

SUPPORTING MATERIAL

Quantitative magnetic resonance cholangiopancreatography metrics are associated with disease severity and outcomes in patients with primary sclerosing cholangitis

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Supplemental Table 1. MRCP+ metrics definition [1]

	Definition
Number of modelled ducts	The total number of modelled ducts
Duct length metrics	
Duct length mean / median / maximum (mm)	Statistics on the mean, median and maximum lengths (mm) of the modelled ducts, measured along the centreline
Duct length sum (mm)	Total length of the centrelines in the modelled tree (mm)
Duct diameter median (mm)	The median over all ducts of the median diameter of each duct (mm)
Duct diameter range [x,y] mm (%)	The percentage of duct median diameters in the interval [x,y]
Duct diameter ≥ 9 mm (%)	The percentage of duct median diameters ≥ 9 mm
Strictures metrics	
Stricture number (n)	The number of ducts containing one or more strictures
Strictures types (n) <ul style="list-style-type: none"> - Band (<3 mm) - Segmental (3-10 mm) - Confluent (≥ 10 mm) 	The number of each category of stricture based on the categorisation of their lengths

Stricture length mean / max /sum (mm)	Statistics on the mean, maximum and total lengths (mm) of strictures
Stricture minimal diameter (mm)	The minimum diameter (mm) of the candidate strictures
Absolute stricture severity	Minimum diameter – Closest maximum diameter
Relative stricture severity	$(\text{Absolute stricture severity} / \text{Closest maximum diameter}) \times 100$
Stricture severity [absolute, relative] mean / max / sum	Statistics on the mean, maximum and total of the absolute and relative stricture severities
Stricture score	Stricture length x (relative severity / 100)
Stricture score mean / max / sum	Statistics on the mean, maximum and total of the stricture score
Dilatations metrics	
Dilatation number	The number of ducts containing one or more dilatation
Dilatation maximum diameter (mm)	The maximum diameter (mm) of the candidate dilatations
Absolute dilatation severity	Maximum diameter – Closest minimum diameter
Relative dilatation severity	$(\text{Absolute dilatation severity} / \text{Closest minimum diameter}) \times 100$
Dilatation severity [absolute, relative] mean / max / sum	Statistics on the mean, maximum and total of the absolute and relative dilatation severities
Dilatation score	Dilatation length x (relative severity / 100)
Dilatation score mean / max / sum	Statistics on the mean, maximum and total of the dilatation score
Strictures and/or dilatations	
Ducts with ≥ 1 stricture (n)	The number of ducts with one or more stricture (n)

Ducts with ≥ 1 dilatation (n)	The number of ducts with one or more dilatation (n)
Duct with ≥ 1 stricture OR dilatation (n)	The number of ducts with one or more stricture or dilatation (n)
Duct with ≥ 1 stricture AND dilatation (n)	The number of ducts with one or more stricture and one or more dilatation (n)
Duct with ≥ 1 stricture OR dilatation (%)	The percentage of ducts with one or more stricture or dilatation (%)
Duct with ≥ 1 stricture AND dilatation (%)	The percentage of ducts with one or more stricture and one or more dilatation (%)
Abnormal length sum (mm)	The total length (mm) of detected abnormalities (stricture length sum + dilatation length sum)
Abnormal length percentage (%)	The percentage of the tree centreline marked as abnormal ($100 \times \text{abnormal length sum} / \text{duct length sum}$)

