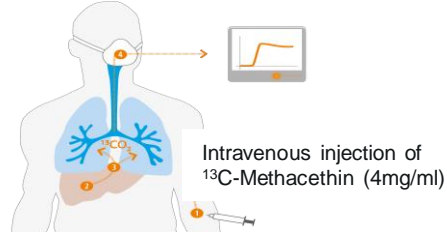
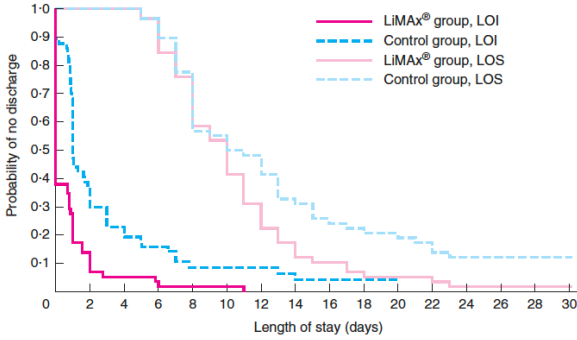


Background & Aims: Introduction of Humedics LiMAX®-test, that offers the possibility of a completely new diagnostic approach, significantly improving treatment and care of affected patients.

Description of the method: The LiMAX®-test is based on the metabolism of the non-radioactive diagnostic agent ¹³C-methacetin. ¹³C-methacetin is a substrate of the hepatic-isoenzyme P4501A2 and is converted into paracetamol and ¹³CO₂ and exhaled via the lungs. The faster and higher the increase of ¹³CO₂ within 15 to 60 minutes, measured by infrared laser-spectroscopy, the better is the liver function of the patient.



Results:



Liver surgery: Perioperative use of the LiMAX® test improves postoperative management and reduces the incidence of severe complications after liver surgery.
Shorter ICU- stay: 0.8 vs. 3.0 days, p<0.001
Shorter hospital stay: 10.6 vs 13.3 days, p=0.012
Lower severe complication rate: 12% vs 28%, p=0.022
 Stockmann et al., BJS 2018

Liver transplantation: Early diagnosis of imminent graft failure, prospective investigation of 99 patients after transplantation, 8 showed initial graft failure

- Immediately after transplantation LiMAX, bilirubin, ammonia, GLDH and INR showed significant difference
- Only LiMAX was *single, independent* predictor
- ICG-PDR as an alternative liver function test did not show meaningful results here

Lock et al., Liver Transplant 2010

TIPS: LiMAX® before TIPS, cut-of ≤ 205 µg/kg/h and one day after TIPS, cut-of ≤ 165 µg/kg/h seem to be good prognostic parameters regarding prediction of transplant-free survival of patients undergoing TIPS implantation

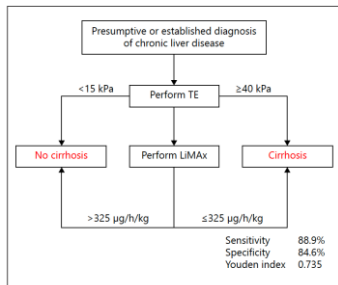
J. Rashidi-Alavijeh et al.; Scientific Reports 2021

	Sensitivity [%]	Specificity [%]	PPV [%]	NPV [%]	Cut-off	Youden index	AUROC
LiMAX one day before TIPS	100.0	73.9	53.9	100.0	≤205	0.74	0.82
LiMAX one day after TIPS	85.7	78.3	54.6	94.7	≤165	0.64	0.85
Creatinine	71.4	87.0	62.5	90.9	≥1.87	0.58	0.70
Child Pugh points	85.7	65.2	42.9	93.8	≥9	0.51	0.74
MELD score	71.4	73.9	45.5	89.5	≥15	0.45	0.80
INR	57.1	87.0	57.1	87.0	≥1.34	0.44	0.73
Bilirubin	57.1	87.0	57.1	87.0	≥1.8	0.44	0.63
Platelets	100.0	43.5	35.0	100.0	≥165	0.43	0.76
Age	71.4	89.6	41.7	88.9	≥61	0.42	0.65
LiMAX drop at day after TIPS	100.0	26.1	29.2	100.0	≥98	0.26	0.49
AST	42.9	82.6	42.9	82.6	≥29	0.25	0.62
Albumin	85.7	39.1	30.0	90.0	≤3.4	0.25	0.57
HVPG before TIPS	71.4	52.2	31.3	85.7	≥22	0.24	0.63
Change in HVPG	100.0	21.7	28.0	100.0	≤17	0.22	0.58
HVPG after TIPS	42.9	78.3	37.5	81.8	≤6	0.21	0.60
ALT	100.0	17.4	26.9	100.0	≤33	0.17	0.49

TACE: ¹³C-methacetin breath test predicts survival in patients with hepatocellular carcinoma undergoing transarterial chemoembolization (n=25)

- Both baseline and longitudinal LiMAX® values are associated with OS in TACE treated HCC patients. In addition, the relative change in LiMAX® values after the first TACE predicts short-term mortality and may assist in identifying patients who will not benefit from further TACE treatment.

Gairing et al., Clin Transl Gastroenterol. 2022



Possible diagnostic algorithm to rule out cirrhosis in patients with chronic liver disease (sensitivity 88.9%, specificity 84.6%, PPV 0.57, NPV 0.97, and Youden index 0.735).

Differential diagnosis: Close association with histologically proven parenchymal changes in patients with CLD. High diagnostic accuracy in noninvasively detecting patients with advanced fibrosis by combining liver stiffness and -function (LiMAX®), a novel and simple algorithm to rule out cirrhosis. Büchter et al., Digestion 2018

NASH: significant correlation between the functional liver capacity (LiMAX®) and the structural liver assessment by VCTE. Identify NAFLD patients at risk for disease progression (n=102)
 Cut-off-value NASH – No-NASH: LiMAX 288µg/h/kg, sensitivity/specificity 85%/83% Alizai et al., Gastroenterol Res Pract 2019

Conclusion: LiMAX® is an innovative, non-invasive dynamic semiquantitative liver function test with 100% reproducibility. The examination can be carried out in daily "real-life" medicine as well as in scientific studies. The LiMAX® test represents a procedure with high potential benefits for diagnostic reliability, therapy decision making, course of therapy and patient safety and satisfaction