1. **Pavlides, M., et al. (2017). Multiparametric magnetic resonance imaging for the assessment of non-alcoholic fatty liver disease severity. Liver international : official journal of the International Association for the Study of the Liver, 37(7), 1065–1073. https://doi.org/10.1111/liv.13284**

First clinical validation on 79 subjects, showing how LiverMultiScan can stage chronic liver disease and has high diagnostic accuracy for assessment of liver fibrosis, steatosis and haemosiderosis. This is the first demonstration of a non-invasive test to differentiate early stages of fibrosis from normal liver.

1. **Pramfalk, C., et al. (2015). Sex-Specific Differences in Hepatic Fat Oxidation and Synthesis May Explain the Higher Propensity for NAFLD in Men. The Journal of clinical endocrinology and metabolism, 100(12), 4425–4433. https://doi.org/10.1210/jc.2015-2649**

In this study men were observed to have a higher prevalence and greater risk of NAFLD compared with women despite similar levels of hepatic fat content. This is potentially driven by sex- specific differences in fatty acid metabolism.

1. **Hodson, L., et al. (2015). Menopausal Status and Abdominal Obesity Are Significant Determinants of Hepatic Lipid Metabolism in Women. Journal of the American Heart Association, 4(10), e002258. https://doi.org/10.1161/JAHA.115.002258**

The first study to report that abdominal obesity in women, as well as weight gain in post-menopausal women, are major drivers of very low density lipoprotein (VLDL) secretion, which may increase risk of cardiovascular disease. Intrahepatic fat was measured by 1H-magnetic resonance spectroscopy, visceral and subcutaneous far were measured by magnetic resonance imaging.

1. **Pavlides, M., et al. (2016). Multiparametric magnetic resonance imaging predicts clinical outcomes in patients with chronic liver disease. Journal of hepatology, 64(2), 308–315. https://doi.org/10.1016/j.jhep.2015.10.009**

LiverMultiScan demonstrated 100% negative predictive value (NPV) for liver-related clinical outcomes, in 112 patients monitored for up to 40 months. This holds prognostic potential for stratification of patients to facilitate clinical management and clinical trials.

1. **Blake, L., et al. (2016). Decision analytic model of the diagnostic pathways for patients with suspected non-alcoholic fatty liver disease using non-invasive transient elastography and multiparametric magnetic resonance imaging. BMJ open, 6(9), e010507. https://doi.org/10.1136/bmjopen-2015-010507**

The inclusion of LiverMultiScan, either as an adjunct to or replacement of transient elastography (TE) in the diagnostic pathway of NAFLD, may lead to cost savings for the NHS by reducing the number of liver biopsies required. When used in place of TE and liver biopsy, LiverMultiScan remains cost-effective up to a price of £672.

1. **Rider, O. J., et al. (2016). Investigating a Liver Fat: Arterial Stiffening Pathway in Adult and Childhood Obesity. Arteriosclerosis, thrombosis, and vascular biology, 36(1), 198–203. https://doi.org/10.1161/ATVBAHA.115.306561**

Study on 77 adults and 18 children showing that hepatic fat measured by 1H-magnetic resonance spectroscopy, is related to increased aortic stiffness in both adults and children. Hepatic fat content is a potential therapeutic target to treat the elevated vascular risk in obesity, which requires reliable biomarkers for monitoring response to treatment.

1. **Piché, M. E., et al. (2020). Obesity Phenotypes, Diabetes, and Cardiovascular Diseases. Circulation research, 126(11), 1477–1500. https://doi.org/10.1161/CIRCRESAHA.120.316101**

LiverMultiScan showed elevated hepatic fibroinflammatory and fat levels in asymptomatic patients with type 2 diabetes, suggesting significant NAFLD and NASH. This highlights an urgent need – and potential application of the technology – in screening, staging and monitoring diabetic liver disease.

1. **Eddowes, P. J., et al. (2018). Utility and cost evaluation of multiparametric magnetic resonance imaging for the assessment of non-alcoholic fatty liver disease. Alimentary pharmacology & therapeutics, 47(5), 631–644. https://doi.org/10.1111/apt.14469**

LiverMultiScan accurately identified patients with steatosis, stratified those with NASH and reliably excluded clinically significant liver disease with superior negative predictive value (83.3%) compared to transient elastography (42.9%) and ELF (57.1%). For the risk stratification of NAFLD, LiverMultiScan was cost effective and, combined with transient elastography, had the lowest cost per correct diagnosis.

1. **Wilman, H. R., et al. (2017). Characterisation of liver fat in the UK Biobank cohort. PloS one, 12(2), e0172921. https://doi.org/10.1371/journal.pone.0172921**

LiverMultiScan was used to measure hepatic fat in 4,949 participants in the UK Biobank with a success rate of 96.8% and acquisition time of 3 minutes, demonstrating feasibility to screen large populations potentially cost-effectively.

1. **Pavlides, M., et al. (2017). Multiparametric magnetic resonance imaging for the assessment of non-alcoholic fatty liver disease severity. Liver international : official journal of the International Association for the Study of the Liver, 37(7), 1065–1073. https://doi.org/10.1111/liv.13284**

LiverMultiScan had a higher success rate on 71 NAFLD patients (95%) compared to transient elastography (59%) and showed high accuracy for the diagnosis of NASH and ballooning. This demonstrates potential application in patient management as well as a surrogate endpoint in clinical trials.

1. **Tunnicliffe, E. M., et al. (2017). A model for hepatic fibrosis: the competing effects of cell loss and iron on shortened modified Look-Locker inversion recovery T<sub>1</sub> (shMOLLI-T<sub>1</sub> ) in the liver. Journal of magnetic resonance imaging : JMRI, 45(2), 450–462. https://doi.org/10.1002/jmri.25392**

Validation of the technology underpinning cT1, showing that iron correction of liver T1 values produces more accurate measures of hepatic fibro-inflammation.

1. **Kleiner, D. E., et al. (2005). Design and validation of a histological scoring system for nonalcoholic fatty liver disease. Hepatology (Baltimore, Md.), 41(6), 1313–1321. https://doi.org/10.1002/hep.20701**

Assessment of liver fibrosis by digital imaging analysis of Collagen Proportionate Area (CPA) followed by visual assessment of CPA, is more robust than visual analysis alone with improved agreement between pathologists.