Supplemental Table 2. MRCP derived metrics in 77 PSC patients

	Median (IQR)
Number of modelled ducts	86 (53 – 137)
Distribution of patients according to quartiles of number of modelled ducts:	
- 1 st quartile: < 53 modelled ducts	19(24.7)
- 2 nd quartile: 54-85 modelled ducts	18(23.4)
- 3 rd quartile: 86-136 modelled ducts	21(27.3)
- 4 th quartile: >137 modelled ducts	19(24.7)
Biliary tree volume (mL)	15.2 (8.5 – 20.9)
Gallbladder volume	47.4 (18.1-83.7)
Duct length metrics	
Duct length mean (mm)	19 (17 - 21)
Duct length median (mm)	12 (11 - 14)
Duct length max (mm)	105 (85 - 131)
Duct length sum (mm)	1608 (956 – 2527)
Duct diameter median (mm)	2.5 (2.4 -2.7)
Duct diameter range 0-1 mm (%)	0
Duct diameter range 1-3 mm (%)	75 (65 – 80)
Duct diameter range 3-5 mm (%)	22(15 – 30)
Duct diameter range 5-7 mm (%)	2 (0 – 4)
Duct diameter range 7-9 mm (%)	0 (0-1)
Duct diameter > 9 mm (%)	0
Strictures metrics	
Stricture number (n)	11 (7 – 18)
Strictures types (n)	
- Band (<3 mm)	1 (0 – 1)
- Segmental (3-10 mm)	8.0 (4.0 – 14.0)

- Confluent (≥ 10 mm)	2.0 (1.0 – 4.0)
Stricture length mean (mm)	6.7 (5.8 -8.1)
Stricture length max (mm)	14.4 (10.2 – 20.1)
Stricture length sum (mm)	77.6 (36.2 – 143.0)
Stricture minimal diameter (mm)	1.3 (1.2 - 1.5)
Stricture severity absolute mean	1.5 (1.4 – 1.7)
Stricture severity absolute max	2.6 (1.9 - 3.5)
Stricture severity absolute sum	18.1 (9.8 \pm 28.6)
Stricture severity relative mean	41.8 (39.8 - 43.4)
Stricture severity relative max	55.7 (50.9 – 64.0)
Stricture severity relative sum	479.9 (266.6 – 733.4)
Stricture score mean	2.9 (2.5 -3.3)
Stricture score max	6.4 (4.3 -8.6)
Stricture score sum	34.7 (16.3 – 56.9)
Dilatations metrics	
Dilatation number	21 (11-34)
Dilatation length mean	6.3 (5.4 – 7.5)
Dilatation length max	18.5 (14.0 – 25.2)
Dilatation length sum	123.5 (70.8 – 210)
Dilatation diameter max	8.4 (7.0 – 10.5)
Dilatation severity absolute mean	1.8 (1.6 – 2.0)
Dilatation severity absolute max	4.0 (2.9 – 5.7)
Dilatation severity absolute sum	39.6 (19.4 – 64.9)
Dilatation severity absolute mean	65.5 (59.2 – 73.9)
Dilatation severity relative max	153.7 (100.2 – 210.9)
Dilatation severity relative sum	1544 (744 – 2253)
Dilatation score mean	4.5 (3.5 -5.2)
Dilatation score max	15.7 (11.8 – 27.3)

Dilatation score sum	91.4 (52.4 -148.9)
Strictures and/or dilatations	
Ducts with ≥ 1 stricture (n)	9.0 (5.0 – 15.0)
Ducts with ≥ 1 dilatation (n)	9.0 (17.0 – 26.5)
Duct with ≥ 1 stricture OR dilatation (n)	20.0 (10.5 – 32.0)
Duct with ≥ 1 stricture AND dilatation (n)	6.0 (3.0 – 11.0)
Duct with ≥ 1 stricture OR dilatation (%)	23.0 (18.6 – 27.2)
Duct with ≥ 1 stricture AND dilatation (%)	7.7 (4.5 – 9.6)
Abnormal length sum (stricture length sum + dilatation length sum)	219 (98 -352)
Percentage of tree centerline abnormal	13.1 (9.7 -17.7)

