Quantitative MRCP metric to distinguish IgG4-sclerosing cholangitis from primary sclerosing cholangitis

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Background & Aim

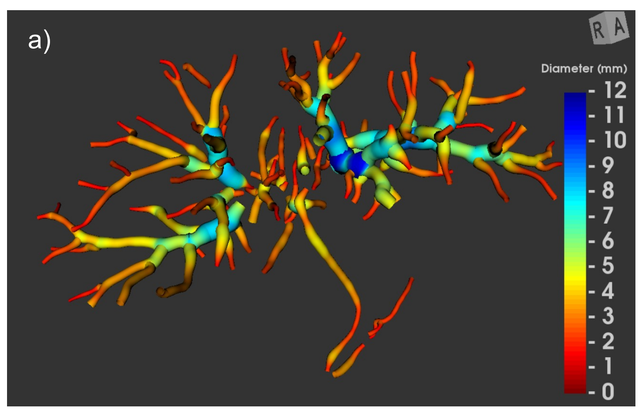
- Immunoglobulin G4-related sclerosing cholangitis (IgG4-SC) is often difficult to distinguish from primary sclerosing cholangitis (PSC) using traditional imaging assessments.
- We hypothesise that quantitative biliary tree assessments would enable stratification of patients with PSC and IgG4-SC.
- MRCP+ (Perspectum, Oxford, UK) is a quantitative imaging tool that uses artificial intelligence led technology to enhance MRCP images and create true 3D rendered models of enhanced data and metrics to facilitate visualisation and quantitative assessment of the biliary tree and pancreatic duct.

Methods

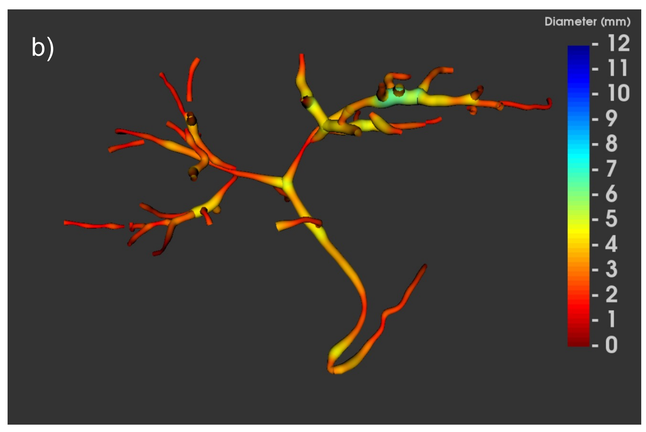
- We recruited 12 patients with histologically-confirmed IgG4-related disease (IgG4-RD). 6 males, median age 67 [range: 46–79] years, disease duration: 2 [range:1–9] years
- Disease phenotype: n=10 pancreatobiliary, n=9 active disease at recruitment
- Coronal T2-weighted 3D MRCP were prospectively performed on 1.5T Siemens scanner.
- MRCP data was processed using MRCP+ as described below to compute biliary tree metrics. MRCP+ metrics with good or excellent scan-rescan repeatability (ICC > 0.60) were included in analysis.
- One patient had MRCP and MRCP+ performed pre- and post-treatment (Figure 1)
- Age- and sex-matched large-duct PSC controls were selected from a previous study (REC: 18/SC/0367)
- The diagnostic performance of MRCP+ metrics with statistically significant differences between PSC and IgG4-SC, as well as serum IgG4 at a previously published threshold (>2.8 g/L)[1] were examined using ROC curve analyses
- AUC, sensitivity and specificity were recorded at the cut-off point that maximised the Youden index

Results

Figure 1: MRCP+-derived biliary tree model and corresponding biliary tree metrics in a 67 year old man with IgG4-sclerosing cholangitis a) pre-steroid; b) post-steroid for 6 weeks. The percentage of ducts with median diameter 3-5mm reduced from 39% to 26%.



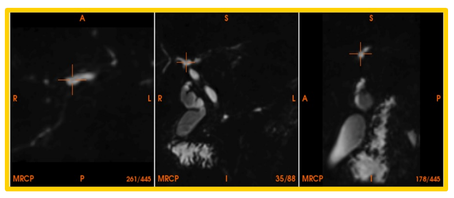
	Measured value	Reference interval
Biliary tree volume:[2]	29.0ml	(0 - 100ml)
Gallbladder volume:[2]	Not available	(1 - 99ml)
Percent of ducts with median width less than 3mm:	59%	(0 - 100%)
Percent of ducts with median width greater than 3mm up to 5mm:	39%	(1 - 99%)
Percent of ducts with median width greater than 5mm up to 7mm:	3%	(2 - 98%)
Percent of ducts with median width greater than 7mm:	0%	(3 - 97%)



	Measured value	Reference interval
Biliary tree volume:[2]	7.1ml	(0 - 100ml)
Gallbladder volume:[2]	7.1ml	(1 - 99ml)
Percent of ducts with median width less than 3mm:	74%	(0 - 100%)
Percent of ducts with median width greater than 3mm up to 5mm:	26%	(1 - 99%)
Percent of ducts with median width greater than 5mm up to 7mm:	0%	(2 - 98%)
Percent of ducts with median width greater than 7mm:	0%	(3 - 97%)

Figure 2: Differences in a) serum IgG4; b) percentage of bile ducts with median diameter 3–5mm between IgG4-sclerosing cholangitis (IgG4-SC; n=7) and primary sclerosing cholangitis (PSC; n=11).