1. **Li, Q., et al. (2018). Current status of imaging in nonalcoholic fatty liver disease. World journal of hepatology, 10(8), 530–542. https://doi.org/10.4254/wjh.v10.i8.530**

Review of imaging methods for NAFLD risk stratification and management, including multiparametric MRI (LiverMultiScan), MR Elastography and Ultrasound Elastography.

1. **Mozes, F. E., et al. (2019). Mapping tissue water T<sub>1</sub> in the liver using the MOLLI T<sub>1</sub> method in the presence of fat, iron and B<sub>0</sub> inhomogeneity. NMR in biomedicine, 32(2), e4030. https://doi.org/10.1002/nbm.4030**

Describes a method for computing a “water T1” by correcting the MOLLI T1 for the confounding influence of iron, fat and frequency offsets. This has the potential to improve the characterisation of fibro-inflammatory liver disease.

1. **McDonald, N., et al. (2018). Multiparametric magnetic resonance imaging for quantitation of liver disease: a two-centre cross-sectional observational study. Scientific reports, 8(1), 9189. https://doi.org/10.1038/s41598-018-27560-5**

LiverMultiScan had superior technical success rate (98.1%) even in obese subjects compared to transient elastography (85%). The technique had excellent repeatability and reproducibility and also demonstrated good diagnostic accuracy in detecting hepatic fibroinflammation, fat and iron.

1. **Mojtahed, A., et al. (2019). Reference range of liver corrected T1 values in a population at low risk for fatty liver disease-a UK Biobank sub-study, with an appendix of interesting cases. Abdominal radiology (New York), 44(1), 72–84. https://doi.org/10.1007/s00261-018-1701-2**

This study established the reference range of cT1 values for a large healthy UK population, which has potential to serve as a benchmark of normality for future studies and enables cT1 as a quantitative imaging biomarker for studies in liver health and disease.

1. **Harrison, S. A., et al. (2018). Utility and variability of three non-invasive liver fibrosis imaging modalities to evaluate efficacy of GR-MD-02 in subjects with NASH and bridging fibrosis during a phase-2 randomized clinical trial. PloS one, 13(9), e0203054. https://doi.org/10.1371/journal.pone.0203054**

cT1 showed superior reproducibility (CoV 3.1%) compared to the other non-invasive liver tests used in this NASH clinical trial: magnetic resonance elastography (CoV 11%) and transient elastography (40%). This underscores utility of cT1 in monitoring longitudinal change in NASH patients.

1. **McKay, A., et al. (2018). Measurement of liver iron by magnetic resonance imaging in the UK Biobank population. PloS one, 13(12), e0209340. https://doi.org/10.1371/journal.pone.0209340**

LiverMultiScan was used to measure hepatic iron levels in 9,108 participants of the UK Biobank study, demonstrating feasibility of large population studies in liver iron with this technique.

1. **Breen D. J. (2018). Multiparametric MRI for early detection of diffuse liver disease: an interview with David Breen. Biomarkers in medicine, 12(2), 105–106. https://doi.org/10.2217/bmm-2017-0368**

An overview of LiverMultiScan from the perspective of a radiologist, highlighting its advantages over liver biopsy and other non-invasive methods, as well as cost-effectiveness.

1. **Mole, D. J., et al. (2018). Study protocol: HepaT1ca - an observational clinical cohort study to quantify liver health in surgical candidates for liver malignancies. BMC cancer, 18(1), 890. https://doi.org/10.1186/s12885-018-4737-3**

This ongoing trial will refine the technology and clinical application of LiverMultiScan in quantifying pre-existing liver health and predicting post-intervention outcomes following liver resection in cancer.

1. **Hutton, C., et al. (2018). Validation of a standardized MRI method for liver fat and T2\* quantification. PloS one, 13(9), e0204175. https://doi.org/10.1371/journal.pone.0204175**

Technical validation of the LiverMultiScan technique (LMS IDEAL) to measure hepatic fat. LMS IDEAL had high accuracy and excellent reproducibility across major MR vendors and field strengths, over a wide range of values. Perspectum is the only imaging provider with the IDEAL technique standardised across Siemens, GE and Philips scanners.

1. **Hoy, A. M., et al. (2018). Non-invasive assessment of liver disease in rats using multiparametric magnetic resonance imaging: a feasibility study. Biology open, 7(7), bio033910. https://doi.org/10.1242/bio.033910**

LiverMultiScan accurately quantified levels of hepatic fibroinflammation, fat and iron in preclinical models.

1. **Bachtiar, V., et al. (2019). Repeatability and reproducibility of multiparametric magnetic resonance imaging of the liver. PloS one, 14(4), e0214921. https://doi.org/10.1371/journal.pone.0214921**

Technical validation of LiverMultiScan demonstrating good reproducibility and repeatability for quantifying liver tissue characteristics across different MR vendors and field strengths. Standardised biomarkers with low variability, like LiverMultiScan, are crucial for reliable readings in multicentre clinical trials.

1. **Levick, C., et al. (2019). Non-invasive assessment of portal hypertension by multi-parametric magnetic resonance imaging of the spleen: A proof of concept study. PloS one, 14(8), e0221066. https://doi.org/10.1371/journal.pone.0221066**

This proof of concept study aimed to evaluate the diagnostic accuracy of LiverMultiScan in the assessment of portal hypertension with comparison to other non-invasive technologies. Spleen cT1 showed to be a promising biomarker of portal pressure that outperformed other non-invasive scores.

1. **Harrison, S. A., et al. (2020). NGM282 Improves Liver Fibrosis and Histology in 12 Weeks in Patients With Nonalcoholic Steatohepatitis. Hepatology (Baltimore, Md.), 71(4), 1198–1212. https://doi.org/10.1002/hep.30590**

Results from a Phase 2 NASH trial showing that LiverMultiScan (cT1) can detect drug efficacy in as little as 6 weeks to serve as an early go/no-go signal. cT1 predicted responders versus nonresponders as well as correlated with histology and serum biomarkers, underscoring effectiveness in longitudinal monitoring in NASH patients.

1. **Castera, L., et al. (2019). Noninvasive Assessment of Liver Disease in Patients With Nonalcoholic Fatty Liver Disease. Gastroenterology, 156(5), 1264–1281.e4. https://doi.org/10.1053/j.gastro.2018.12.036**

Review of non-invasive methods for assessing liver disease in NAFLD and how they could be used in clinical practice. Highlights the key issues of differentiating NASH from simple steatosis and identifying advanced fibrosis.