Stricture length max (mm)	p	0,68	0,47	0,82	0,59	0,18	0,88	0,00	0,85	0,00	0,00	0,04	0,75	0,03	0,00	0,34	0,29	0,00	0,00	0,00	0,00	0,13	0,46	0,00	0,21	0,21	0,62	0,00	0,07	0,75	0,00	0,00	0,64	0,00	0,00	0,00	0,40	0,05	0,00	0,08	0,00	0,00	0,00	0,00	0,02	0,02	0,00	0,00	0,00			0,00	
Stricture length sum (mm)	R	0,22	-0,07	0,17	-0,03	-0,14	0,10	0,95	0,32	0,89	0,85	-0,21	0,14	0,50	0,92	-0,26	0,31	0,95	0,25	0,63	0,99	-0,33	0,14	0,83	0,44	0,11	0,43	0,82	-0,08	0,31	0,84	-0,32	0,16	0,76	0,87	0,91	0,23	0,41	0,93	0,32	0,95	0,85	0,87	0,80	0,17	0,18	0,39	0,83	0,41	0,73	1,00		
	p	0,06	0,55	0,14	0,82	0,23	0,38	0,00	0,00	0,00	0,00	0,06	0,21	0,00	0,00	0,02	0,01	0,00	0,03	0,00	0,00	0,00	0,22	0,00	0,00	0,36	0,00	0,00	0,47	0,01	0,00	0,00	0,16	0,00	0,00	0,00	0,04	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,13	0,12	0,00	0,00	0,00	0,00			
Biliary tree volume	R	0,29	-0,19	0,28	0,03	-0,04	0,16	0,86	0,41	0,83	0,63	-0,07	0,29	0,49	0,86	-0,28	0,24	0,85	0,02	0,41	0,82	-0,33	0,19	0,91	0,51	0,20	0,51	0,91	-0,08	0,44	0,90	-0,26	0,32	0,86	0,94	0,84	0,10	0,15	0,91	0,07	0,87	0,93	0,93	0,93	0,11	0,21	0,36	0,94	0,17	0,51	0,84	1,00	
	p	0,01	0,10	0,01	0,78	0,76	0,15	0,00	0,00	0,00	0,00	0,57	0,01	0,00	0,00	0,02	0,04	0,00	0,84	0,00	0,00	0,00	0,10	0,00	0,00	0,08	0,00	0,00	0,47	0,00	0,00	0,02	0,01	0,00	0,00	0,00	0,41	0,18	0,00	0,52	0,00	0,00	0,00	0,00	0,34	0,07	0,00	0,00	0,13	0,00	0,00		

Note: R = Spearman's rank correlation coefficient

Supplemental table 4. Correlations between MRCP+ derived metrics, biochemical indices, liver stiffness and prognostic scores.

