

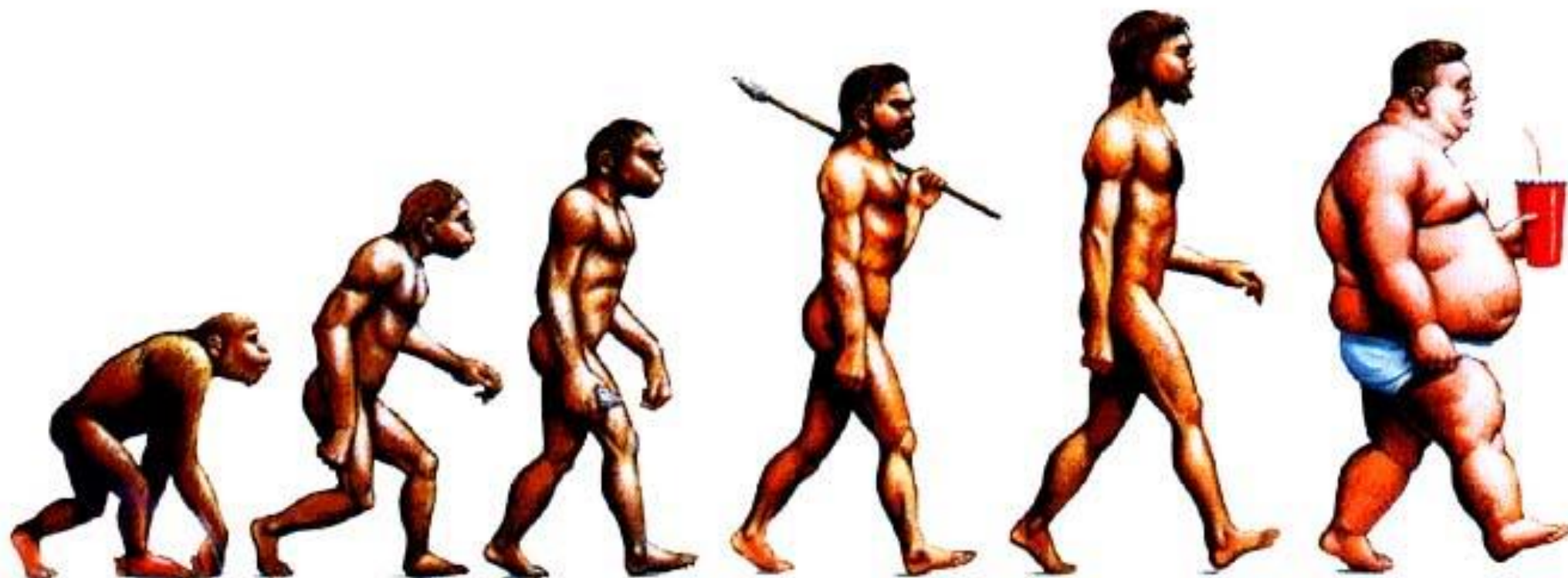
The NASH Patient: Mitigating Cardiovascular Risk Peri-Transplant

DR MARK EAGAR

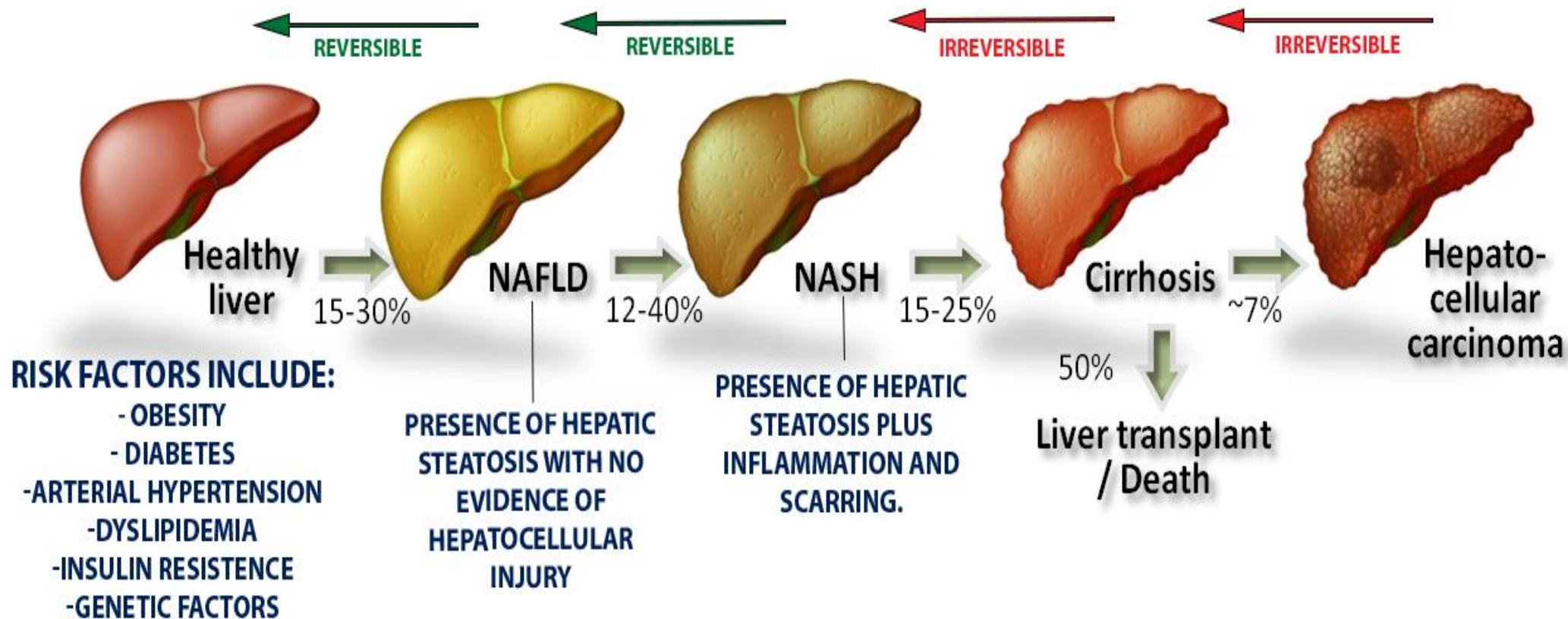


Wits University
Donald Gordon
Medical Centre

Patient-centred. Independent. Academic.



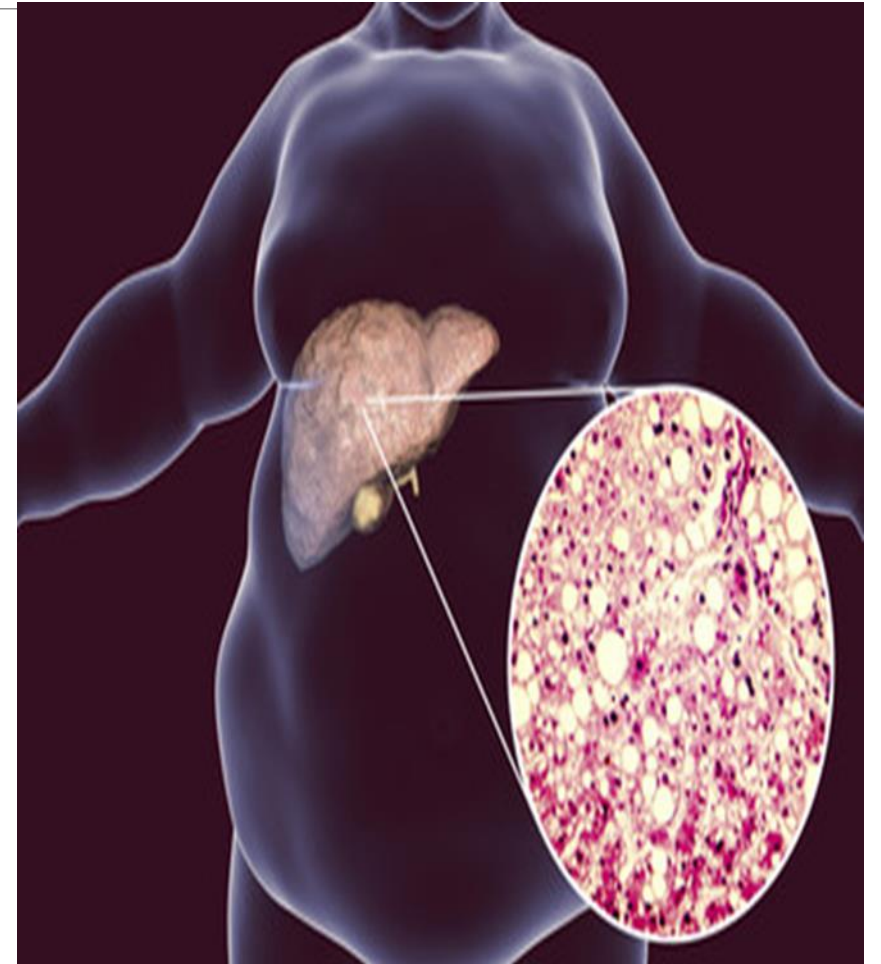
THE NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD) SPECTRUM

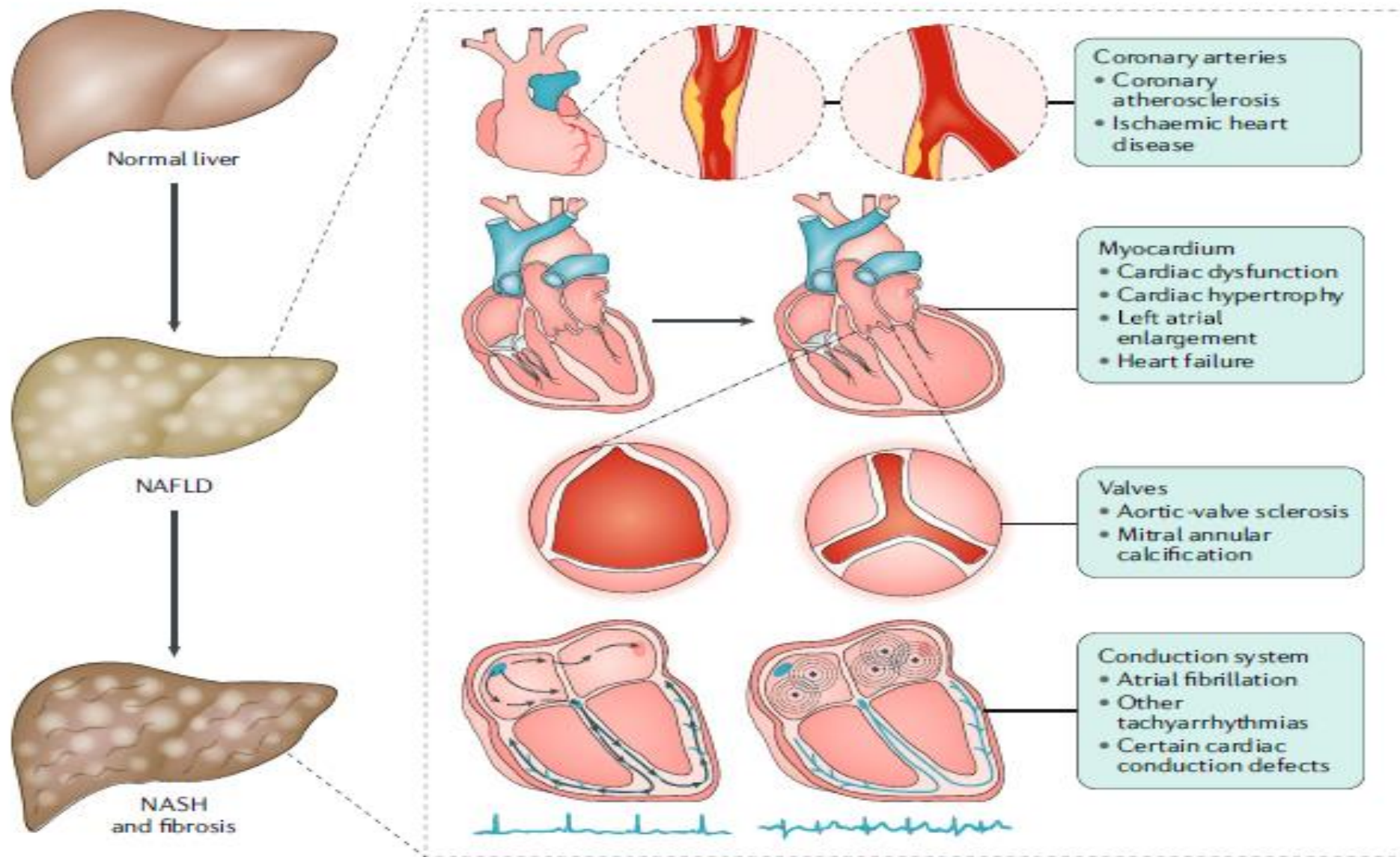


Texas Liver Institute
The Road to A Healthier Liver

PRE –OPERATIVE CARDIAC

- IDENTIFY PATIENT AT INCREASED RISK
- OPTIMAL MEDICAL THERAPY - EG. STATINS
- PRE-HABILITATION : EXERCISE, NUTRITION
- CORONARY INTERVENTION WHERE INDICATED