1. **Dillman, J. R., et al. (2019). Diagnostic performance of quantitative magnetic resonance imaging biomarkers for predicting portal hypertension in children and young adults with autoimmune liver disease. Pediatric radiology, 49(3), 332–341. https://doi.org/10.1007/s00247-018-4319-1**

Evaluates the utility of quantitative MRI biomarkers including elastography and cT1 mapping for predicting portal hypertension in a paediatric population. Liver and spleen stiffness, along with liver cT1, predict radiologic portal hypertension with good accuracy.

1. **Wilman, H. R., et al. (2019). Genetic studies of abdominal MRI data identify genes regulating hepcidin as major determinants of liver iron concentration. Journal of hepatology, 71(3), 594–602. https://doi.org/10.1016/j.jhep.2019.05.032**

In this study, 3 genetic variants that are linked to an increased risk of developing higher liver iron content were identified. The same genetic variants were shown to be linked to higher risk of many diseases, but they may also be associated with some health advantages. Finally, genetic variants associated with waist-to-hip ratio were used as a tool to show that central obesity is causally associated with increased liver iron content.

1. **Triay Bagur, A., et al. (2019). Magnitude-intrinsic water-fat ambiguity can be resolved with multipeak fat modeling and a multipoint search method. Magnetic resonance in medicine, 82(1), 460–475. https://doi.org/10.1002/mrm.27728**

Technical validation of a LiverMultiScan technique (MAGO) for measurement of liver fat. MAGO showed excellent accuracy and reproducibility across different MR vendors at different field strengths. Technically challenging cases were processable with MAGO, demonstrating robustness of the technique.

1. **Tromp, J., et al. (2021). Sodium-glucose co-transporter 2 inhibition in patients hospitalized for acute decompensated heart failure: rationale for and design of the EMPULSE trial. European journal of heart failure, 23(5), 826–834. https://doi.org/10.1002/ejhf.2137**

LiverMultiScan’s cT1 was used alongside other technologies to identify new indications for existing type 2 diabetes drugs. cT1 confirmed the absence of an effect for dapagliflozin in a small NAFLD population.

1. **Gilligan, L. A., et al. (2020). Differentiating pediatric autoimmune liver diseases by quantitative magnetic resonance cholangiopancreatography. Abdominal radiology (New York), 45(1), 168–176. https://doi.org/10.1007/s00261-019-02184-z**

MRCP+ parameters and serum biochemistry values were assessed for performance in discriminating primary/autoimmune sclerosing cholangitis (PSC/ASC) from AIH in paediatric population. All but one quantitative MRCP parameter were significantly different between cohorts and predictive of diagnosis. No laboratory values were significantly different between cohorts. Study indicates that MRCP+ provides good discrimination of PSC/ASC from AIH and has the potential to provide numerous imaging biomarkers of autoimmune liver disease.

1. **Mole, D. J., et al. (2020). Quantitative magnetic resonance imaging predicts individual future liver performance after liver resection for cancer. PloS one, 15(12), e0238568. https://doi.org/10.1371/journal.pone.0238568**

This study highlights the utility of Hepatica for identifying patients at increased risk of poor post-operative liver performance and a longer stay in hospital. The results show that pre-operative cT1 is predictive of duration of post-operative hospital stay and has potential to inform the assessment of individualised patient risk as part of the clinical decision-making process for liver cancer surgery.

1. **Parmar, K. L., et al. (2020). Prospective study of change in liver function and fat in patients with colorectal liver metastases undergoing preoperative chemotherapy: protocol for the CLiFF Study. BMJ open, 10(9), e027630. https://doi.org/10.1136/bmjopen-2018-027630**
2. **Teo, K., et al. (2021). rs641738C>T near MBOAT7 is associated with liver fat, ALT and fibrosis in NAFLD: A meta-analysis. Journal of hepatology, 74(1), 20–30. https://doi.org/10.1016/j.jhep.2020.08.027**

Participants from UK Biobank and LiverMultiScan fat measurements were included in this meta-analysis of more than 42 studies, which confirmed that a common genetic variant is a risk factor for presence and severity of NAFLD in individuals of European descent.

1. **Younossi, Z., et al. (2019). Global Perspectives on Nonalcoholic Fatty Liver Disease and Nonalcoholic Steatohepatitis. Hepatology (Baltimore, Md.), 69(6), 2672–2682. https://doi.org/10.1002/hep.30251**

This proof of concept study aimed to evaluate the diagnostic accuracy of LiverMultiScan in the assessment of portal hypertension with comparison to other non-invasive technologies. Spleen cT1 showed to be a promising biomarker of portal pressure that outperformed other non-invasive scores.

1. **Parisinos, C. A., et al. (2020). Genome-wide and Mendelian randomisation studies of liver MRI yield insights into the pathogenesis of steatohepatitis. Journal of hepatology, 73(2), 241–251. https://doi.org/10.1016/j.jhep.2020.03.032**

This GWAS study of LiverMultiScan cT1 in 14,440 UK Biobank participants identified that genetic variant (SLC39A) was associated with fibro-inflammatory liver disease and could therefore be a potential target for new drugs to prevent the disease in at-risk patients.

1. **Alenaini, W., et al. (2020). Ethnic Differences in Body Fat Deposition and Liver Fat Content in Two UK-Based Cohorts. Obesity (Silver Spring, Md.), 28(11), 2142–2152. https://doi.org/10.1002/oby.22948**

This study of two independent UK‐based cohorts, showed a limited number of ethnic differences in the distribution of body fat depots associated with metabolic disease suggesting that alternative mechanisms should be investigated. LiverMultiScan® was used to measure proton density fat fraction in the UK Biobank cohort.

1. **Goldfinger, M. H., et al. (2020). Quantitative MRCP Imaging: Accuracy, Repeatability, Reproducibility, and Cohort-Derived Normative Ranges. Journal of magnetic resonance imaging : JMRI, 52(3), 807–820. https://doi.org/10.1002/jmri.27113**

Technical validation of quantitative MRCP (MRCP+), demonstrating that quantitative MRCP, especially as compared with current qualitative MRCP, could reduce subjectivity, enable measurement of duct diameter throughout the biliary tree, and automatically detect candidate strictures and dilatations with a high degree of sensitivity and specificity. Quantitative MRCP therefore improves upon the current “gold standard” of noninvasive imaging of the biliary tree.

