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Beta-blocker Efficacy Assessment using MRI in Guiding Therapy of Varices (BEAMinG)

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Background

Hepatic Venous Pressure Gradient (HVPG)

- Prognosis
- Assessment of treatment response

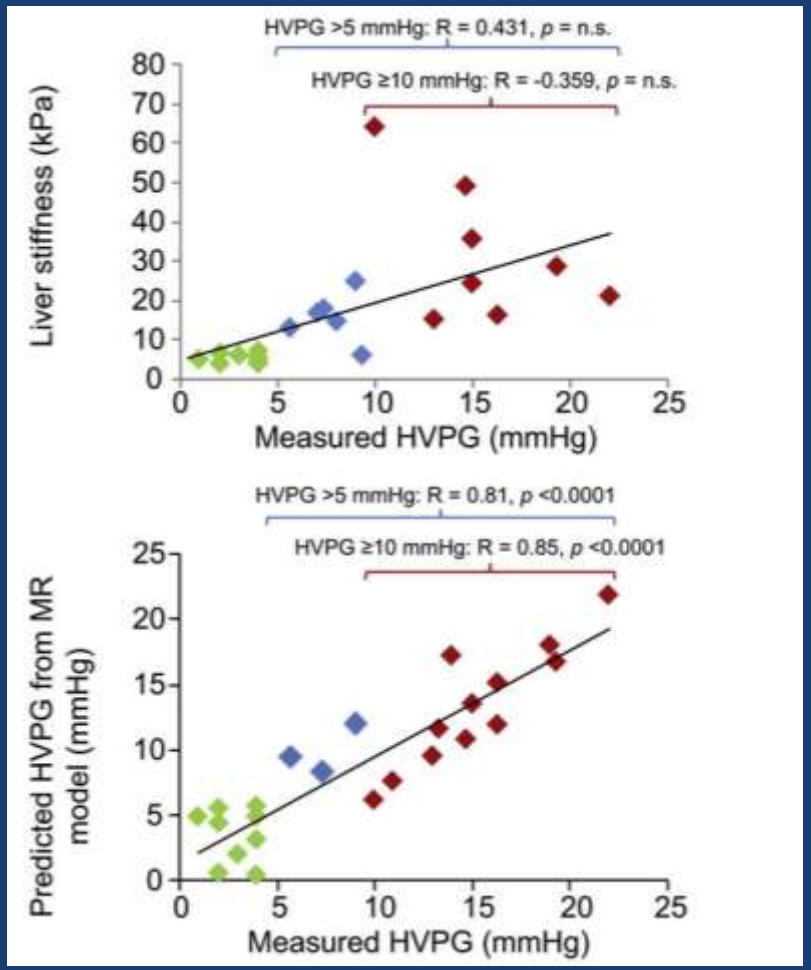
BUT…

- Invasive
- Not widely available
- Expensive

Quantitative MRI in Portal Hypertension

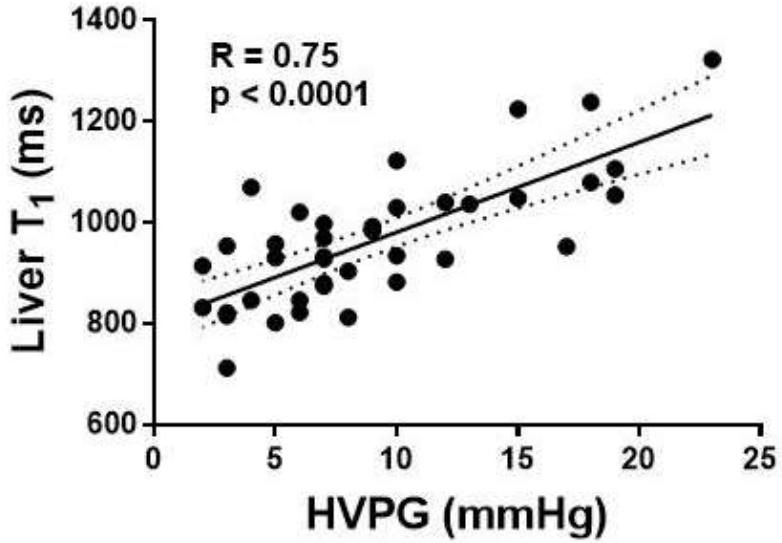
- Combination of
  - Liver T1
    - liver architecture
  - Splenic artery velocity / SMA velocity
    - splanchnic haemodynamics