Cirrhotic Cardiomyopathy—A Veiled Threat

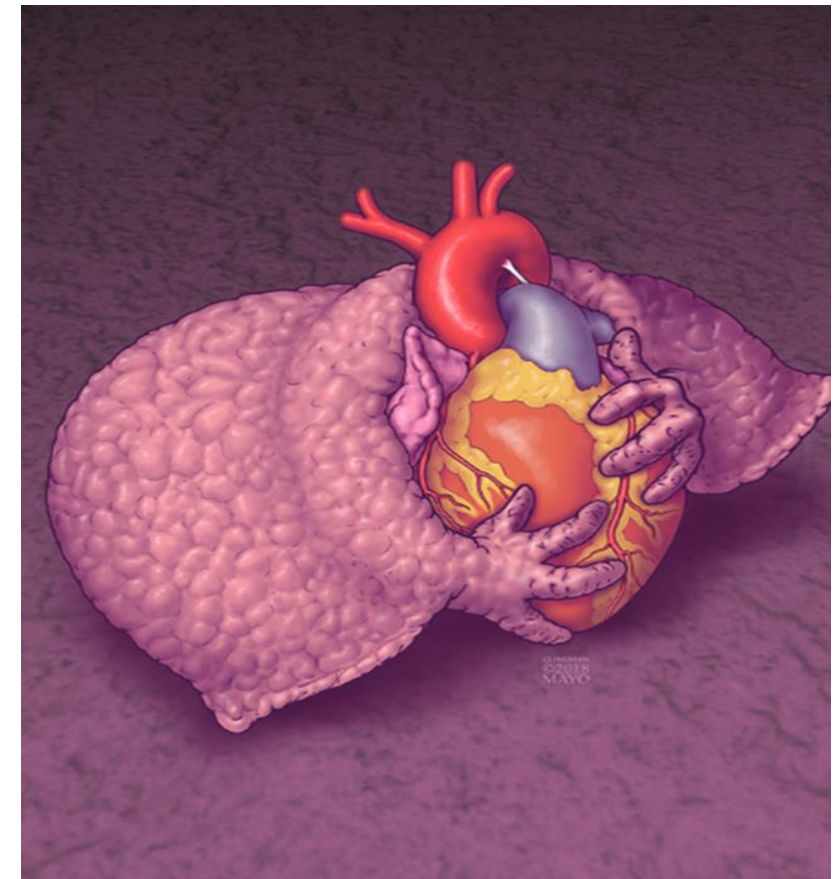
Ecaterina Scarlatescu, MD, PhD, Sergey P. Marchenko, MD, PhD,† and Dana R Tomescu, MD, PhD*‡*

Cardiology in Review • Volume 30, Number 2, March/April 2022

TABLE 3. Criteria Proposed by the Cirrhotic Cardiomyopathy Consortium (2019)

Systolic dysfunction (any of the criteria)	<ul style="list-style-type: none">- LV ejection fraction $\leq 50\%$- Absolute GLS $< 18\%$ or $> 22\%$
Diastolic dysfunction (≥ 3 of the criteria)	<ul style="list-style-type: none">- Septal e' velocity < 7 cm/s- E/e' ratio ≥ 15- LAVI > 34 mL/m²- TR velocity > 2.8 m/s
Other criteria	<ul style="list-style-type: none">- Abnormal chronotropic or inotropic response§- Electrocardiographic changes- Electromechanical uncoupling- Myocardial mass change- Serum biomarkers- Chamber enlargement- CMR

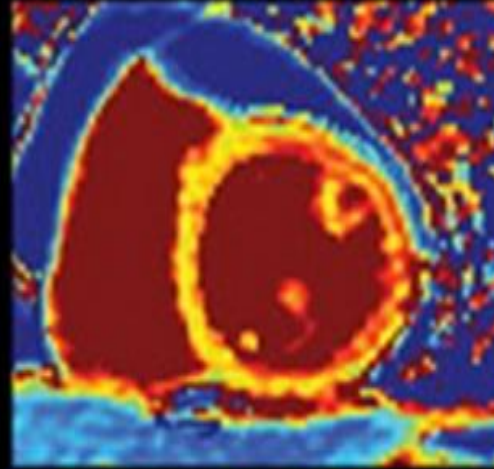
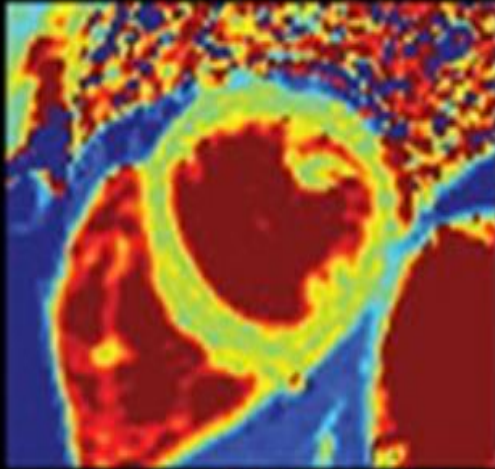
GLS, global longitudinal strain; LV, left ventricle; e' , early diastolic mitral annular velocity; LAVI, left atrial volume index; TR, tricuspid regurgitation; CMR, cardiac magnetic resonance.



Control

Cirrhosis

T1 map



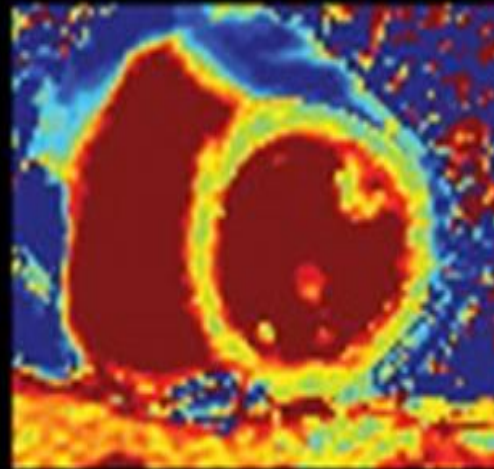
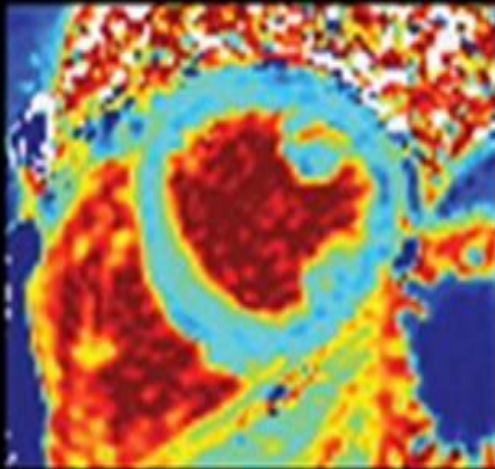
1300 ms

1100

900

700

ECV



50 %

40

30

20

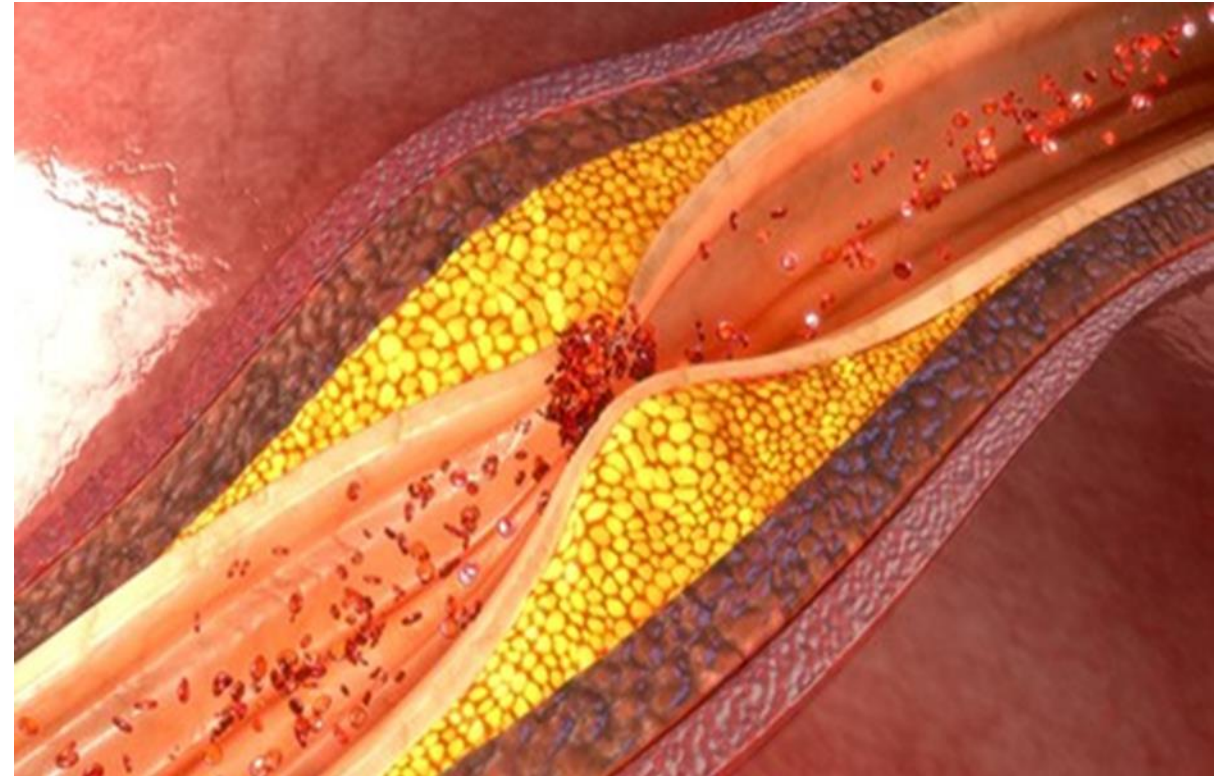
TREATMENT CCM

- ?NOT VASODILATORS – ALREADY VASODILATED
- ?NOT ACE-I ; RISK HYPOTENSION AND HRS
- NON SPECIFIC BETA BLOCKERS – ALSO LOWER PORTAL VENOUS PRESSURE
- EXPERIMENTAL:



CORONARY ARTERY DISEASE

- INCREASING INCIDENCE
- 32,5% OF NASH PATIENTS
- OLDER PATIENTS
- DIABETES
- HYPERTENSION
- OBESITY
- DYSLIPIDEMIA
- INFLAMMATION OF NASH