	Serum bilirubin	AST	ALP	GGT	Serum albumin	Platelets count	Liver Stiffness	Anali score without gadolinium [2]	Anali score with gadolinium [2]	Mayo Risk Score [3]	Amsterdam - Oxford Model [4]
Biliary tree volume	R = -0.135 p = 0.240	R = 0.008 p = 0.943	R = 0.061 p = 0.605	R = 0.110 p = 0.349	R = 0.023 p = 0.851	R = 0.136 p = 0.851	R = 0.075 p = 0.519	R = 0.382 p = 0.001	R = 0.273 p = 0.029	R = 0.057 p = 0.649	R = -0.174 p = 0.349
Total number of modelled ducts	R = -0.187 p = 0.104	R = -0.042 p = 0.721	R = -0.030 p = 0.796	R = 0.047 p = 0.688	R = 0.114 p = 0.342	R = 0.146 p = 0.211	R = -0.034 p = 0.771	R = 0.262 p = 0.021	R = 0.208 p = 0.098	R = -0.034 p = 0.787	R = -0.317 p = 0.082
Duct length mean (mm)	R = 0.036 p = 0.757	R = -0.274 p = 0.017	R = -0.092 p = 0.434	R = -0.142 p = 0.223	R = 0.061 p = 0.616	R = -0.073 p = 0.535	R = -0.211 p = 0.065	R = -0.138 p = 0.230	R = -0.175 p = 0.167	R = -0.116 p = 0.353	R = 0.056 p = 0.766
Duct length median (mm)	R = -0.045 p = 0.695	R = -0.274 p = 0.017	R = -0.167 p = 0.153	R = -0.158 p = 0.177	R = 0.184 p = 0.124	R = -0.026 p = 0.825	R = -0.266 p = 0.019	R = -0.149 p = 0.197	R = -0.151 p = 0.233	R = -0.186 p = 0.135	R = -0.085 p = 0.649
Duct length max (mm)	R = -0.105 p = 0.364	R = 0.186 p = 0.110	R = -0.013 p = 0.912	R = -0.106 p = 0.363	R = 0.011 p = 0.930	R = 0.193 p = 0.098	R = -0.067 p = 0.564	R = -0.079 p = 0.495	R = 0.045 p = 0.723	R = 0.006 p = 0.962	R = 0.127 p = 0.496
Duct length sum (mm)	R = -0.170 p = 0.138	R = -0.096 p = 0.413	R = -0.041 p = 0.727	R = 0.008 p = 0.946	R = 0.119 p = 0.323	R = 0.116 p = 0.322	R = -0.065 p = 0.573	R = 0.226 p = 0.048	R = 0.160 p = 0.206	R = -0.059 p = 0.640	R = -0.255 p = 0.166
Duct diameter median (mm)	R = 0.108 p = 0.351	R = -0.422 p < 0.001	R = 0.437 p < 0.001	R = 0.399 p < 0.001	R = -0.265 p = 0.025	R = 0.077 p = 0.513	R = 0.511 p < 0.001	R = 0.714 p < 0.001	R = 0.645 p < 0.001	R = 0.340 p = 0.005	R = 0.302 p = 0.099
Duct diameter range 1-3 mm (%)	R = -0.115 p = 0.321	R = -0.418 p < 0.001	R = -0.379 p = 0.001	R = -0.354 p = 0.002	R = 0.272 p = 0.022	R = -0.073 p = 0.535	R = -0.474 p < 0.001	R = -0.583 p < 0.001	R = -0.453 p < 0.001	R = -0.362 p = 0.003	R = -0.340 p = 0.061