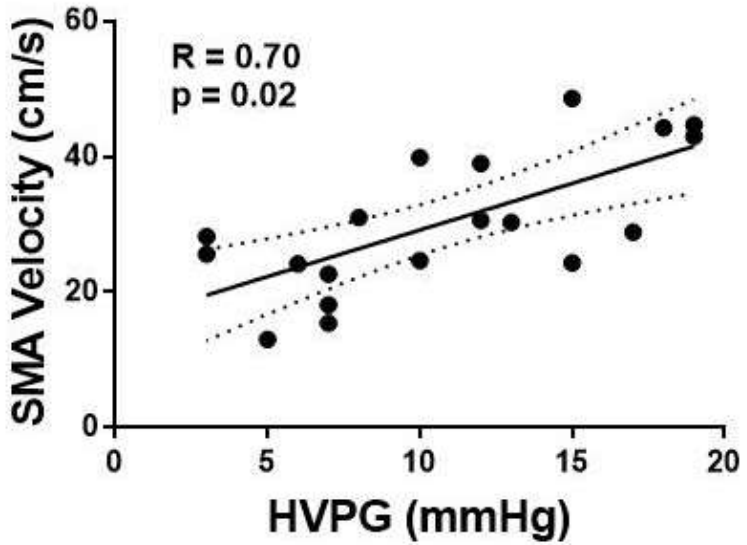
- Non-contrast scan
- Short scan time
- 1.5 T scanners



Palaniyappan 2016 J Hep

Validation at 3T





Scott EASL 2019

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Submitted to EME Researcher-led Call 18/170

Aim

To compare changes in splanchnic haemodynamic and structural MRI measures with changes in HVPG in patients with cirrhosis and varices treated with carvedilol

Objectives

- To harmonise the Nottingham MRI protocol validated as a surrogate for HVPG across research centres.
- To evaluate if changes in quantitative MRI measures reflect changes in HVPG following carvedilol treatment in the primary prophylaxis for varices.
- To investigate the mechanism of action of carvedilol by evaluating the changes in splanchnic and collateral flow, cardiac function, and liver T1.