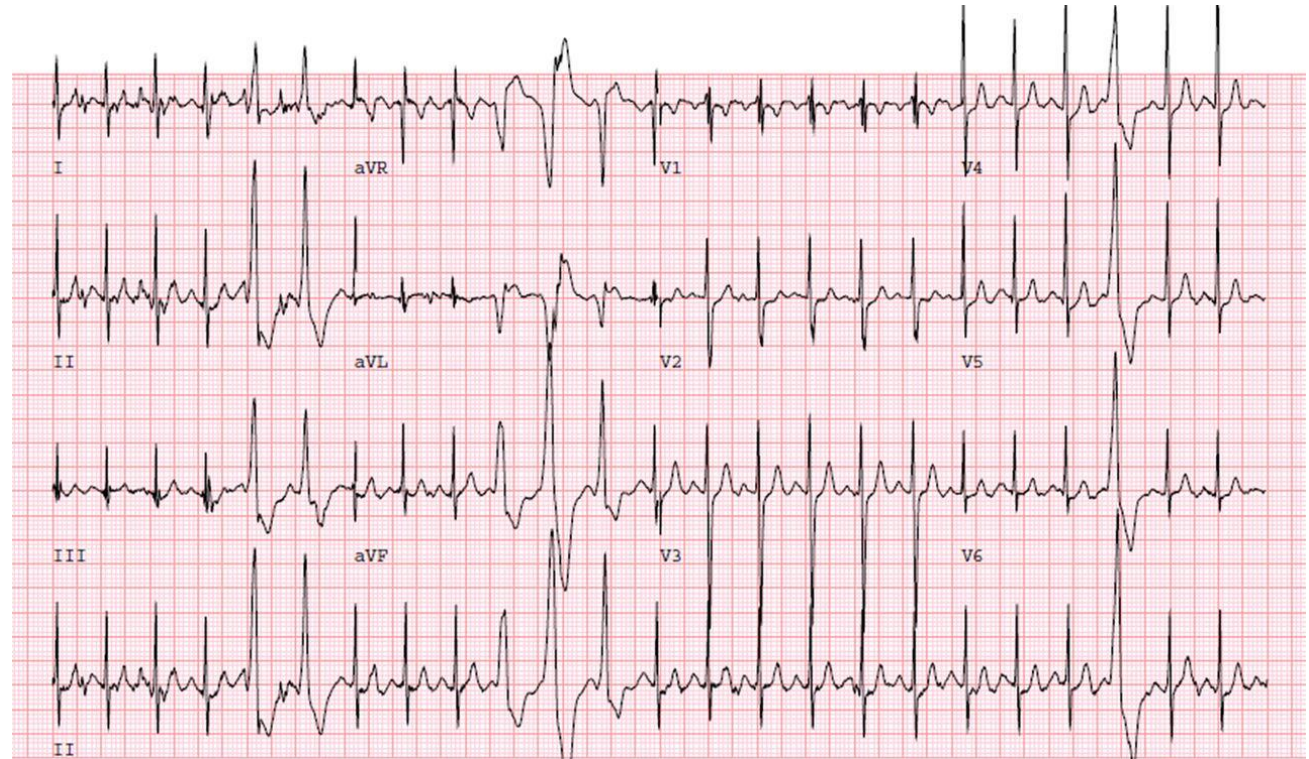




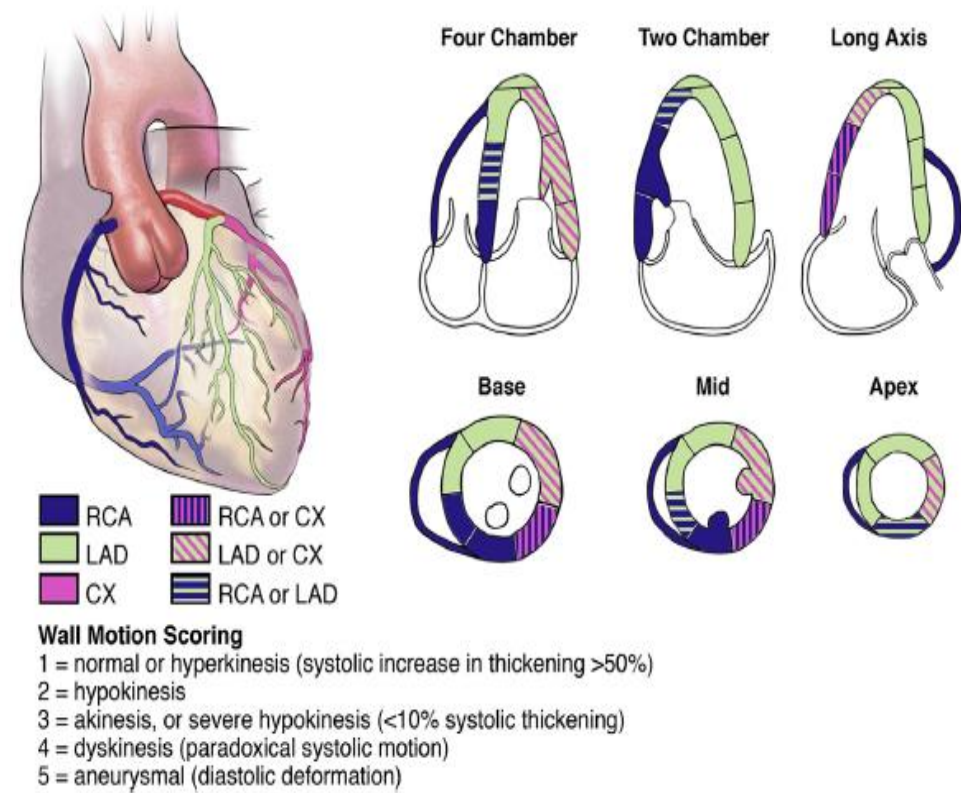
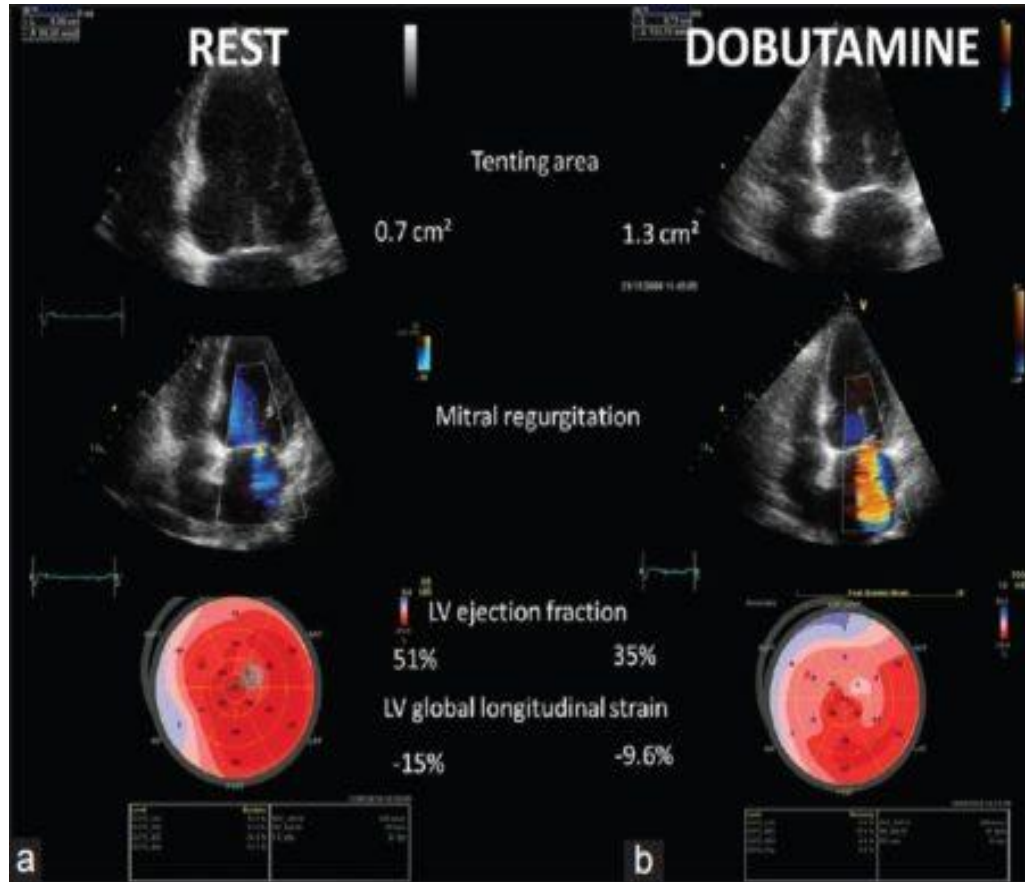
FATTY LIVER DISEASE