1. **Ponnoprat, D., et al. (2020). Classification of hepatocellular carcinoma and intrahepatic cholangiocarcinoma based on multi-phase CT scans. Medical & biological engineering & computing, 58(10), 2497–2515. https://doi.org/10.1007/s11517-020-02229-2**

This study shows that a machine learning method, inspired by radiological practice, combining complementary tumour characteristics from both arterial phase (AP) and portal venous phase (PVP) CT images offers better accuracy in automatically delineating liver lesions.

1. **Dillman, J. R., et al. (2020). Relationship between magnetic resonance imaging spleen T1 relaxation and other radiologic and clinical biomarkers of liver fibrosis in children and young adults with autoimmune liver disease. Abdominal radiology (New York), 45(11), 3709–3715. https://doi.org/10.1007/s00261-020-02536-0**

In this study, splenic T1 relaxation was found to be associated with other radiologic and clinical biomarkers of liver fibrosis, including radiologic portal hypertension, in children and young adults with AILD.

1. **Thomaides-Brears, H. B., et al. (2020). Multiparametric MR mapping in clinical decision-making for diffuse liver disease. Abdominal radiology (New York), 45(11), 3507–3522. https://doi.org/10.1007/s00261-020-02684-3**

This review of techniques for clinical decision making in diffuse liver disease highlights the advantages of LiverMultiScan’s cT1 with superior NASH diagnostic ability compared with MRE which requires additional hardware and is confounded by even mild iron overload and inflammation, and DWI which currently lacks standardisation.

1. **Schaapman, J. J., et al. (2021). Multiparametric MRI in Patients With Nonalcoholic Fatty Liver Disease. Journal of magnetic resonance imaging : JMRI, 53(6), 1623–1631. https://doi.org/10.1002/jmri.27292**

This review contains the first European guidance on using multiparametric MRI, including cT1®, to assess the risk of liver fibrosis and inflammation in patients suspected of NAFLD, suggesting how improve clinical management and treatment monitoring can be improved.

1. **Jayaswal, A., et al. (2020). Prognostic value of multiparametric magnetic resonance imaging, transient elastography and blood-based fibrosis markers in patients with chronic liver disease. Liver international : official journal of the International Association for the Study of the Liver, 40(12), 3071–3082. https://doi.org/10.1111/liv.14625**

LiverMultiScan’s noninvasive MRI biomarker cT1 was shown to predict clinical outcomes in 197 liver disease patients, to outperform FibroScan’s transient elastography and FIB-4, and have similar performance to invasive liver biopsy. FibroScan was no longer predictive when high technical failure rate was accounted for.

1. **Hydes, T. J., et al. (2020). Mechanisms, screening modalities and treatment options for individuals with non-alcoholic fatty liver disease and type 2 diabetes. Diabetic medicine : a journal of the British Diabetic Association, 37(11), 1793–1806. https://doi.org/10.1111/dme.14356**

This review of screening and treatment options for patients with type 2 diabetes and non-alcoholic fatty liver disease (NAFLD) emphasizes the link between these two diseases.

1. **Cruz, M., et al. (2020). New boundaries of liver imaging: from morphology to function. European journal of internal medicine, 79, 12–22. https://doi.org/10.1016/j.ejim.2020.06.004**

This review of functional imaging techniques applied to liver imaging emphasizes how modern approaches combine morphological and functional information to provide noninvasive surrogate biomarkers of many focal and diffuse liver diseases.

1. **Dillman, J. R., et al. (2020). Comparison of liver T1 relaxation times without and with iron correction in pediatric autoimmune liver disease. Pediatric radiology, 50(7), 935–942. https://doi.org/10.1007/s00247-020-04663-8**

Using LiverMultiScan an excellent positive correlation was demonstrated between liver native T1 and iron corrected cT1 in a cross-sectional study of pediatric patients with autoimmune liver disease, bringing into question the need to perform T1 iron correction in this population.

1. **Jayaswal, A., et al. (2021). Liver cT<sub>1</sub> decreases following direct-acting antiviral therapy in patients with chronic hepatitis C virus. Abdominal radiology (New York), 46(5), 1947–1957. https://doi.org/10.1007/s00261-020-02860-5**

This study shows a decrease in liver cT1 in patients with chronic hepatitis C virus (HCV) undergoing successful direct-acting antiviral therapy. The fast reduction in cT1 suggests a reduction in inflammation rather than regression of fibrosis and demonstrates the potential for LiverMultiScan to be used as a monitoring biomarker.

1. **Zang, S., et al. (CNAFLD CRN) (2018). Haptoglobin Genotype and Vitamin E Versus Placebo for the Treatment of Nondiabetic Patients with Nonalcoholic Steatohepatitis in China: A Multicenter, Randomized, Placebo-Controlled Trial Design. Advances in therapy, 35(2), 218–231. https://doi.org/10.1007/s12325-018-0670-8**

This describes the protocol for the RADIcAL1 study, a multi-centre randomised control trial with two arms conducted in four European territories, including 1072 adult patients with suspected fatty liver disease, to evaluate cost-effectiveness of using mpMRI in tertiary-referral hepatology centres as a standardised diagnostic test for NAFLD. The goal is to demonstrate that including LiverMultiScan as a NAFLD diagnostic test may be cost-effective compared to liver-related hospital consultations and/or liver biopsies.

1. **Dennis, A., et al. (2020). A composite biomarker using multiparametric magnetic resonance imaging and blood analytes accurately identifies patients with non-alcoholic steatohepatitis and significant fibrosis. Scientific reports, 10(1), 15308. https://doi.org/10.1038/s41598-020-71995-8**

In a study of 86 biopsy confirmed NAFLD patients, LiverMultiScan’s cT1, blood tests AST (aspartate aminotransferase), GGT (gamma-glutamyl transferase) and fasting glucose were all shown to be good predictors of significant fibrosis, with the combination of cT1, AST and fasting glucose (cTAG) being superior to the independent measures. This highlights the utility of cTAG for screening patients prior to biopsy to identify those suitable for NASH clinical trial enrolment.

1. **Kennedy, P., et al. (2020). Noninvasive imaging assessment of portal hypertension. Abdominal radiology (New York), 45(11), 3473–3495. https://doi.org/10.1007/s00261-020-02729-7**
2. **Janowski, K., et al. (2021). Quantitative multiparametric MRI as a non-invasive stratification tool in children and adolescents with autoimmune liver disease. Scientific reports, 11(1), 15261. https://doi.org/10.1038/s41598-021-94754-9**

In a study of 60 pediatric patients with autoimmune hepatitis (AIH), versus 21 healthy controls, LiverMultiScan’s cT1 was shown to correlate with blood markers of disease severity and was able to identify patients with active disease despite having normal biochemistry. This demonstrates the utility of cT1 as a non-invasive technique to aid monitoring of AIH.