Duct diameter range 3-5 mm (%)	R = 0.043 p = 0.710	R = 0.337 p = 0.003	R = 0.321 p = 0.005	R = 0.319 p = 0.005	R = -0.227 p = 0.057	R = 0.094 p = 0.421	R = 0.389 p < 0.001	R = 0.583 p < 0.001	R = 0.483 p < 0.001	R = 0.265 p = 0.031	R = 0.216 p = 0.244
Duct diameter range 5-7 mm (%)	R = 0.038 p = 0.740	R = 0.201 p = 0.084	R = 0.150 p = 0.198	R = 0.209 p = 0.072	R = -0.125 p = 0.299	R = -0.028 p = 0.812	R = 0.288 p = 0.011	R = 0.231 p = 0.044	R = 0.228 p = 0.070	R = 0.229 p = 0.065	R = 0.373 p = 0.039
Duct diameter range 7-9 mm (%)	R = 0.284 p = 0.012	R = 0.293 p = 0.011	R = 0.349 p = 0.002	R = 0.198 p = 0.089	R = -0.342 p = 0.004	R = -0.036 p = 0.762	R = 0.248 p = 0.030	R = 0.118 p = 0.308	R = 0.053 p = 0.680	R = 0.434 p < 0.001	R = 0.456 p = 0.010
Duct diameter > 9 mm (%)	R = 0.306 p = 0.007	R = 0.256 p = 0.027	R = 0.177 p = 0.128	R = 0.237 p = 0.040	R = -0.124 p = 0.303	R = -0.178 p = 0.126	R = 0.195 p = 0.089	R = 0.181 p = 0.115	R = 0.072 p = 0.571	R = 0.240 p = 0.052	R = 0.247 p = 0.180
Strictures metrics											
Stricture number (n)	R = -0.033 p = 0.774	R = 0.045 p = 0.704	R = 0.188 p = 0.106	R = 0.190 p = 0.103	R = 0.010 p = 0.933	R = 0.089 p = 0.448	R = 0.087 p = 0.450	R = 0.436 P < 0.001	R = 0.346 p = 0.005	R = 0.081 p = 0.520	R = -0.156 p = 0.401
Number of band (<3 mm) stricture	R = -0.071 p = 0.540	R = 0.117 p = 0.319	R = 0.157 p = 0.179	R = 0.115 p = 0.324	R = -0.033 p = 0.783	R = -0.117 p = 0.319	R = 0.348 p = 0.002	R = 0.398 p < 0.001	R = 0.291 p = 0.020	R = 0.130 p = 0.298	R = 0.047 p = 0.801
Number of segmental (3-10 mm) strictures	R = -0.047 p = 0.687	R = 0.015 p = 0.897	R = 0.135 p = 0.249	R = 0.155 p = 0.185	R = 0.032 p = 0.788	R = 0.050 p = 0.673	R = 0.025 p = 0.829	R = 0.404 p < 0.001	R = 0.325 p = 0.009	R = 0.041 p = 0.747	R = -0.148 p = 0.428
Number of confluent (≥ 10 mm) strictures	R = 0.033 p = 0.775	R = 0.001 p = 0.990	R = 0.156 p = 0.180	R = 0.133 p = 0.256	R = -0.007 p = 0.953	R = 0.248 P = 0.032	R = 0.058 p = 0.618	R = 0.246 p = 0.031	R = 0.249 p = 0.047	R = 0.129 p = 0.303	R = -0.286 p = 0.118
Stricture length mean (mm)	R = 0.001 p = 0.993	R = -0.163 p = 0.161	R = -0.063 p = 0.593	R = 0.008 p = 0.947	R = 0.064 p = 0.595	R = 0.173 p = 0.138	R = -0.165 p = 0.152	R = -0.112 p = 0.330	R = 0.014 p = 0.912	R = -0.051 p = 0.682	R = -0.450 p = 0.011