NON-INVASIVE TESTS

- EXERCISE STRESS ECG
- DOBUTAMINE STRESS ECHO (DSE)
- SPECT SCAN
- CORONARY CALCIUM SCORE
- CT CORONARY ANGIOGRAM

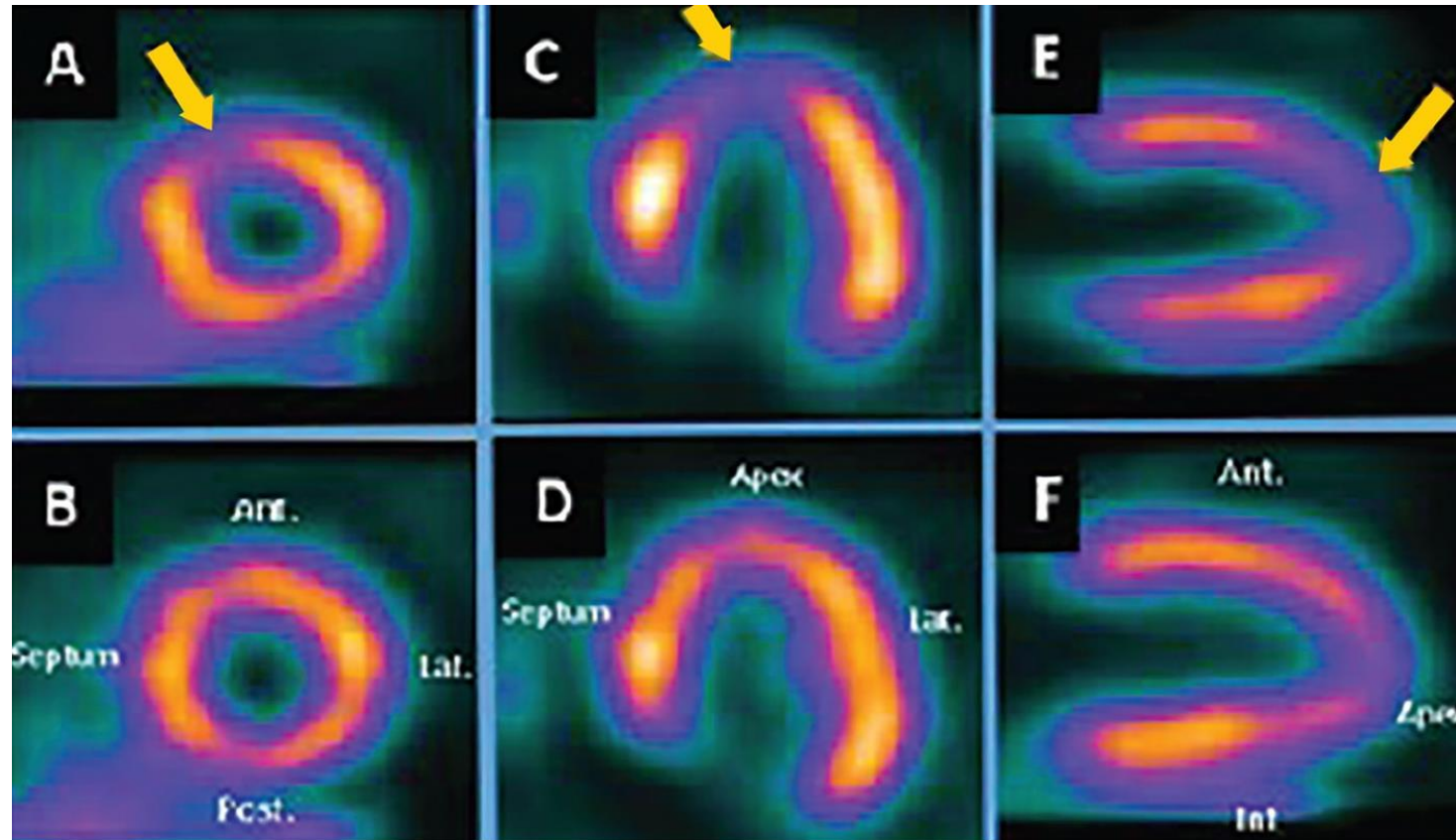


DOBUTAMINE STRESS ECHO

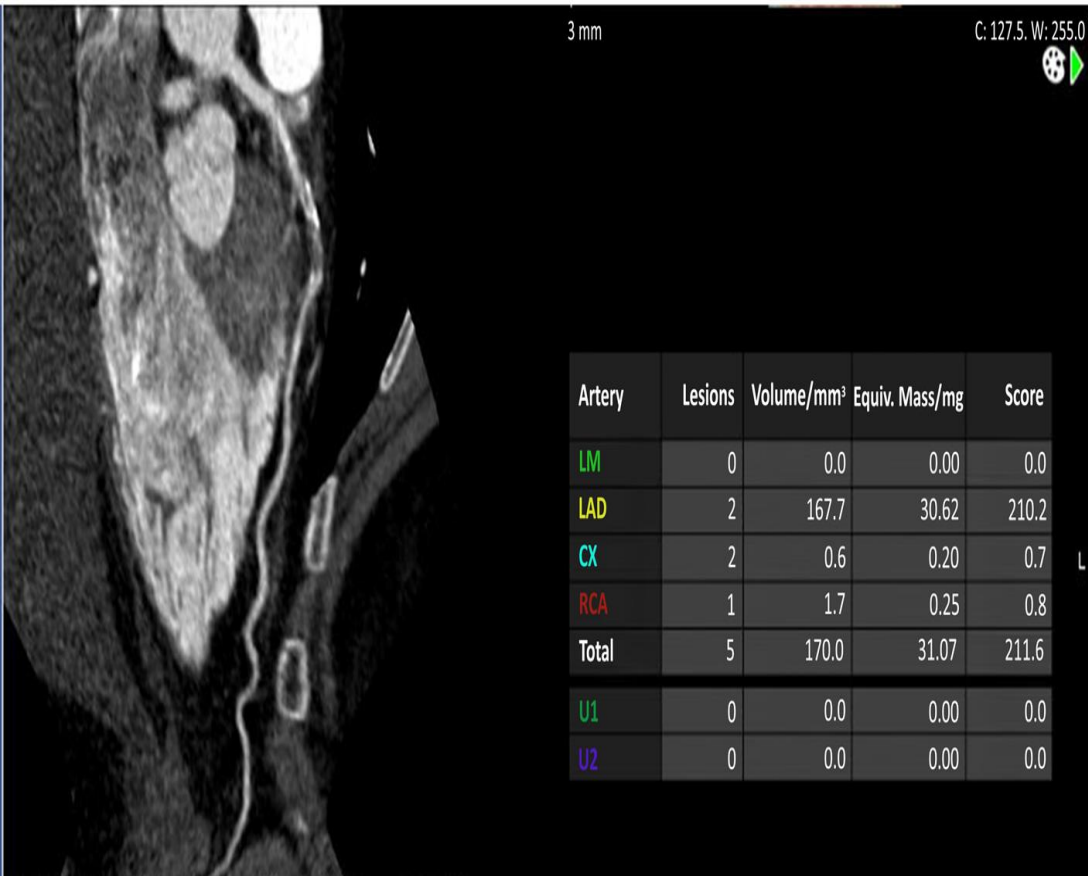


Pellikka et al, Journal of the American Society of Echocardiography

SPECT SCAN

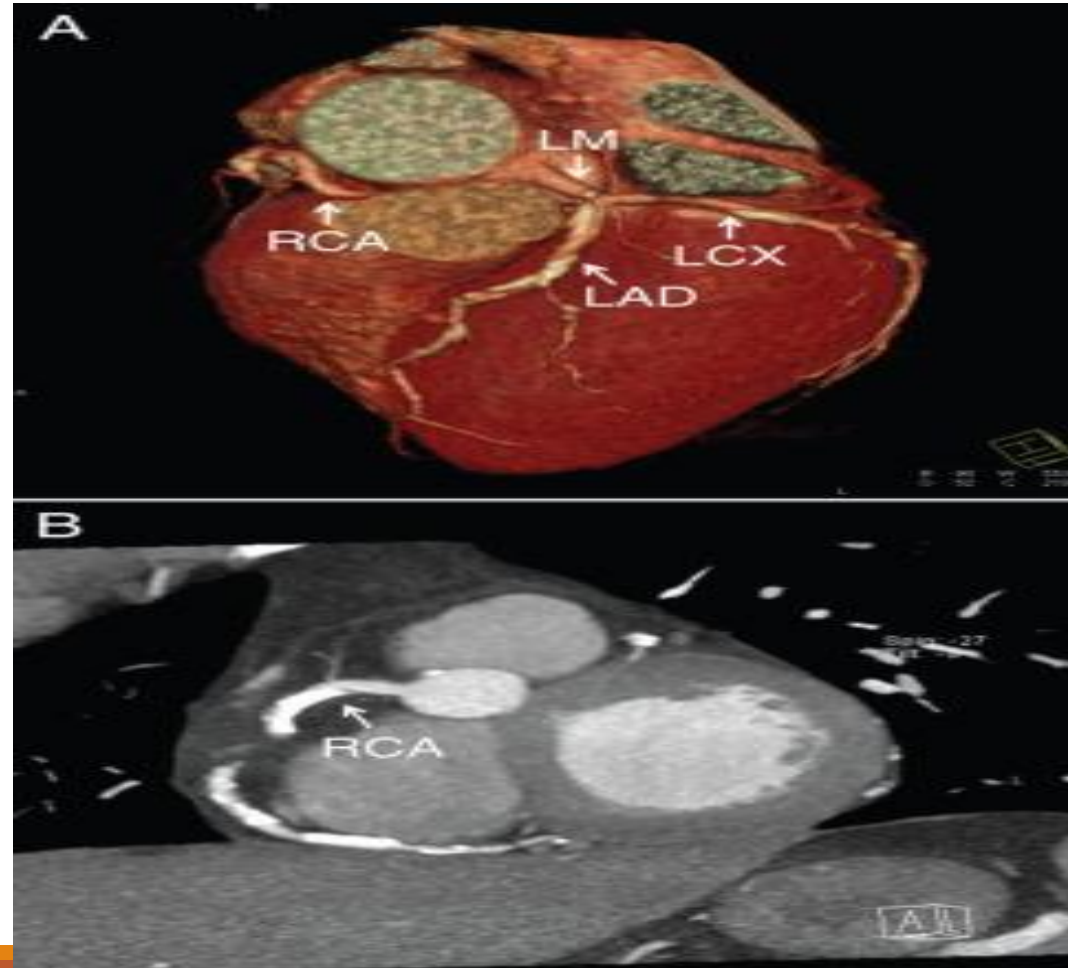


CORONARY CALCIUM SCORE



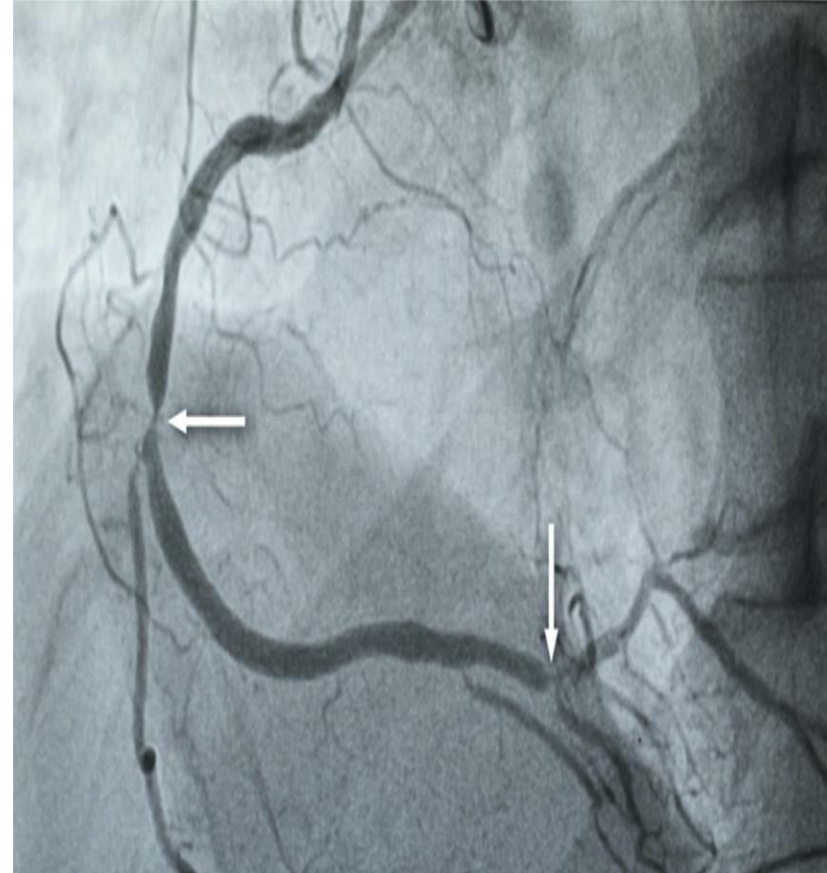
CCS (Agaston)	Risk	Description
0	Non-identified	Negative test. Findings are consistent with a low risk of having a cardiovascular event in the next 5 years.
1-10	Minimal	Minimal atherosclerosis is present. Findings are consistent with a low risk of having a cardiovascular event in the next 5 years.
11-100	Mild	Mild coronary atherosclerosis is present. There is likely mild or minimal coronary stenosis. A mild risk of having CAD exists.
101-400	Moderate	Moderate calcium is detected in the coronary arteries and confirms the presence of atherosclerotic plaque. A moderate risk of having a cardiovascular event exists.
>400	High	A high calcium score may be consistent with significant risk of having a cardiovascular event within the next 5 years

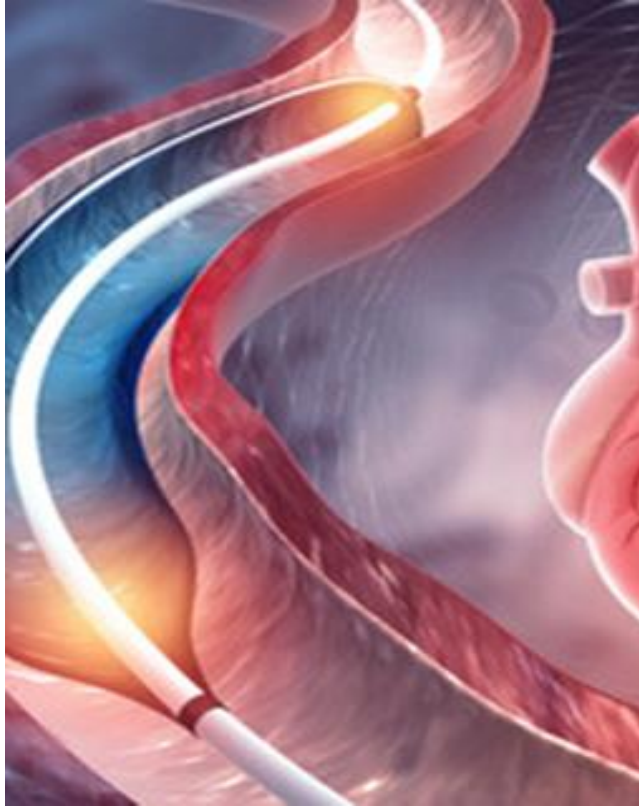
CT CORONARY ANGIOGRAPHY



INVASIVE – CORONARY ANGIOGRAPHY

- GOLD STANDARD
- ALLOWS FOR INTERVENTION
- ALLOWS FOR MEASUREMENT OF FFR
- CAN DO RHC DURING SAME PROCEDURE
- RISKS
 - ✓ BLEEDING
 - ✓ CIN / WORSENING RENAL FUNCTION