1. **Lam, S., et al. (2020). Serum Matrix Metalloproteinase 7 Is a Diagnostic Biomarker of Biliary Injury and Fibrosis in Pediatric Autoimmune Liver Disease. Hepatology communications, 4(11), 1680–1693. https://doi.org/10.1002/hep4.1589**

In this study to evaluate the performance of serum MMP7 (sMMP7) as a biomarker for sclerosing cholangitis (SC) in children with autoimmune liver disease (AILD), relationships were revealed between sMMP7 concentrations and bile duct injury and hepatic fibrosis as assessed by liver histopathology and using MRCP+, for which sMMP7 correlated with the number of biliary dilatations and strictures.

1. **Dennis, A., et al. (2021). Multiorgan impairment in low-risk individuals with post-COVID-19 syndrome: a prospective, community-based study. BMJ open, 11(3), e048391. https://doi.org/10.1136/bmjopen-2020-048391**

Study of 201 individuals at low risk of COVID-19 mortality, but who remained symptomatic (post-COVID-19 syndrome, PCS), showed that four months after onset of COVID-19, 42% had ≥10 symptoms, 60% had severe PCS, 70% had impairment in at least one organ and 29% had multi-organ impairment. Impairment was observed in the pancreas, heart, lung, kidneys and liver, with cardiac impairment being more common in severe PCS. Study highlights the feasibility and potential utility of community-based multi-organ assessment for management of underlying symptoms before and after infection.

1. **Sethi, P., et al. (2021). Quantitative multiparametric MRI allows safe surgical planning in patients undergoing liver resection for colorectal liver metastases: report of two patients. BJR case reports, 7(3), 20200172. https://doi.org/10.1259/bjrcr.20200172**

Case study reviewing two patients with colorectal liver metastases who had different outcomes following the same surgical procedure. After surgery, retrospective Hepatica scans revealed that the patient with a high cT1 and PDFF had a long length of stay and complications following surgery, whereas the patient with normal cT1 and PDFF had a short stay in hospital and no complications.

1. **Amerikanou, C., et al. (2021). Effect of Mastiha supplementation on NAFLD: The MAST4HEALTH Randomised, Controlled Trial. Molecular nutrition & food research, 65(10), e2001178. https://doi.org/10.1002/mnfr.202001178**

LiverMultiScan’s cT1 was the primary outcome measure in a multicenter, randomized, double blinded, placebo-controlled clinical trial (n=98) on the effect of Mastiha on liver inflammation and fibrosis. Reduction in cT1 in the Mastiha group after 6 months was observed in severely obese patients only (BMI > 35 kg/m2). No significant change observed in cT1 in placebo group.

1. **Ismail, M. F., et al. (2022). Evaluation of quantitative MRCP (MRCP+) for risk stratification of primary sclerosing cholangitis: comparison with morphological MRCP, MR elastography, and biochemical risk scores. European radiology, 32(1), 67–77. https://doi.org/10.1007/s00330-021-08142-y**

Study of 65 patients with PSC who had MRCP as well as MRE and established biochemical risk scores. MRCP images were processed with MRCP+ to provide quantitative measures and ANALI (morphological scores based on MRCP images). Key results were that compared with biochemical risk scores, MRCP+ and ANALI scores had comparable ability to stratify risk, the combination of MRCP+ with both MRE and ANALI improved their risk stratification performance.

1. **Langford, C. R., et al. (2022). Improved pathology reporting in NAFLD/NASH for clinical trials. Journal of clinical pathology, 75(2), 73–75. https://doi.org/10.1136/jclinpath-2021-207967**

Synoptic reporting provides a comprehensive and structured format, which results in a complete assessment of liver disease. This opinion piece proposes using synoptic reporting, in place of the existing narrative style, in liver biopsies for NAFLD and NASH clinical trials to improve trial success rates and accelerate drug development.

1. **Mojtahed, A., et al. (2022). Repeatability and reproducibility of deep-learning-based liver volume and Couinaud segment volume measurement tool. Abdominal radiology (New York), 47(1), 143–151. https://doi.org/10.1007/s00261-021-03262-x**

Hepatica performance was evaluated using liver MRI data from 48 participants. Hepatica automatic volume measurements were in good agreement with, had lower inter-operator variability than, and were quicker to perform than measurements made by experienced radiologists using OsiriX. The study therefore shows that Hepatica can provide accurate and precise measurements of liver volume and health to support pre-surgical decision making.

1. **Beyer, C., et al. (2021). Comparison between magnetic resonance and ultrasound-derived indicators of hepatic steatosis in a pooled NAFLD cohort. PloS one, 16(4), e0249491. https://doi.org/10.1371/journal.pone.0249491**

Study of 451 NAFLD patients with biopsy-graded steatosis, showed that diagnostic performance of LiverMultiScan PDFF was good across all steatosis grades. Diagnostic performance of CAP was good for lower levels of fat (steatosis grades ≥1) but inferior to LiverMultiScan PDFF for higher levels of fat (steatosis grades ≥2 and ≥3).

1. **Selvaraj, E. A., et al. (2021). Diagnostic accuracy of elastography and magnetic resonance imaging in patients with NAFLD: A systematic review and meta-analysis. Journal of hepatology, 75(4), 770–785. https://doi.org/10.1016/j.jhep.2021.04.044**

Comparative study in 145 patients with historical diagnosis of NAFLD or suspected of NAFLD showed that LiverMultiScan cT1 and PDFF outperformed FibroScan, MRE and SWE for identifying NASH in NAFLD population, providing vital evidence for clinical adoption.

1. **Arndtz, K., et al. (2021). Multiparametric Magnetic Resonance Imaging, Autoimmune Hepatitis, and Prediction of Disease Activity. Hepatology communications, 5(6), 1009–1020. https://doi.org/10.1002/hep4.1687**

Study of 62 AIH patients who had baseline and follow-up LiverMultiScan, showed that failure to maintain disease remission was associated with significant increases in cT1 but not liver stiffness (using FibroScan) or ELF blood test. Furthermore, baseline cT1, but not liver stiffness or ELF, was a significant predictor of future loss of biochemical remission demonstrating the potential for LiverMultiScan to contribute to risk stratification of patients with AIH.