Stricture length max (mm)	R = 0.127 p = 0.270	R = - 0.009 p = 0.937	R = 0.101 p = 0.390	R = 0.179 p = 0.125	R = 0.046 p = 0.704	R = 0.200 p = 0.085	R = 0.018 p = 0.878	R = 0.179 p = 0.119	R = 0.242 p = 0.054	R = 0.160 p = 0.199	R = - 0.285 p = 0.121
Stricture length sum (mm)	R = - 0.009 p = 0.939	R = - 0.015 p = 0.901	R = 0.127 p = 0.276	R = 0.126 p = 0.280	R = 0.059 p = 0.627	R = 0.117 p = 0.318	R = 0.039 p = 0.737	R = 0.347 p = 0.002	R = 0.311 p = 0.012	R = 0.061 p = 0.626	R = -0.219 p = 0.237
Stricture minimal diameter (mm)	R = 0.093 p = 0.422	R = 0.119 p = 0.307	R = 0.131 p = 0.264	R = 0.025 p = 0.834	R = -0.074 p = 0.540	R = 0.100 p = 0.394	R = 0.120 p = 0.297	R = 0.110 p = 0.341	R = 0.060 p = 0.635	R = -0.029 p = 0.817	R = 0.116 p = 0.534
Stricture severity absolute mean	R = - 0.095 p = 0.410	R = 0.053 p = 0.653	R = -0.011 p = 0.923	R = 0.048 p = 0.682	R = -0.112 p = 0.352	R = 0.110 p = 0.349	R = 0.063 p = 0.587	R = 0.152 p = 0.188	R = -0.007 p = 0.958	R = 0.204 p = 0.101	R = 0.067 p = 0.721
Stricture severity absolute max	R = - 0.186 p = 0.105	R = - 0.016 p = 0.889	R = 0.029 p = 0.805	R = 0.067 p = 0.568	R = - 0.112 p = 0.310	R = 0.052 p = 0.658	R = 0.034 p = 0.772	R = 0.241 p = 0.034	R = 0.133 p = 0.296	R = 0.169 p = 0.176	R = 0.038 p = 0.840
Stricture severity absolute sum	R = - 0.066 p = 0.569	R = 0.042 p = 0.720	R = 0.197 p = 0.090	R = 0.184 p = 0.114	R = - 0.041 p = 0.732	R = 0.136 p = 0.246	R = 0.103 p = 0.374	R = 0.449 P < 0.001	R = 0.337 p = 0.006	R = 0.143 p = 0.253	R = - 0.098 p = 0.602
Stricture severity relative mean	R = - 0.009 p = 0.939	R = - 0.064 p = 0.583	R = - 0.144 p = 0.217	R = -0.054 p = 0.646	R = 0.034 p = 0.777	R = 0.025 p = 0.833	R = -0.127 p = 0.271	R = - 0.235 p = 0.040	R = -0.277 p = 0.027	R = 0.146 p = 0.243	R = 0.036 p = 0.846
Stricture severity relative max	R = - 0.065 p = 0.574	R = 0.016 p = 0.893	R = -0.004 p = 0.974	R = 0.040 p = 0.735	R = - 0.061 p = 0.616	R = 0.002 p = 0.988	R = 0.044 p = 0.706	R = 0.148 p = 0.197	R = 0.066 p = 0.602	R = 0.185 p = 0.137	R = 0.139 p = 0.457
Stricture severity relative sum	R = - 0.049 p = 0.674	R = 0.039 p = 0.737	R = 0.182 p = 0.117	R = 0.188 p = 0.105	R = 0.017 p = 0.890	R = 0.099 p = 0.400	R = 0.081 p = 0.485	R = 0.431 p < 0.001	R = 0.341 p = 0.006	R = 0.094 p = 0.452	R = -0.163 p = 0.381
Stricture score mean	R = 0.008	R = - 0.185	R = -0.121	R = -0.047	R = 0.033	R = 0.172	R = -0.195	R = -0.201	R = -0.098	R = 0.009	R = - 0.409

