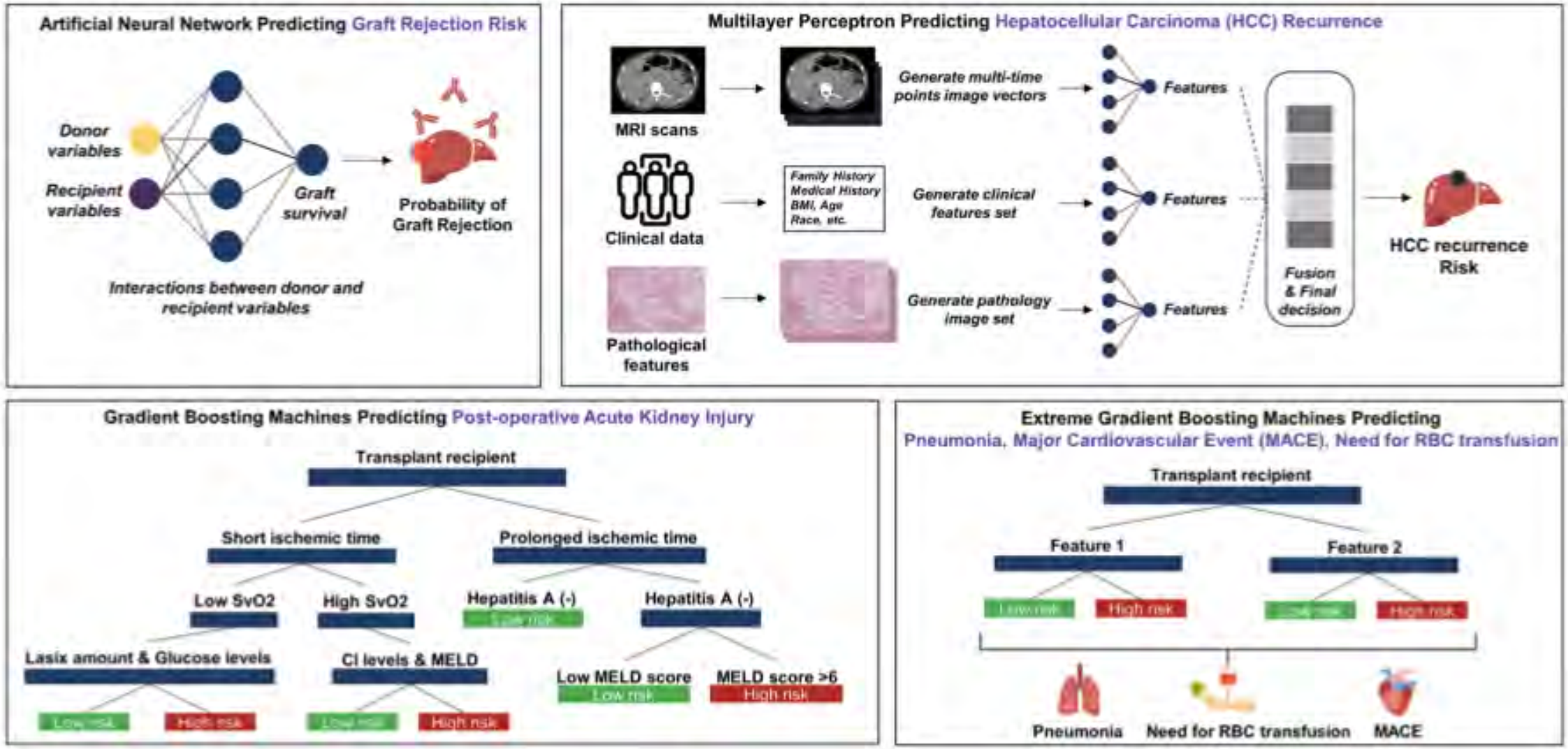






Jason Tran · Divya Sharma· Neta Gotlieb · Wei Xu · Mamatha Bhat
Hepatology International 2022

Summary of machine learning applications in the post-liver transplantation setting



Jason Tran · Divya Sharma· Neta Gotlieb · Wei Xu · Mamatha Bhat
Hepatology International 2022

Take home messages

Liver transplantation is a constantly evolving discipline.

What may have been a contraindication in the past is now accepted as an indication in selected cases.

The rigor of research in transplant oncology will only tell us in the medium to long term whether the therapeutic choice was correct.

Future innovations must always take into consideration what patients expect.

Padua, Italy, Multivisceral Transplant Unit