1. **Dennis, A., et al. (2021). Correlations Between MRI Biomarkers PDFF and cT1 With Histopathological Features of Non-Alcoholic Steatohepatitis. Frontiers in endocrinology, 11, 575843. https://doi.org/10.3389/fendo.2020.575843**

The correlations between cT1 and PDFF with the histopathological hallmarks of NASH demonstrate the potential utility of both cT1 and PDFF as non-invasive biomarkers to detect a pharmacodynamic change in NASH, with cT1 showing superiority for detecting changes in inflammation and fibrosis, rather than liver fat alone.

1. **Thomaides-Brears, H. B., et al. (2022). Incidence of Complications from Percutaneous Biopsy in Chronic Liver Disease: A Systematic Review and Meta-Analysis. Digestive diseases and sciences, 67(7), 3366–3394. https://doi.org/10.1007/s10620-021-07089-w**

Review of incidence of all complications and technical failure associated with percutaneous liver biopsy showed that 2.4% had major complications, mainly bleeding, 9.5% had minor complications, mainly pain and 0.9% were technical failures, encouraging consideration of non-invasive alternatives to liver biopsy.

1. **Roca-Fernández, A., et al. (2021). Hepatic Steatosis, Rather Than Underlying Obesity, Increases the Risk of Infection and Hospitalization for COVID-19. Frontiers in medicine, 8, 636637. https://doi.org/10.3389/fmed.2021.636637**

Study of 4,458 people from the UK Biobank population showed that obese people with liver fat above healthy levels were 5 times more likely to require hospitalisation for COVID-19, indicating that high BMI in combination with high liver fat are risk factors for severe COVID-19. This study highlights how LiverMultiScan can be used to identify high risk COVID-19 patients and has potential to help guide public policies, clinical decisions and lifestyle interventions.

1. **Harrison, S. A., et al. (2021). Prospective evaluation of the prevalence of non-alcoholic fatty liver disease and steatohepatitis in a large middle-aged US cohort. Journal of hepatology, 75(2), 284–291. https://doi.org/10.1016/j.jhep.2021.02.034**

In a study of asymptomatic middle-aged Americans, the prevalence of NAFLD determined by LiverMultiScan PDFF was 38% and the prevalence of NASH defined by biopsy was 14%, with associated factors for presence of NASH being race, obesity, and diabetes. This study shows that LiverMultiScan is well-positioned to identify the high percentage of individuals with NASH in the USA.

1. **Andersson, A., et al. (2021). Clinical Utility of Magnetic Resonance Imaging Biomarkers for Identifying Nonalcoholic Steatohepatitis Patients at High Risk of Progression: A Multicenter Pooled Data and Meta-Analysis. Clinical gastroenterology and hepatology : the official clinical practice journal of the American Gastroenterological Association, S1542-3565(21)01056-9. Advance online publication. https://doi.org/10.1016/j.cgh.2021.09.041**

Study of largest cohort of suspected NAFLD patients (n=543) to date that have undergone LiverMultiScan paired with biopsy showed that MR liver fat (PDFF) and iron corrected T1 (cT1) can accurately identify NASH and cT1 is better than liver fat for identifying NASH patients at high risk of disease progression.

1. **Selvaraj, E. A., et al. (2022). A Quantitative Magnetic Resonance Cholangiopancreatography Metric of Intrahepatic Biliary Dilatation Severity Detects High-Risk Primary Sclerosing Cholangitis. Hepatology communications, 6(4), 795–808. https://doi.org/10.1002/hep4.1860**

Study in 80 patients with large-duct primary sclerosing cholangitis and 20 healthy subjects who had MRCP scans analyzed using MRCP+, showed that MRCP+ metrics related to biliary dilatation severity had promising risk-stratification ability and better interobserver agreement compared to qualitative MRCP interpretation in patients with PSC.

1. **Janowski, K., et al. (2021). Quantitative multiparametric MRI as a non-invasive stratification tool in children and adolescents with autoimmune liver disease. Scientific reports, 11(1), 15261. https://doi.org/10.1038/s41598-021-94754-9**

Study of 68 children (aged 6 to 18) with AIH (54) and ASC (14) who had LiverMultiScan, MRCP+, biopsy and liver function (blood enzyme) tests, showed that biliary tree metrics from MRCP+ could provide good discrimination between different types of AILD, and that although cT1 was not significantly different between those with AIH and those with ASC, it has utility for characterization and monitoring of parenchymal disease. The study showed that MRCP+ can be used to help stratify paediatric AILD and LiverMultiScan can help with characterization and monitoring of parenchymal disease.

1. **McKay, A., et al. (2021). Patient understanding and experience of non-invasive imaging diagnostic techniques and the liver patient pathway. Journal of patient-reported outcomes, 5(1), 89. https://doi.org/10.1186/s41687-021-00363-5**

First-of-its-kind study of 101 participants affected by liver disease who received LiverMultiScan® followed by a structured interview showed that visual reports of liver test results developed an increased understanding of liver disease care. This may have contributed to a more positive experience overall and could potentially improve patient-reported outcomes, patient engagement and adherence to treatment.

1. **Johnson, K., et al. (2021). Increased serum miR-193a-5p during non-alcoholic fatty liver disease progression: Diagnostic and mechanistic relevance. JHEP reports : innovation in hepatology, 4(2), 100409. https://doi.org/10.1016/j.jhepr.2021.100409**

This study, as part of LITMUS, performed genetic sequencing of serum blood tests (miRNA) in 138 patients with NAFLD and 10 control subjects. Results showed increased levels of miR-193a-5p between cases with mild and advanced fibrosis, low and high NAS score and low and high steatosis, activity and fibrosis (SAF) score, which were replicated in a cohort of 372 additional NAFLD cases. The study suggests that measuring miRNA may be a useful way to determine whether a patient has advanced NAFLD without a liver biopsy.

1. **Selvaraj, E. A., et al. (2021). Diagnostic accuracy of elastography and magnetic resonance imaging in patients with NAFLD: A systematic review and meta-analysis. Journal of hepatology, 75(4), 770–785. https://doi.org/10.1016/j.jhep.2021.04.044**
2. **Carolan, J. E., et al. (2022). Technology-Enabled, Evidence-Driven, and Patient-Centered: The Way Forward for Regulating Software as a Medical Device. JMIR medical informatics, 10(1), e34038. https://doi.org/10.2196/34038**

Artificial Intelligence (AI) and Machine Learning (ML) are increasingly used in software as a medical device (SaMD). This opinion piece discusses some the steps that are needed to ensure that AI-based SaMD can demonstrate patient safety and effectiveness, emphasising the need for a better understanding of the technology, clearer regulatory evidence requirements over the entire product lifecycle and continuous dialogue with end-users.