	p = 0.944	p = 0.113	p = 0.302	p = 0.690	p = 0.787	p = 0.140	p = 0.09	p = 0.079	p = 0.440	p = 0.941	p = 0.022
Stricture score max	R = 0.054 p = 0.639	R = - 0.017 p = 0.886	R = 0.094 p = 0.422	R = 0.178 p = 0.126	R = - 0.077 p = 0.523	R = 0.182 p = 0.119	R = 0.028 p = 0.812	R = 0.171 p = 0.137	R = 0.219 p = 0.082	R = 0.194 p = 0.119	R = -0.279 p = 0.128
Stricture score sum	R = - 0.034 p = 0.770	R = - 0.031 p = 0.793	R = 0.114 p = 0.329	R = 0.125 p = 0.285	R = 0.059 p = 0.623	R = 0.136 p = 0.246	R = 0.025 p = 0.831	R = 0.338 p = 0.003	R = 0.301 p = 0.016	R = 0.079 p = 0.527	R = -0.228 p = 0.217
Dilatations metrics											
Dilatation number	R = - 0.113 p = 0.330	R = 0.046 p = 0.694	R = 0.134 p = 0.252	R = 0.183 p = 0.115	R = 0.015 p = 0.901	R = 0.139 p = 0.233	R = 0.075 p = 0.515	R = 0.437 p < 0.001	R = 0.347 p = 0.005	R = 0.093 p = 0.458	R = -0.216 p = 0.243
Dilatation length mean	R = 0.013 p = 0.908	R = - 0.022 p = 0.852	R = -0.166 p = 0.155	R = -0.123 p = 0.293	R = 0.103 p = 0.394	R = -0.018 p = 0.878	R = 0.055 p = 0.637	R = - 0.200 p = 0.081	R = -0.165 p = 0.192	R = -0.076 p = 0.543	R = 0.009 p = 0.962
Dilatation length max	R = 0.008 p = 0.946	R = 0.074 p = 0.526	R = -0.019 p = 0.873	R = -0.003 p = 0.979	R = 0.060 p = 0.619	R = 0.155 p = 0.185	R = 0.181 p = 0.114	R = 0.126 p = 0.275	R = 0.190 p = 0.132	R = 0.086 p = 0.491	R = -0.003 p = 0.988
Dilatation length sum	R = - 0.106 p = 0.358	R = 0.056 p = 0.634	R = 0.127 p = 0.279	R = 0.182 p = 0.117	R = 0.018 p = 0.882	R = 0.142 p = 0.224	R = 0.103 p = 0.374	R = 0.456 p < 0.001	R = 0.347 p = 0.005	R = 0.097 p = 0.436	R = -0.208 p = 0.262
Dilatation diameter max	R = 0.071 p = 0.539	R = 0.165 p = 0.158	R = 0.307 p = 0.007	R = 0.285 p = 0.013	R = -0.023 p = 0.850	R = 0.210 p = 0.071	R = 0.228 p = 0.046	R = 0.456 p < 0.001	R = 0.385 p = 0.002	R = 0.159 p = 0.202	R = 0.090 p = 0.629
Dilatation severity absolute mean	R = 0.066 p = 0.571	R = 0.332 p = 0.004	R = 0.307 p = 0.007	R = 0.284 p = 0.014	R = -0.289 p = 0.014	R = 0.008 p = 0.945	R = 0.409 p < 0.001	R = 0.457 p < 0.001	R = 0.232 p = 0.065	R = 0.370 p = 0.002	R = 0.466 p = 0.008