Chief Investigator : Guruprasad Aithal

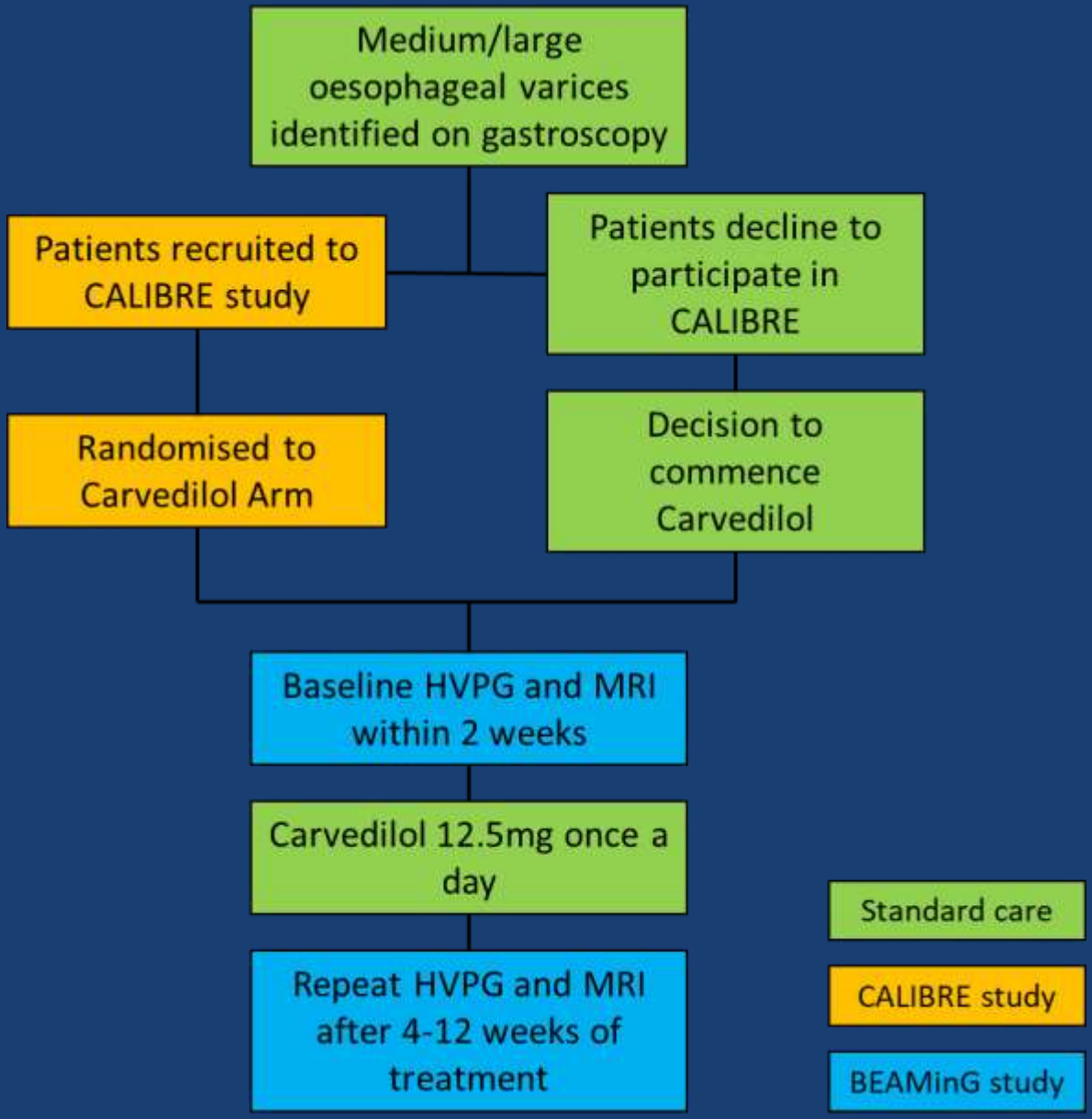
Team

- Hepatology
  - Nottingham – N Palaniyappan, IN Guha, S Ryder
  - Edinburgh – J Fallowfield, P Hayes
  - UCL – R Mookerjee
  - Birmingham – D Tripathi
  - Derby – A Austin
- Physics/Radiology
  - Nottingham – S Francis
  - Edinburgh – S Semple
  - UCL – M Chouhan
- Nottingham CTU
  - A Montgomery
  - C Partlett

Project plan

- Stage 1
  - Dissemination and harmonisation of quantitative MRI protocol across sites
  - QA scans including phantoms and healthy volunteers

- Stage 2
  - Prospective, cross-sectional study


Medium/large oesophageal varices identified on gastroscopy
Patients recruited to CALIBRE study
Patients decline to participate in CALIBRE
Randomised to Carvedilol Arm
Decision to commence Carvedilol
Baseline HVPG and MRI within 2 weeks
Carvedilol 12.5mg once a day
Repeat HVPG and MRI after 4-12 weeks of treatment
Standard care
CALIBRE study
BEAMinG study

Statistical analysis

- Pearson correlation to determine strength of correlation between change in MRI measures and change in HVPG

Sample size

- Conservatively assuming a correlation of 0.72 between change in MRI and change in HVPG, n=94 required to ensure lower limit of 95% confidence interval is at least 0.6.
- Allowing 20% drop-out, we aim to recruit 118 patients.