1. **Welsh, F. K., et al. (2022). Precision medicine for liver tumours with quantitative MRI and whole genome sequencing (Precision1 trial): study protocol for observational cohort study. BMJ open, 12(4), e057163. https://doi.org/10.1136/bmjopen-2021-057163**

This paper details the plans for the Precision1 trial, which is designed to investigate the clinical utility of radiogenomics in treatment planning for liver tumours. The primary endpoint will to be calculate the proportion of recruited patients that would have had a change in clinical management after whole genome sequencing. In addition, the study will evaluate the impact of LMS and Hepatica-derived results on decision making and assess the correlations between imaging, genomic and histology data.

1. **Heneghan, M. A., et al. (2022). Quantitative magnetic resonance imaging to aid clinical decision making in autoimmune hepatitis. EClinicalMedicine, 46, 101325. https://doi.org/10.1016/j.eclinm.2022.101325**

This is a first-of-its-kind study to evaluate the physician-reported confidence in LiverMultiScan for clinical management of patients with biopsy-proven AIH (n=82). The study showed that LiverMultiScan cT1 had a significant positive impact on clinician's decision making through improved disease characterisation and early detection of patients in biochemical remission with undetected, active sub-clinical disease at a high risk of relapse, compared to VCTE and serum biomarkers alone.

1. **Nanashima, A., et al. (2021). A 3D Quantitative MRC Modeling Images Detected Case of Intrahepatic Biliary Stricture Diseases. Case reports in gastroenterology, 15(2), 680–688. https://doi.org/10.1159/000518020**

Study of 3 control subjects and 5 patients with intrahepatic biliary stricture diseases who had MRCP imaging followed by analysis with MRCP+ to provide 3D visualisations of the biliary tree and quantitative metrics characterising the biliary tree anatomy. In the 3 control cases, dilated regions in the intrahepatic bile ducts were not observed. In all but 1 of the 5 patients, the volume of the biliary tree, and the total length of strictures and dilatations were lower than in the 3 control subjects. The results demonstrate that MRCP+ can indicate strictures and dilatations in the entire biliary tree at a glance and has potential to detect subtle features of intrahepatic biliary diseases at an earlier stage.

1. **Mahalingam, N., et al. (2022). Comparison of quantitative 3D magnetic resonance cholangiography measurements obtained using three different image acquisition methods. Abdominal radiology (New York), 47(1), 196–208. https://doi.org/10.1007/s00261-021-03330-2**

This study compares quantitative biliary measurements obtained using MRCP+ and three different magnetic resonance cholangiopancreatography (MRCP) acquisition methods in 69 patients, showing that MRCP with compressed sensing to reduce acquisition time produced comparable biliary diameter metrics and global duct quantification to clinically indicated MRCP.

1. **Mahalingam, N., et al. (2022). Associations between MRI T1 mapping, liver stiffness, quantitative MRCP, and laboratory biomarkers in children and young adults with autoimmune liver disease. Abdominal radiology (New York), 47(2), 672–683. https://doi.org/10.1007/s00261-021-03378-0**

This study investigated the relationship between quantitative MRI metrics, obtained from LiverMultiScan and MRCP+, and laboratory markers in children and young people with autoimmune liver disease (AILD). The results showed cT1 significantly correlates with markers of liver disease and cT1 IQR is potentially less confounded compared to MRE. MRCP+ was also shown to stratify patients into AIH and PSC/ASC sub-groups.

1. **McCrary, J., et al. (2022). Associations Between Quantitative MRI Metrics and Clinical Risk Scores in Children and Young Adults With Autoimmune Liver Disease. AJR. American journal of roentgenology, 219(1), 142–150. https://doi.org/10.2214/AJR.21.27204**

This study showed that, in a population of children and young adults with autoimmune liver disease (AILD), both LiverMultiScan and MRCP+ provided metrics that were significantly associated with the MAYO and SCOPE risk scores, and that the metrics were independent predictors of the risk scores. This means that quantitative multiparametric MRI using LiverMultiScan and MRCP+ can provide non-invasive diagnostic and prognostic tools for AILD.

1. **Ferguson, L. D., et al. (2021). Psoriatic arthritis is associated with adverse body composition predictive of greater coronary heart disease and type 2 diabetes propensity - a cross-sectional study. Rheumatology (Oxford, England), 60(4), 1858–1862. https://doi.org/10.1093/rheumatology/keaa604**
2. **Triay Bagur, A., et al. (2022). Pancreas MRI Segmentation Into Head, Body, and Tail Enables Regional Quantitative Analysis of Heterogeneous Disease. Journal of magnetic resonance imaging : JMRI, 56(4), 997–1008. https://doi.org/10.1002/jmri.28098**

This technical paper showcasing a novel algorithm from Perspectum that aims to enable regional quantification of the pancreas, which is important given that many pancreatic diseases affect the pancreas heterogeneously. The algorithm showed excellent accuracy and reproducibly of pancreas sub-segments (N=50), and provided novel insights into the health of the pancreas in diabetes (N=1170).

1. **Borlotti, A., et al. (2022). The Additive Value of Cardiovascular Magnetic Resonance in Convalescent COVID-19 Patients. Frontiers in cardiovascular medicine, 9, 854750. https://doi.org/10.3389/fcvm.2022.854750**

This review demonstrated how cardiovascular magnetic resonance (CMR) can provide a deeper insight into myocardial injury in patients recovering from COVID-19. Here, a cardiovascular finding was identified in 16% to 83% of 1,221 convalescent COVID-19 patients at 1 to 10 months following the acute phase. CMR also enabled the identification of multi-organ damage, indicating the importance of further investigation into the relationship between cardiac injury, ongoing symptoms, pre-existing risk factors and damage to other organs.