CAD – PREOP INTERVENTIONS

■ PER CUTANEOUS INTERVENTION

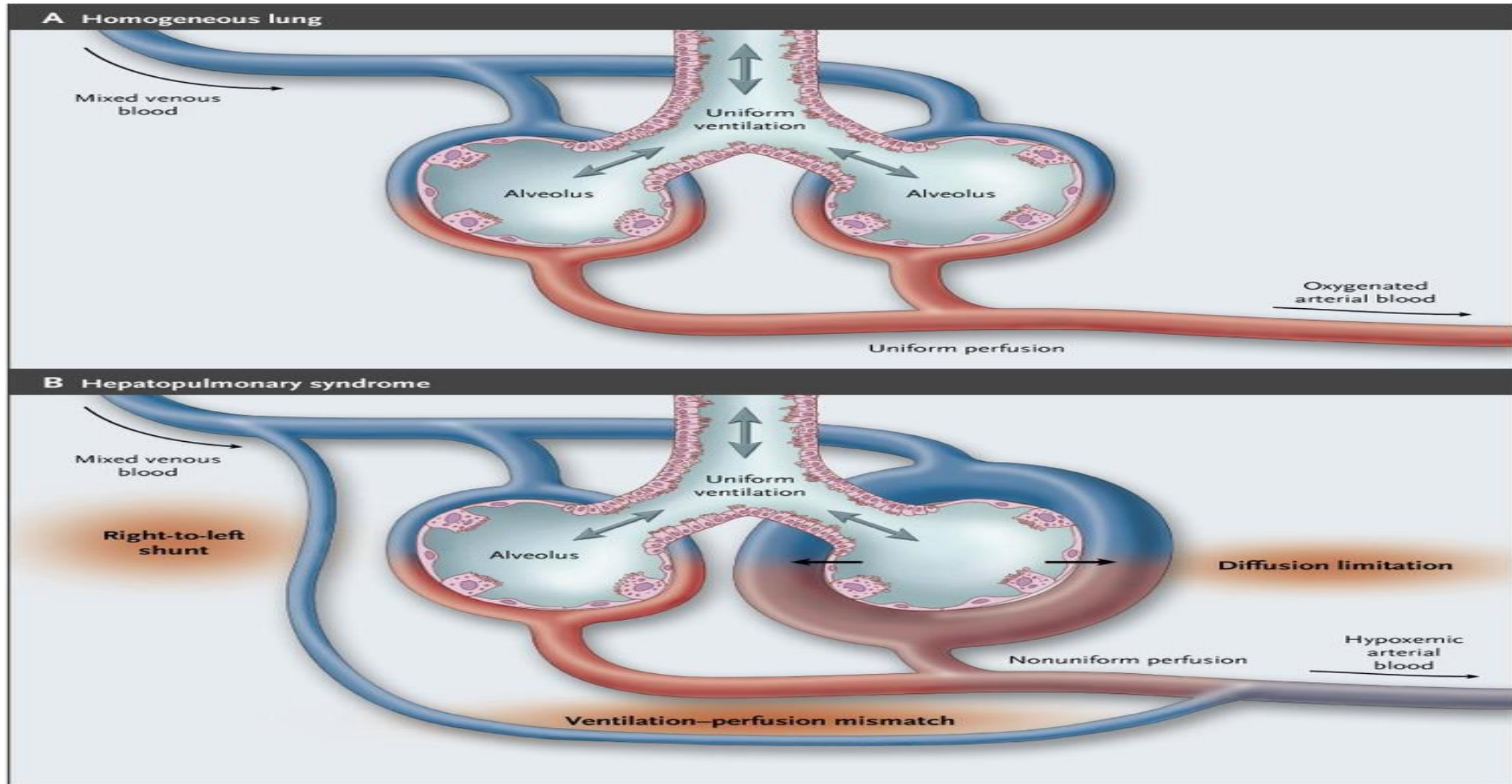
- I. BALLOON ANGIOPLASTY
- II. STENT

➤ DAPT – DELAY TRANSPLANT. RISK OF BLEEDING

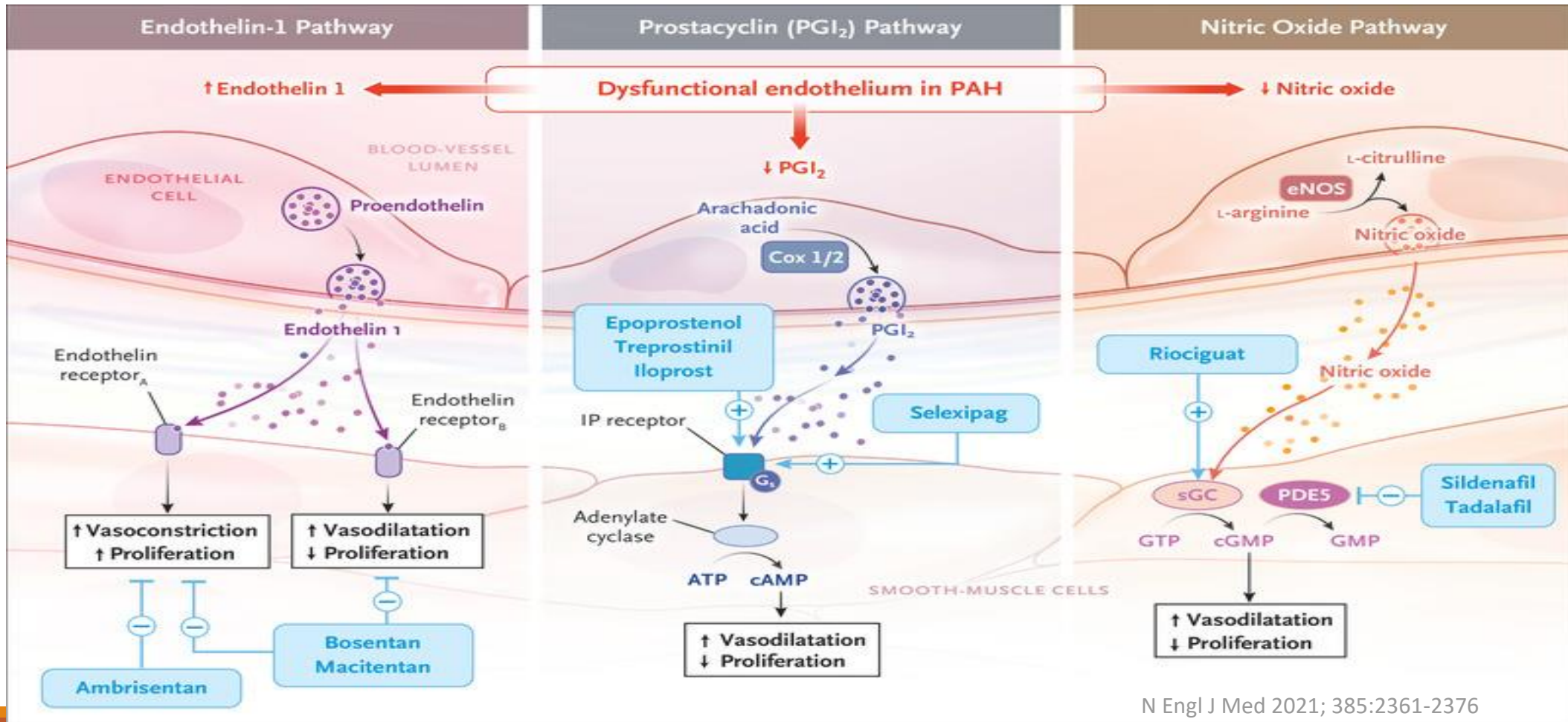
■ CABG

- I. PERIOP RISK ACLF
- ? COMBINED CABG LIVER TRANSPLANT

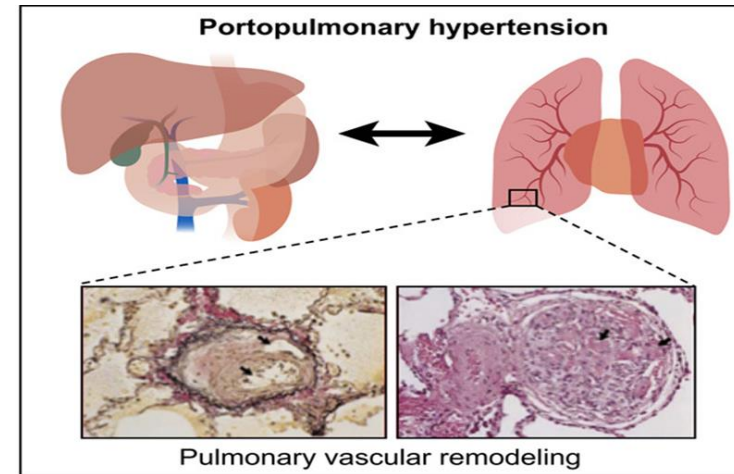
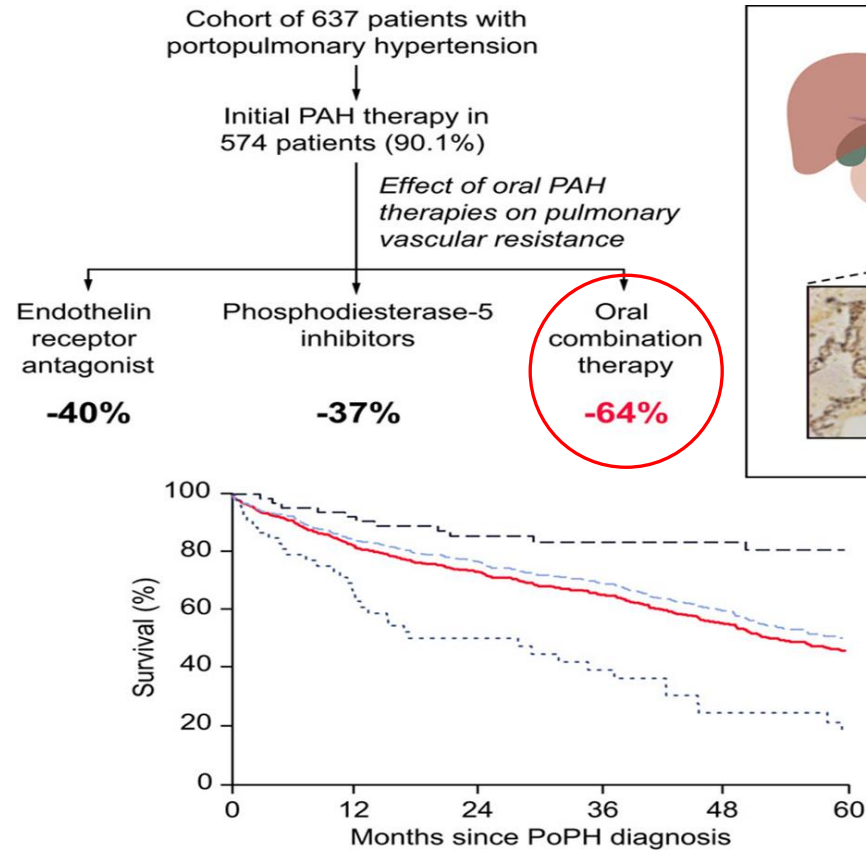
HEPATOPULMONARY SYNDROME



