Prevalence and stratification of NAFLD/NASH in a UK and US cohort using non-invasive multiparametric MRI

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Background
- There is a clear need to assess the prevalence of NAFLD and NASH in the general population.
- MRI iron corrected T1 (cT1) has been shown to correlate with liver inflammation and fibrosis, and liver-related outcomes [1], and distinguish NASH from simple steatosis [2].
- Proton density fat fraction (PDFF) and cT1 are being collected as part of the UK Biobank imaging study of 100,000 individuals, and as a part of the US Prevalence study [3].

Aims
- To investigate the effectiveness of multiparametric MRI for the assessment and stratification of NAFLD/NASH in two large UK and US cohorts.

MRI identifies high risk NASH
- Of the biopsy subjects (n = 139) from the US cohort, 98% (94%) with PDFF ≥ 5% & cT1 ≥ 800 ms (750ms) had NAFLD, and 67% (67%) had NASH. (Figure 3).
- 29% (75%) of subjects with PDFF ≥ 5% & cT1 ≥ 800 ms (750ms) had high risk NASH (NAFLD and fibrosis F3-4).
- 36% (44%) of the US cohort with PDFF ≥ 5% & cT1 < 800ms (750ms) had NASH, and only 6% (11%) had high risk NASH.
- 62.5% (92%) of high risk NASH subjects had PDFF ≥ 5% & cT1 ≥ 800ms (750ms).
- Adding cT1 (800ms) improved PDFF-based stratification for NASH and high risk NASH with enrichment ratios of 116% and 25% respectively.

UK Biobank participants at high risk of NASH
- A clinical NASH cohort was derived from the UK Biobank cohort, and PDFF alone identified patients with steatosis (4).
- Applying the prevalence from the US cohort to the UK Biobank cohort, we would expect 11% prevalence of 11%.
- Similarly, we would expect 49% of Biobank participants with PDFF ≥ 5 to have NASH, and 15% to have high risk NASH.
- The US and UK cohort are ethnically different (72% Latino, 73% non-Latino vs 90% white), and the US cohort has a higher prevalence of diabetes (14.5% vs 5.4%), hypertension (41% vs 26%), and has a higher mean BMI (30 vs 26 kg/m²).

Conclusions
- Multiparametric MRI (LiverMultiScan™) is an effective non-invasive method to identify and stratify individuals with NAFLD and NASH at a population level.
- LiverMultiScan™ acquisition takes < 5 minutes, requires no contrast, can be used for high throughput analysis of a general population, and can identify individuals less likely to benefit from a liver biopsy.
- Iron corrected T1 can be used in addition to PDFF to further enrich a population for NASH with significant fibrosis.

Inflammation and/or fibrosis, no steatosis

No inflammation, fibrosis or steatosis

Inflammation and/or fibrosis, and steatosis

No inflammation or fibrosis, steatosis

Methods
Data is presented for 2895 individuals from the UK Biobank cohort. Each individual received multiparametric MRI (LiverMultiScan™ protocol; < 5 min.) to estimate liver fat fraction (PDFF) and cT1. LiverMultiScan™ uses MRI T2 combined with T1 to derive cT1. Values presented here are based on LiverMultiScan™ v2.0. cT1 has been shown to correlate with inflammation, fibrosis, and liver-related outcomes [1]. The PDFF and cT1 values from the UK Biobank cohort were compared to those obtained in a general population study in the San Antonio (TX) area [3]. Patients were recruited from those referred for routine colon cancer screening with no prior history of liver disease or alcohol abuse. Patients were invited for a biopsy if any of the four non-invasive markers they were at risk of liver disease (FibroScan Liver Stiffness Measurement ≥ 3.0kPa, MR elastography ≥ 3.0kPa, and LiverMultiScan™ PDFF ≥ 7%) and UF ≥ 3). Fibrosis was staged on the Kleiner-Brunt scale, with ≥F1 classed as significant fibrosis. Liver biopsies were double-blind evaluated with consensus using the NASH CRN scoring system by two expert pathologists.

References and acknowledgments

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