1. **Waddell, T., et al. (2022). Greater ectopic fat deposition and liver fibroinflammation and lower skeletal muscle mass in people with type 2 diabetes. Obesity (Silver Spring, Md.), 30(6), 1231–1238. https://doi.org/10.1002/oby.23425**

This study of UK Biobank participants matched for BMI, age and gender (131 patients with type 2 diabetes [T2D] vs. 135 non-diabetics) showed that LiverMultiScan detected significantly greater liver damage in participants with T2D that had normal liver biochemistry (AST, ALT). Compared to their non-diabetic counterparts, the participants with T2D had significantly higher liver fat (PDFF, 7.4% vs. 5.3%) and fibroinflammation (cT1, 730 ms vs. 709 ms), and significantly reduced skeletal muscle index (SMI, 45.2 cm2/m2 vs. 50.6 cm2/m2).

1. **Yang, L., et al. (2022). Genetic Variants of Glycogen Metabolism Genes Were Associated With Liver PDFF Without Increasing NAFLD Risk. Frontiers in genetics, 13, 830445. https://doi.org/10.3389/fgene.2022.830445**

This study was a secondary analysis of the UK Biobank data using LiverMultiScan, which showed that liver glycogen metabolism genes associated with PDFF were not associated with NAFLD, thus, implicating a potential bias effect of glycogen storage on the quantification of liver fat content by PDFF.

1. **Rijnberg, F. M., et al. (2022). 4D flow cardiovascular magnetic resonance derived energetics in the Fontan circulation correlate with exercise capacity and CMR-derived liver fibrosis/congestion. Journal of cardiovascular magnetic resonance : official journal of the Society for Cardiovascular Magnetic Resonance, 24(1), 21. https://doi.org/10.1186/s12968-022-00854-4**

Study of patients with Fontan circulation demonstrating correlation between liver fibrosis/congestion measured with LiverMultiScan’s cT1, decreased exercise capacity and adverse blood flow measured with 4D cardiac magnetic resonance.

1. **Hui, R. W., et al. (2022). Magnetic resonance imaging metrics and the predictability of adverse outcomes in on-treatment Asian chronic hepatitis B. Journal of gastroenterology and hepatology, 37(6), 1139–1147. https://doi.org/10.1111/jgh.15846**

Study of 192 patients with chronic hepatitis B (CHB) who had advanced fibrosis and were receiving treatment of nucleos(t)ide analogs, showed that liver iron level measured using LiverMultiScan predicted hepatocellular carcinoma (HCC) occurrence over 2 years. This pilot study demonstrated that LiverMultiScan could simultaneously monitor the liver and pancreas and its potential as a one-stop option for monitoring and prognostication in CHB.

1. **Seidelin, A. S., et al. (2022). A rare genetic variant in the manganese transporter SLC30A10 and elevated liver enzymes in the general population. Hepatology international, 16(3), 702–711. https://doi.org/10.1007/s12072-022-10331-w**

Study showed that a rare genetic variant (SLC30A10 p.Thr95Ile) was associated with elevated plasma alanine transaminase (ALT) and higher cT1 measured by LiverMultiScan, a marker of liver fibro-inflammation, in 14,462 UK biobank participants. Data support that the genetic variant may increase the risk of liver disease.

1. **Reddel, H. K., et al. (2021). Global Initiative for Asthma Strategy 2021: executive summary and rationale for key changes. The European respiratory journal, 59(1), 2102730. https://doi.org/10.1183/13993003.02730-2021**
2. **Catucci, D., et al. (2021). Noninvasive assessment of clinically significant portal hypertension using ΔT1 of the liver and spleen and ECV of the spleen on routine Gd-EOB-DTPA liver MRI. European journal of radiology, 144, 109958. https://doi.org/10.1016/j.ejrad.2021.109958**
3. **Abstracts of Presentations at the Association of Clinical Scientists 143<sup>rd</sup> Meeting Louisville, KY May 11-14,2022. (2022). Annals of clinical and laboratory science, 52(3), 511–525.**
4. **Martineau, A. R., et al. (2017). Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. BMJ (Clinical research ed.), 356, i6583. https://doi.org/10.1136/bmj.i6583**
5. **Janowski, K., et al. (2022). Quantitative MR in Paediatric Patients with Wilson Disease: A Case Series Review. Children (Basel, Switzerland), 9(5), 613. https://doi.org/10.3390/children9050613**

This paper is a novel case series review of seven pediatric patients with Wilson’s disease who underwent LiverMultiScan and MRCP+ along with standard of care clinical and histological examination at the Children’s Memorial Health Institute, Warsaw. While LiverMultiScan’s cT1 and PDFF correlated with histological scores of fibrosis, inflammation, and steatosis, findings from ultrasound imaging did not. MRCP+ identified dilatations in the biliary tree, not observed during the standard of care examination.

1. **Abstracts of Presentations at the Association of Clinical Scientists 143<sup>rd</sup> Meeting Louisville, KY May 11-14,2022. (2022). Annals of clinical and laboratory science, 52(3), 511–525.**
2. **Abstracts of Presentations at the Association of Clinical Scientists 143<sup>rd</sup> Meeting Louisville, KY May 11-14,2022. (2022). Annals of clinical and laboratory science, 52(3), 511–525.**
3. **Orlowski, J., et al. (2011). Na+/H+ exchangers. Comprehensive Physiology, 1(4), 2083–2100. https://doi.org/10.1002/cphy.c110020**
4. **Orlowski, J., et al. (2011). Na+/H+ exchangers. Comprehensive Physiology, 1(4), 2083–2100. https://doi.org/10.1002/cphy.c110020**
5. **Orlowski, J., et al. (2011). Na+/H+ exchangers. Comprehensive Physiology, 1(4), 2083–2100. https://doi.org/10.1002/cphy.c110020**
6. **Budjan, J., et al. (2016). Semi-automatic Volumetric Measurement of Treatment Response in Hepatocellular Carcinoma After Trans-arterial Chemoembolization. Anticancer research, 36(8), 4353–4358.**
7. **Reddel, H. K., et al. (2021). Global Initiative for Asthma Strategy 2021: executive summary and rationale for key changes. The European respiratory journal, 59(1), 2102730. https://doi.org/10.1183/13993003.02730-2021**
8. **Reddel, H. K., et al. (2021). Global Initiative for Asthma Strategy 2021: executive summary and rationale for key changes. The European respiratory journal, 59(1), 2102730. https://doi.org/10.1183/13993003.02730-2021**
9. **Kim, J. M., et al. (2020). Keratinocyte Growth Factor-1 Protects Radioiodine-Induced Salivary Gland Dysfunction in Mice. International journal of environmental research and public health, 17(17), 6322. https://doi.org/10.3390/ijerph17176322**