PORTOPULMONARY HYPERTENSION



PORTOPULMONARY HYPERTENSION



<https://carolt.nm.org/>



STEP 1: Assess Global Cardiac Risk

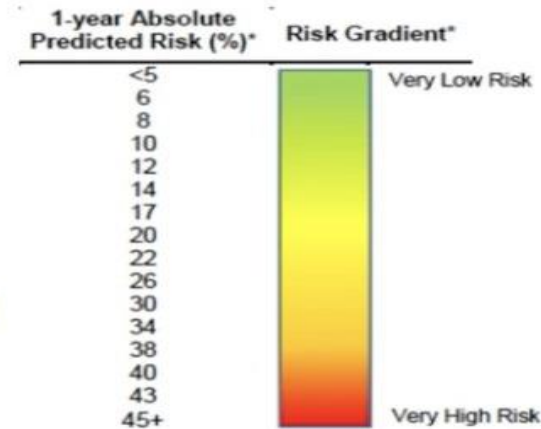
- Age
- Sex
- Race
- Employment status
- Highest education Level
- History of
 - Atrial Fibrillation
 - Diabetes
 - Pulmonary Hypertension
 - Heart Failure
 - HCC
- Current respiratory failure on a ventilator

CAR-OLT Score





www.carolt.us

Calculate



1-year risk of death or hospitalization related to a major CV event

Pretransplant Risk Factor	Points Assigned	CAR-OLT Score	1-Year Absolute Predicted Risk (%)*	Risk Gradient*	
Age Group, year		<9	<5		Very Low Risk
< 45	0	10-12	6		
45-49	-6	13-15	8		
50-54	-4	16-17	10		
55-59	2	18-19	12		
60-64	5	20-22	14		
65+	8	23-24	17		
Sex		25-26	20		
Men	0	27-28	22		
Women	1	29-30	26		
Race		31-32	30		
White	7	33-34	34		
Black	10	35-36	38		
Others	0	37-38	40		
Working status		39-40	43		
Working for income	0	> 40	45+		
Not working for income	10				Very High Risk
Education					
<= High school	5				
/unknown					
College+	0				
Atrial Fibrillation					
Yes	25				
No	0				
Respiratory failure on ventilator at transplant					
Yes	13				
No	0				
Pulmonary hypertension					
Yes	9				
No	0				
Hepatocellular carcinoma					
Yes	0				
No	6				
Hypertension					
Yes	4				
No	0				
Diabetes					
Yes	4				
No	0				
Heart Failure					
Yes	7				
No	0				

Focused H&P plus

- 12-lead ECG
- Resting TTE
- Random Troponin, BNP

Functional assessment

- 6 MWD
- CPET

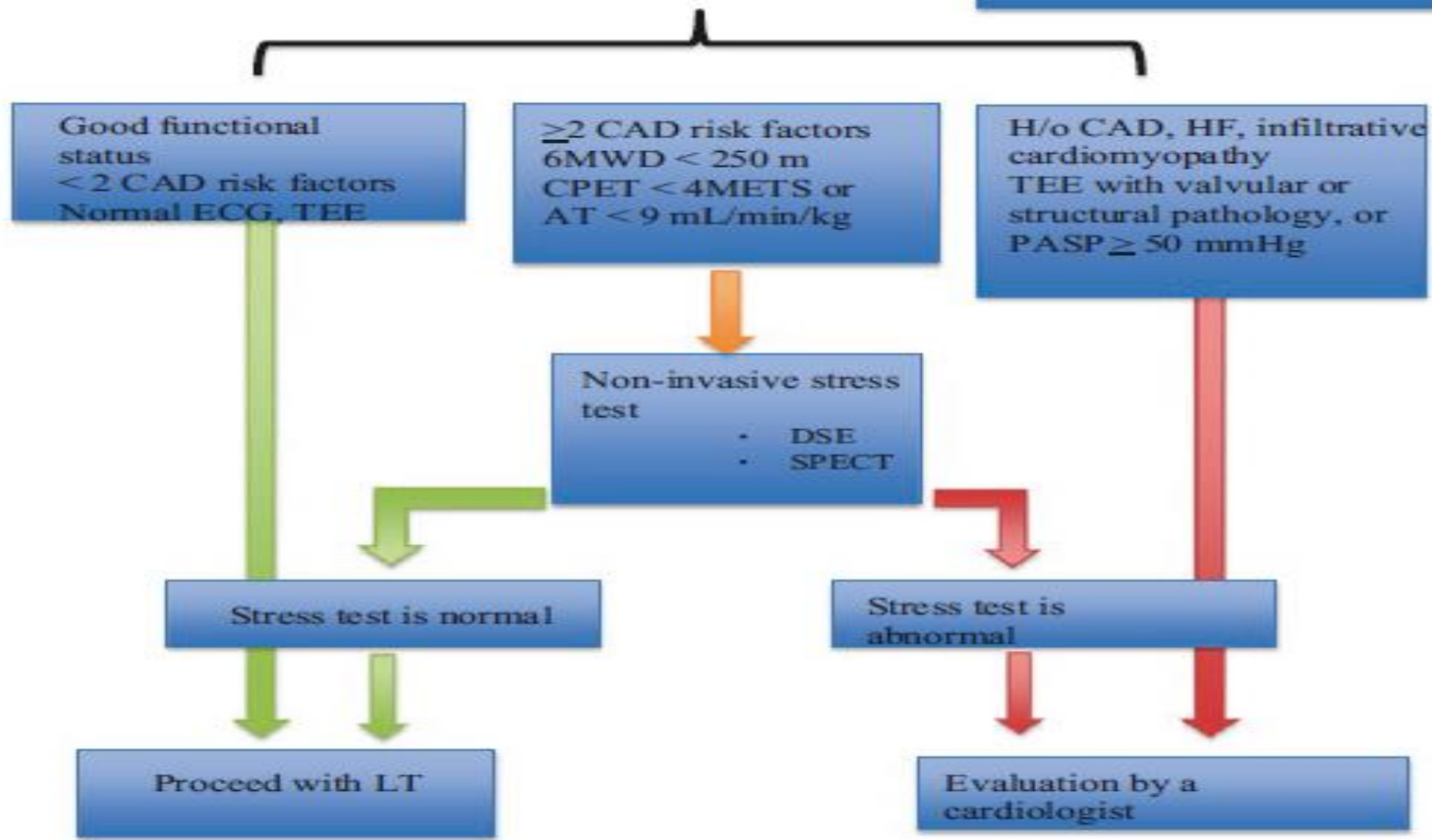
CAD assessment

History of CAD

Traditional risk factors for CAD

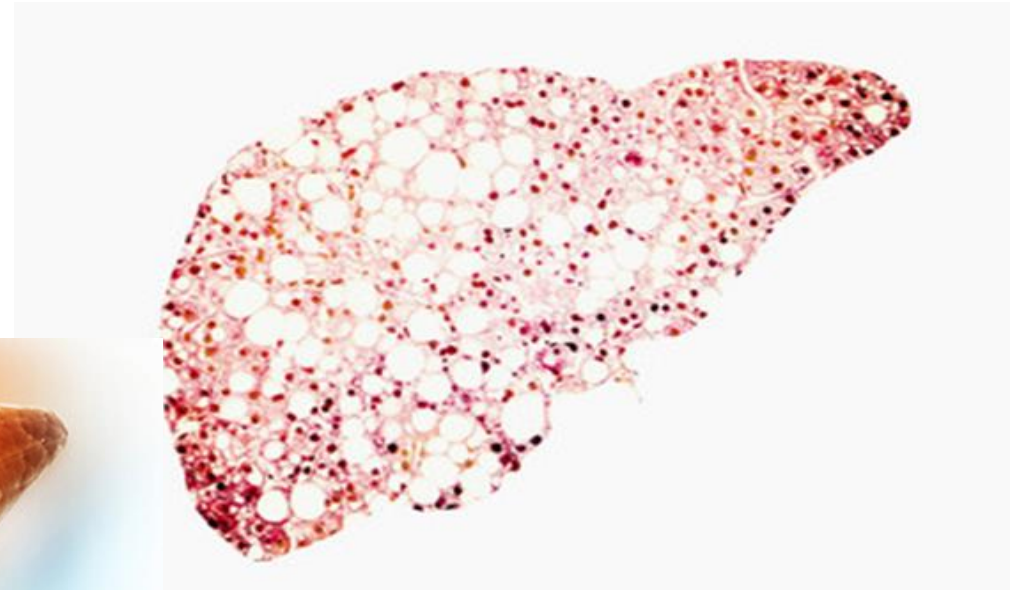
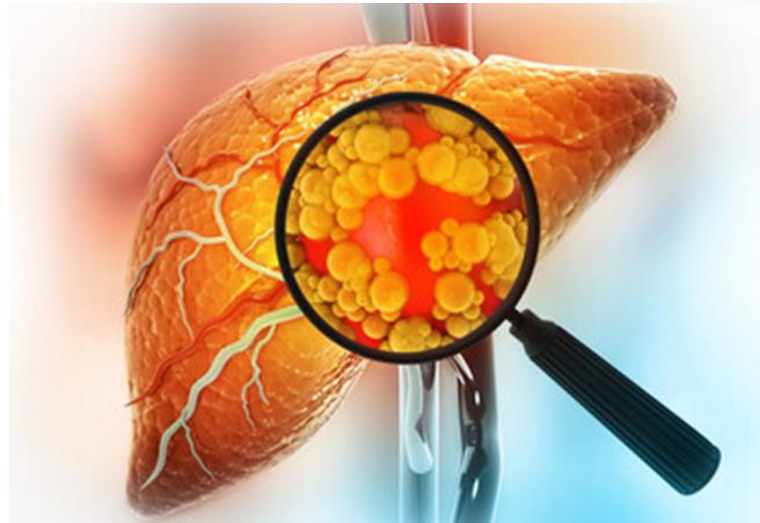
- HTN
- DM
- Dyslipidemia
- Tobacco use
- Family history of early CAD

Male < 55 y/o
Female < 65 y/o

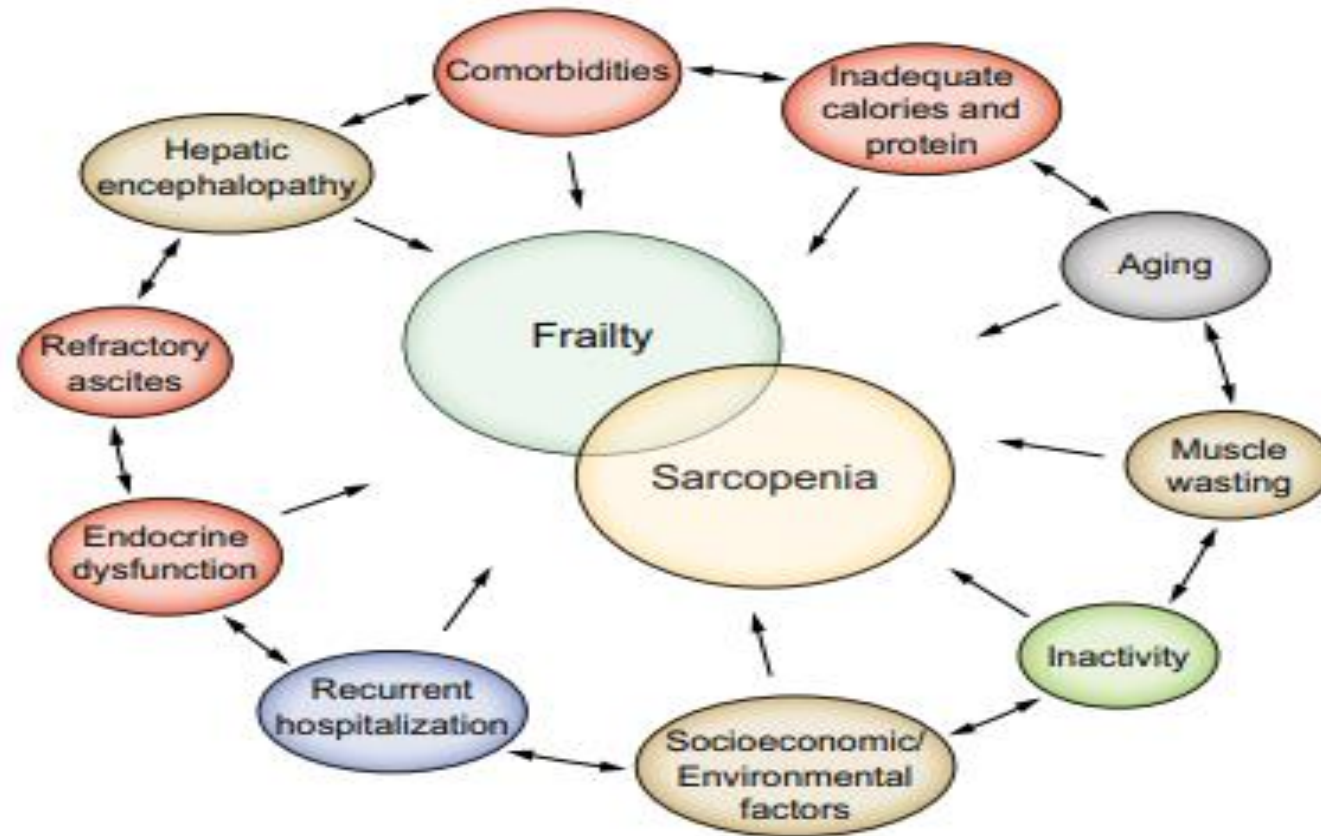


BEYOND THE HEART....