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Thank you

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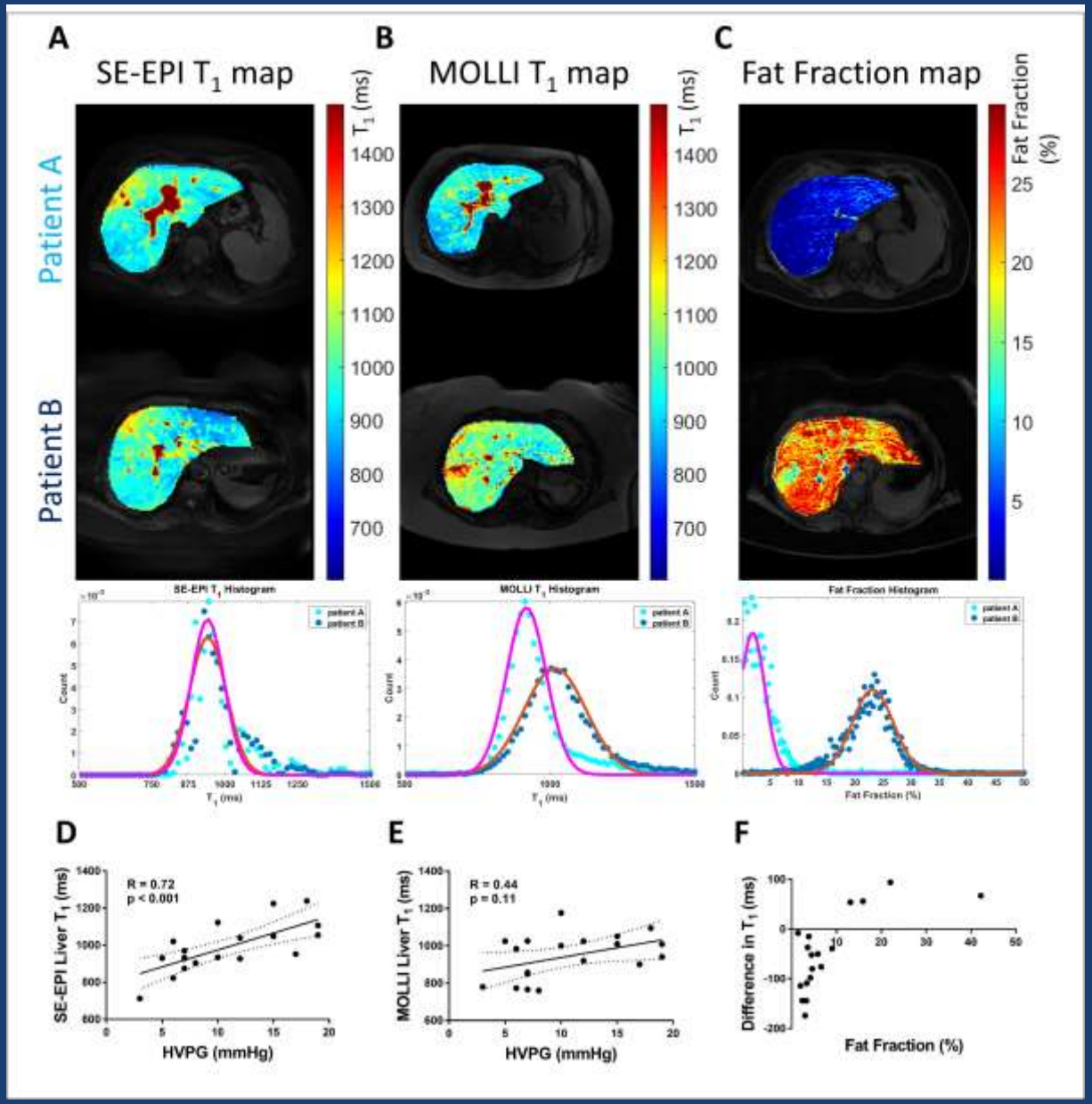
Not all T1 measurements are the same…


A
SE-EPI T_1 map
B
MOLLI T_1 map
C
Fat Fraction map
Patient A
Patient B
T_1 (ms)
1400
1300
1200
1100
1000
900
800
700
Fat Fraction (%)
25
20
15
10
5
SE-EPI T_1 Histogram
MOLLI T_1 Histogram
Fat Fraction Histogram
patient A
patient B
Count
T_1 (ms)
Fat Fraction (%)
D
E
F
SE-EPI Liver T_1 (ms)
R = 0.72
p < 0.001
HVPG (mmHg)
MOLLI Liver T_1 (ms)
R = 0.44
p = 0.11
HVPG (mmHg)
Difference in T_1 (ms)
Fat Fraction (%)