Quantitative MRCP Analysis MRCP+



Non-contrast 3D MRCP images in axial, coronal and sagittal views

Step 1

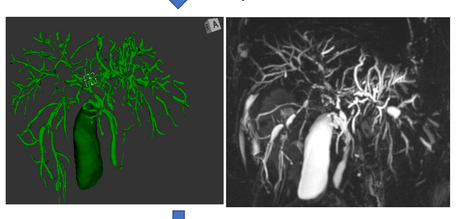
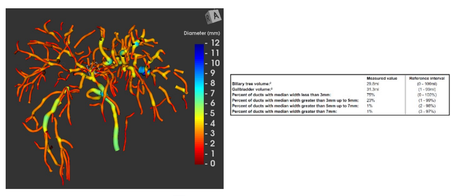


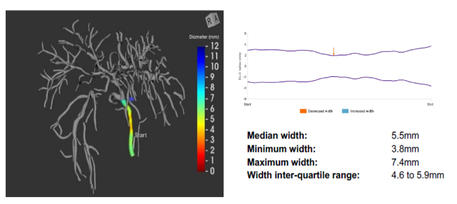
Image enhancement and segmentation of the biliary tree. Maximum intensity projection (MIP) image for comparison.

Step 2



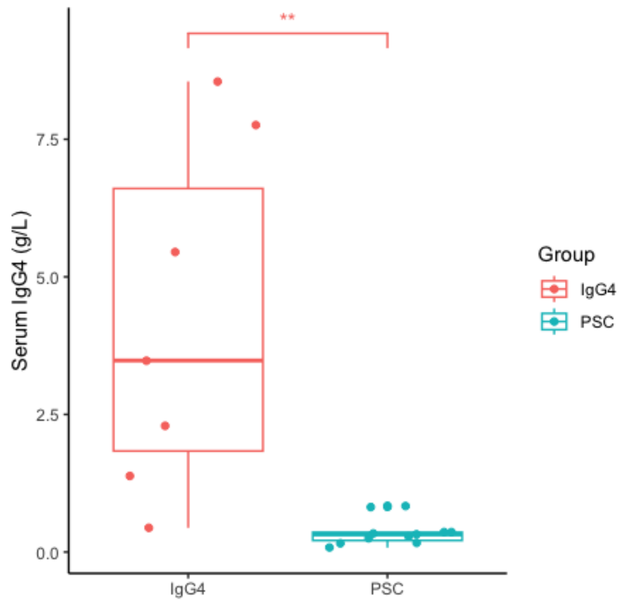
Automatic generation of a parametric model colour-coded according to duct width. Biliary tree metrics provided.

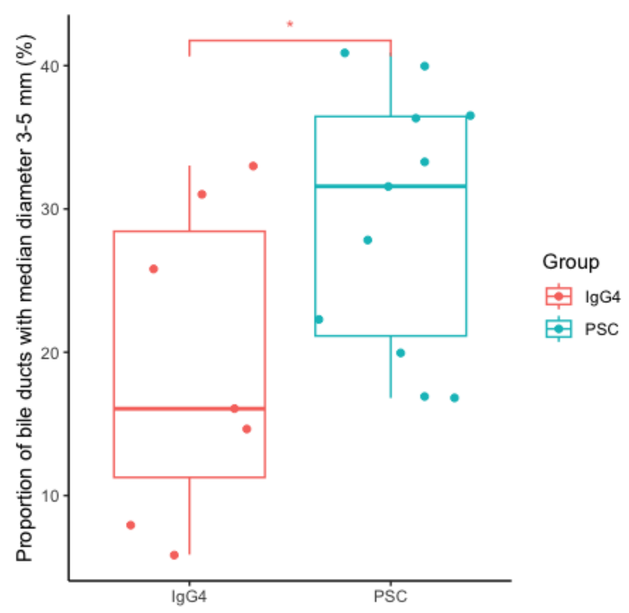
Step 3



Median width:	5.5mm
Minimum width:	3.8mm
Maximum width:	7.4mm
Width inter-quartile range:	4.6 to 5.9mm

Individual duct analysis and mathematical unfolding of the duct in 2D. Example of common bile duct (CBD) analysis.





- Median serum IgG4 was elevated in patients with IgG4-SC compared to PSC (IgG4-RD vs PSC: 2.29 [0.05–13.14] vs 0.32 [0.08–0.84] g/L, p = 0.001). It had 100% specificity for detecting patients with IgG4-SC but lower sensitivity (57%) at 2.8 g/L threshold.
- The percentage of ducts with median diameter 3–5 mm was lower in IgG4-SC than PSC (16 [11–28] vs 32 [21–36]; p=0.03). A cut-off value of 16.4% was able to differentiate the two conditions with AUC of 0.81 (0.58 – 1.00).
- Using serum IgG4 as a first line assessment and the percentage of ducts with median diameter 3–5 mm as a second line assessment in patients with low serum IgG4, maintained 100% specificity observed using serum IgG4 alone but increased the sensitivity of detection in this small cohort to 71%.

Conclusion

- **Quantitative MRCP metric may aid the differentiation of patients with IgG4-SC from those with PSC.**
- **The percentage of ducts with median diameter 3–5 mm has previously been shown to predict disease severity and transplant-free survival in patients with PSC[2,3], but further suitably powered study is needed to test its discriminatory value in differentiating IgG4-SC from PSC.**

References

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3.Cazzagon N, El Mouhadi S, Vanderbecq Q, Ferreira C, Finnegan S, Lemoinne S, Corpechot C, Chazouillères O, Arrivé L. Quantitative magnetic resonance cholangiopancreatography metrics are associated with disease severity and outcomes in people with primary sclerosing cholangitis. JHEP Rep. 2022 Sep 3;4(11):100577. doi: 10.1016/j.jhepr.2022.100577.

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