- FRAILITY
- SARCOPENIA
- SARCOPENIC OBESITY
- MYOSTEATOSIS



FRAILITY



<https://liverfrailtyindex.ucsf.edu/>



Liver Frailty Index™

Inputs: For instructions, see [i](#) below.

1. Gender: ☐ Male ☐ Female

2. [i](#) Dominant hand grip strength (kg):

attempt 1:

attempt 2:

attempt 3:

Avg:

kg

3. [i](#) Time to do 5 chair stands:

sec

4. [i](#) Seconds holding 3 position balance:

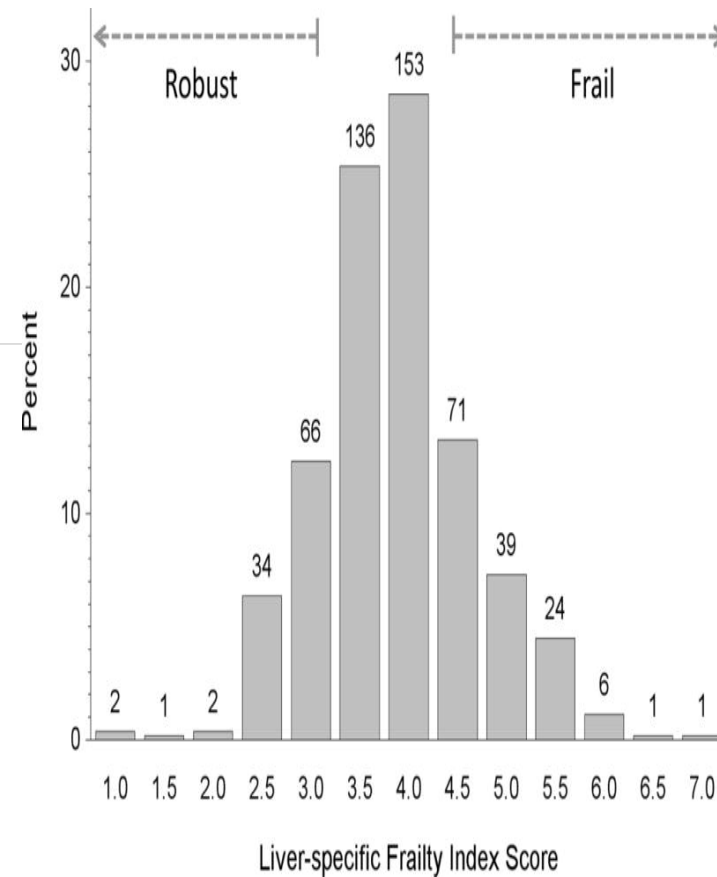
Side:

SemiTandem:

Tandem:

Total:

sec



Original Article

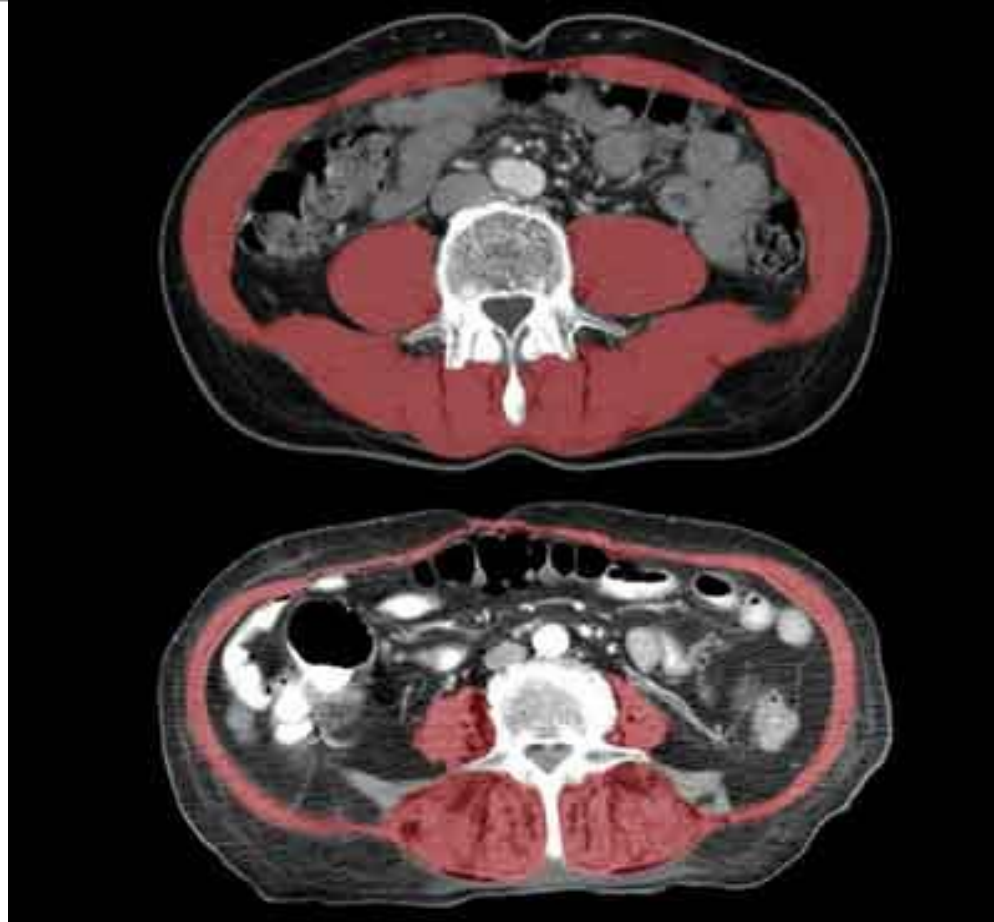
Identifying an Optimal Liver Frailty Index Cutoff to Predict Waitlist Mortality in Liver Transplant Candidates

Ani Kardashian, Jin Ge, Charles E. McCulloch, Matthew R. Kappus, Michael A. Dunn, Andres Duarte-Rojo, Michael L. Volk, Robert S. Rahimi, Elizabeth C. Verna, Daniel R. Ganger ... See all authors ✓

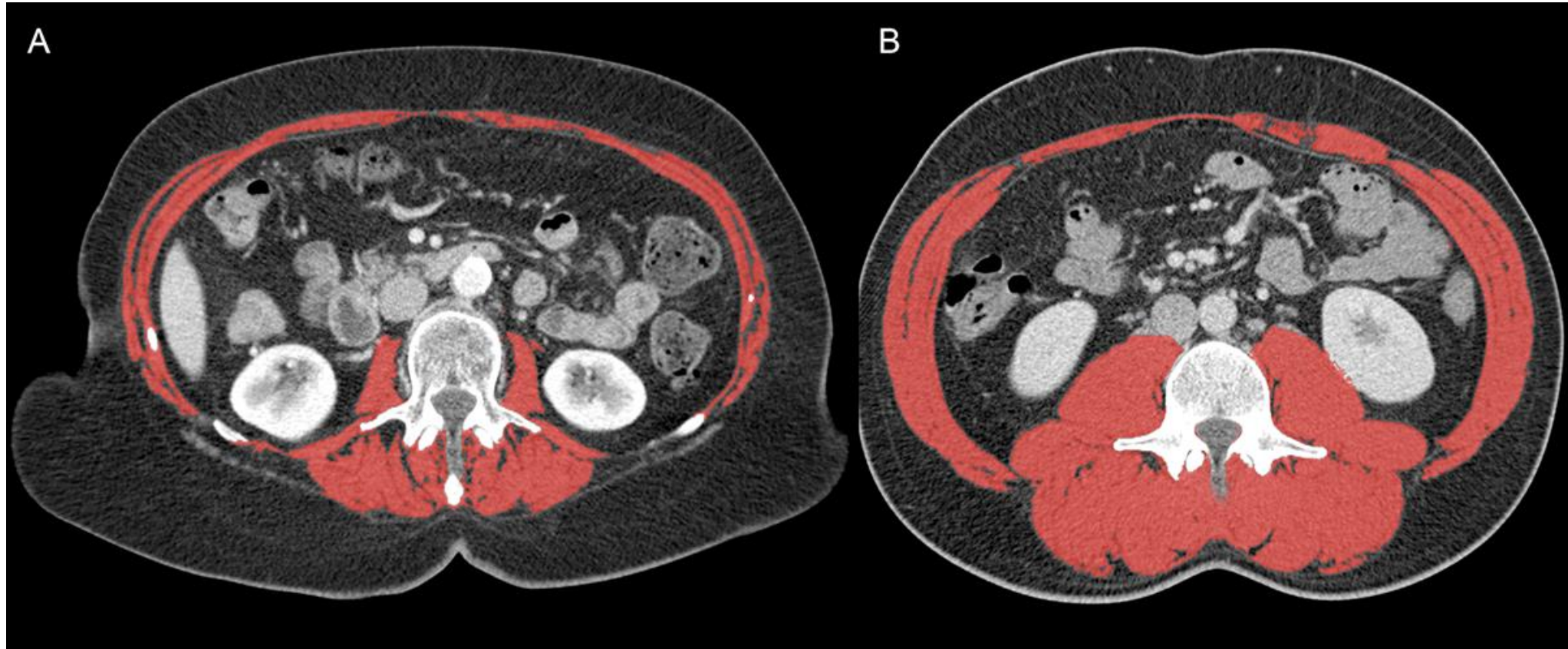
First published: 03 June 2020 | <https://doi.org/10.1002/hep.31406> | Citations: 18

LFI is predictive of waitlist mortality across a wide spectrum of LFI values. The optimal LFI cutoff for waitlist mortality was 4.4 at 3 months and 4.2 at 6 and 12 months. The discriminative performance of LFI+MELDNa was greater than MELDNa alone. Our data suggest that incorporating LFI with MELDNa can more accurately represent waitlist mortality in LT candidates.

SARCOPENIA- SKELETAL MUSCLE INDEX



SARCOPENIC OBESITY

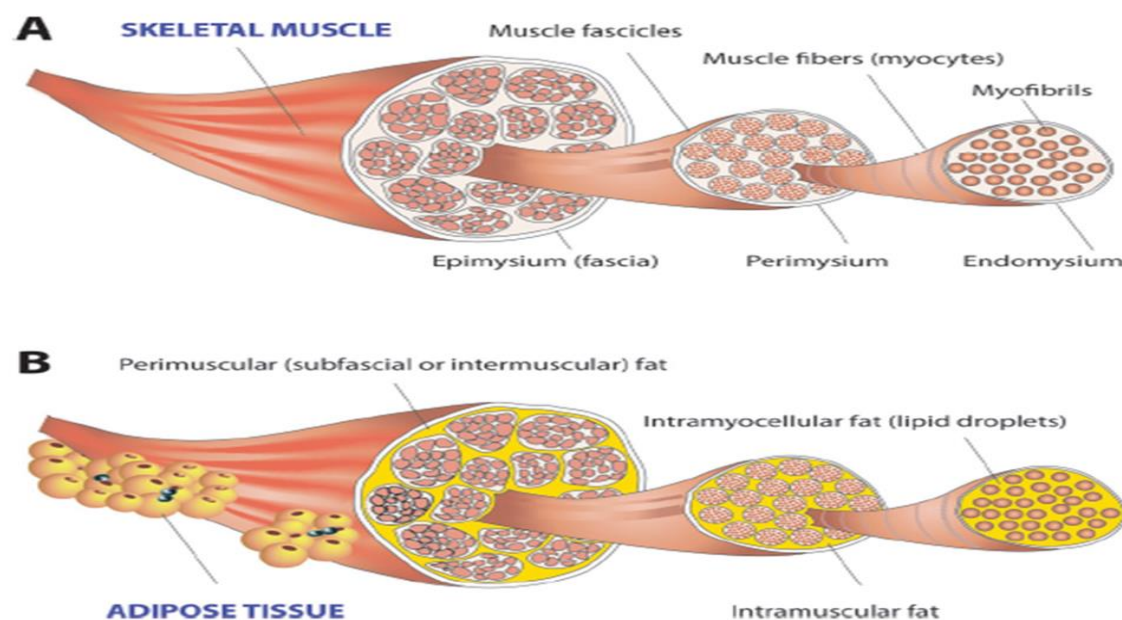


Gruber ES, Jomrich G, Tamandl D, Gnant M, Schindl M, Sahora K (2019) Sarcopenia and sarcopenic obesity are independent adverse prognostic factors in resectable pancreatic ductal adenocarcinoma. PLoS ONE

Myosteatorsis, the More Significant Predictor of Outcome: An Analysis of the Impact of Myosteatorsis, Sarcopenia, and Sarcopenic Obesity on Liver Transplant Outcomes in Johannesburg, South Africa

*Natalie E. A. Irwin¹, June Fabian,² Kapila R. Hari,¹ Liam Lorentz,³
Adam Mahomed,^{1,2} Jean F. Botha,^{1,4}*

Experimental and clinical transplantation: official journal of the Middle East Society for Organ Transplantation · August 2021



GLOBAL RISK PREDICTION SCORES OF SCORES....

TYING IT ALL TOGETHER.....

- CARDIAC
- RESPIRATORY
- NEUROLOGICAL
- MUSCULOSKELETAL
- ENDOCRINE
- ENERGY SUBSTRATE
- PSYCHO SOCIAL



Scoring the Duke Activity Status Index (in METs)

Can you.....	Score Only for Answers: "Yes, With No Difficulty."	MET Value
1. Take care of yourself, that is, eating, dressing, bathing, and using the toilet?		0.8
2. Walk indoors, such as around your house?		0.5
3. Walk a block or two on level ground?		0.8
4. Climb a flight of stairs or walk up a hill?		1.6
5. Run a short distance?		2.3
6. Do light work around the house like dusting or washing dishes?		0.8
7. Do moderate work around the house like vacuuming, sweeping floors, carrying in groceries?		1.0
8. Do heavy work around the house like scrubbing floors, or lifting or moving heavy furniture?		2.3
9. Do yard work like raking leaves, weeding or pushing a power mower?		1.3
10. Have sexual relations?		1.5
11. Participate in moderate recreational activities, like golf, bowling, dancing, doubles tennis, or throwing baseball or football?		1.7
12. Participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?		2.1

Total Score _____

Source: Cardiosource © 2008 by the American College of Cardiology Foundation



DASI SCORE



Parameters	(a) Physiological score			
	1	2	4	8
Age	≤60	61-70	≥70	
Cardiac signs	No failure	Diuretic, digoxin, anti-anginal or hypertensive therapy	Peripheral oedema or warfarin therapy	Raised central venous pressure or cardiomegaly
Respiratory signs*	No dyspnoea	Dyspnoea on exertion, mild obstructive airway disease	Limiting dyspnoea (one flight) or moderate obstructive airway disease	Dyspnoea at rest (rate ≥30/min) fibrosis or consolidation
Systolic blood pressure (mmHg)	110-130	131-170 100-109	≥171 90-99	≤89
Pulse (rate/minute)	50-80	81-100 40-49	101-120	≥121≤39
Glasgow coma scale*	15	12-14	9-11	≤8
Haemoglobin (g/dl)	13-16	11.5-12.9 16.1-17.0	10.0-11.4	≤9.9≥18.1
White cell count* (10 ⁹ cells/L)	4-10	10.1-20 3.1-4.0	≥20.1≤3.0	
Urea (mmol/L)	≤7.5	7.6-10	10.1-15.0	≥15.1
Sodium* (mmol/L)	≥136	131-135	126-130	≤125
Potassium* (mmol/L)	3.5-5.5	3.2-3.4 5.1-5.3	2.9-3.1 5.4-5.9	≥2.8≥6.0
Electrocardiogram*	Normal		Atrial fibrillation (rate 60-90)	Any abnormal rhythm or ≥5 ectopics/minute or Q waves or ST/T wave changes
(b) Operative score				
Operative severity	Minor	Moderate	Major	Major+
Multiple procedures*	1		2	>2
Total blood loss* (ml)	≤100	101-500	501-999	≥1000
Peritoneal soiling	None	Minor (serous fluid)	Local pus	Free bowel content
Malignancy	None	Minor (serous fluid)	Nodal metastasis	Distant metastasis
Mode of surgery	Elective		Urgent	Emergency

POSSUM scale (Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity)

CPET

LIVER TRANSPLANTATION 18:152-159, 2012

ORIGINAL ARTICLE


Submaximal Cardiopulmonary Exercise Testing Predicts 90-Day Survival After Liver Transplantation

James M. Prentis,^{1,4} Derek M. D. Manas,^{2,4} Michael I. Trenell,^{4,5,6} Mark Hudson,^{3,4} David J. Jones,⁴ and Chris P. Snowden^{1,4}

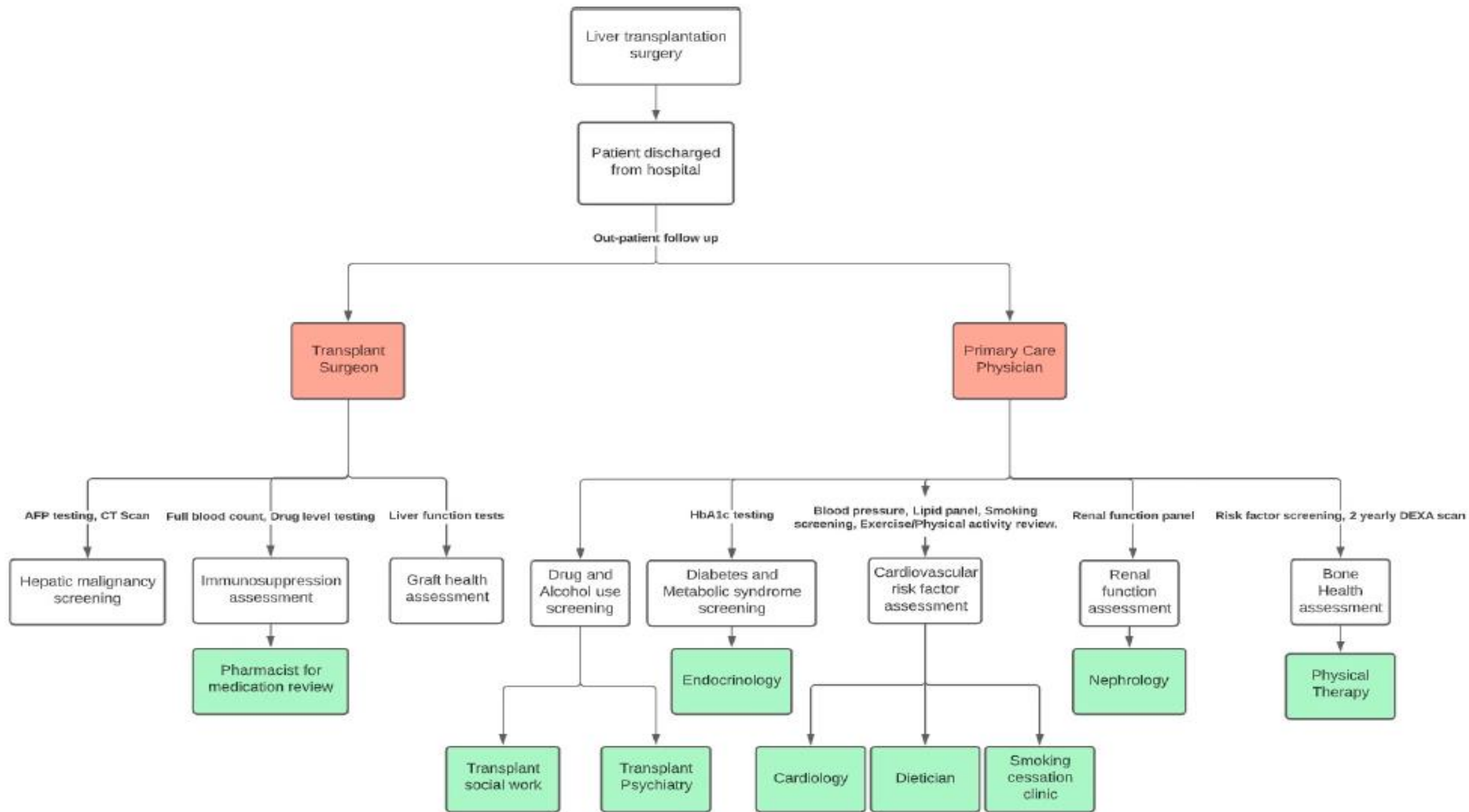
Anesthesia for Hepatico-Pancreatic-Biliary Surgery and Transplantation

Review

A Comprehensive Review on the Risk of Metabolic Syndrome and Cardiovascular Disease after Liver Transplantation

Kashyap Chauhan ¹, Adnan Khan ^{1,*}, Salil Chowdhury ¹, Heather M. Ross ², Natalia Salinas Parra ² 
and Dina Halegoua-DeMarzio ³

- 25 % RECURRENCE OF NASH POST TRANSPLANT WITHIN 3 YEARS
- 30 % NASH PATIENTS – STAGE 3 B CKD
- MECHANISM POST OP CARDIAC DISEASE:
 - HPT (UP TO 82%)– STEROID, CNI, mTOR INHIBITORS
 - DM – NODAT/PTDM (20-40%). STEROIDS, CNI
 - OBESITY – UP TO 66% - MULTIFACTORIAL
 - LIPIDS – STEROIDS, CNI, mTOR INHIBITORS
- ? ROLE OF BARIATRIC SURGERY POST TRANSPLANT



TAKE HOME MESSAGE

- NASH SOON TO BE MOST COMMON REASON FOR LIVER TRANSPLANT
- INCREASED CAD BEYOND TRADITIONAL RISK FACTORS
- MULTI-DISCIPLINARY APPROACH
- CCMO
- IDENTIFY AND TREAT CORONARY DISEASE EARLY
- PORTO PULMONARY HYPERTENSION = LETHAL
- FRAILITY, SARCOPENIA, SARCOPENIC OBESITY, MYOSTEATOSIS
- PREHABILITATION –EXERCISE, NUTRITION
- POST TRANSPLANT CARDIOVASCULAR DISEASE BURDEN