Dilatation severity absolute max	R = 0.107 p = 0.353	R = 0.251 p = 0.030	R = 0.357 p = 0.002	R = 0.324 p = 0.005	R = -0.210 p = 0.079	R = 0.079 p = 0.499	R = 0.264 p = 0.021	R = 0.567 p < 0.001	R = 0.358 p = 0.004	R = 0.344 p = 0.005	R = 0.242 p = 0.189
Dilatation severity absolute sum	R = - 0.106 p = 0.361	R = 0.101 p = 0.386	R = 0.215 p = 0.064	R = 0.254 p = 0.028	R = -0.067 p = 0.577	R = 0.145 p = 0.215	R = 0.159 p = 0.166	R = 0.521 p < 0.001	R = 0.394 p = 0.001	R = 0.177 p = 0.156	R = -0.115 p = 0.540
Dilatation severity relative mean	R = 0.137 p = 0.234	R = 0.390 p = 0.001	R = 0.363 p = 0.001	R = 0.374 p = 0.001	R = -0.199 p = 0.097	R = -0.086 p = 0.462	R = 0.336 p = 0.003	R = 0.191 p = 0.096	R = 0.084 p = 0.511	R = 0.390 p = 0.001	R = 0.440 p = 0.013
Dilatation severity relative max	R = 0.051 p = 0.662	R = 0.313 p = 0.006	R = 0.358 p = 0.002	R = 0.377 p = 0.001	R = -0.230 p = 0.054	R = 0.066 p = 0.574	R = 0.250 p = 0.029	R = 0.469 p < 0.001	R = 0.298 p = 0.017	R = 0.393 p = 0.001	R = -0.137 p = 0.461
Dilatation severity relative sum	R = - 0.107 p = 0.352	R = 0.102 p = 0.383	R = 0.203 p = 0.080	R = 0.248 p = 0.032	R = - 0.052 p = 0.665	R = 0.142 p = 0.225	R = 0.146 p = 0.205	R = 0.481 p < 0.001	R = 0.382 p = 0.002	R = 0.174 p = 0.162	R = -0.137 p = 0.461
Dilatation score mean	R = 0.037 p = 0.751	R = 0.181 p = 0.120	R = 0.071 p = 0.547	R = 0.115 p = 0.326	R = -0.063 p = 0.603	R = -0.075 p = 0.520	R = 0.226 p = 0.048	R = 0.046 p = 0.689	R = -0.034 p = 0.791	R = 0.147 p = 0.239	R = 0.250 p = 0.174
Dilatation score max	R = 0.015 p = 0.897	R = 0.167 p = 0.153	R = 0.112 p = 0.339	R = 0.217 p = 0.062	R = -0.141 p = 0.242	R = 0.031 p = 0.792	R = 0.248 p = 0.029	R = 0.423 p < 0.001	R = 0.185 p = 0.144	R = 0.213 p = 0.239	R = 0.123 p = 0.510
Dilatation score sum	R = - 0.108 p = 0.350	R = 0.115 p = 0.325	R = 0.187 p = 0.108	R = 0.249 p = 0.031	R = -0.065 p = 0.591	R = 0.116 p = 0.320	R = 0.182 p = 0.114	R = 0.526 p < 0.001	R = 0.385 p = 0.002	R = 0.188 p = 0.130	R = -0.069 p = 0.712
Strictures and/or dilatations											
Ducts with ≥ 1 stricture (n)	R = - 0.032 p = 0.785	R = 0.019 p = 0.872	R = 0.147 p = 0.210	R = 0.157 p = 0.177	R = 0.053 p = 0.658	R = 0.086 p = 0.461	R = 0.020 p = 0.860	R = 0.410 p < 0.001	R = 0.341 p = 0.007	R = 0.053 p = 0.670	R = -0.194 p = 0.296
Ducts with ≥ 1 dilatation (n)	R = - 0.119 p = 0.304	R = 0.043 p = 0.715	R = 0.108 p = 0.356	R = 0.166 p = 0.154	R = 0.059 p = 0.628	R = 0.112 p = 0.338	R = 0.076 p = 0.512	R = 0.399 p < 0.001	R = 0.336 p = 0.007	R = 0.078 p = 0.534	R = -0.148 p = 0.427

Duct with ≥ 1 stricture OR dilatation (n)	R = -0.097 p = 0.400	R = 0.045 p = 0.700	R = 0.108 p = 0.356	R = 0.149 p = 0.202	R = 0.078 p = 0.515	R = 0.104 p = 0.376	R = 0.238 p = 0.037	R = 0.388 p < 0.001	R = 0.339 p = 0.006	R = 0.054 p = 0.664	R = -0.194 p = 0.296
Duct with ≥ 1 stricture AND dilatation (n)	R = -0.052 p = 0.654	R = 0.024 p = 0.840	R = 0.147 p = 0.207	R = 0.192 p = 0.099	R = 0.002 p = 0.989	R = 0.117 p = 0.316	R = 0.195 p = 0.089	R = 0.422 p < 0.001	R = 0.306 p = 0.014	R = 0.114 p = 0.360	R = -0.148 p = 0.427
Duct with ≥ 1 stricture OR dilatation (%)	R = 0.303 p = 0.007	R = 0.345 p = 0.002	R = 0.482 p < 0.001	R = 0.398 p < 0.001	R = -0.116 p = 0.334	R = -0.206 p = 0.077	R = 0.238 p = 0.037	R = 0.440 p < 0.001	R = 0.428 p < 0.001	R = 0.380 p = 0.002	R = 0.354 p = 0.050
Duct with ≥ 1 stricture AND dilatation (%)	R = 0.183 p = 0.111	R = 0.109 p = 0.350	R = 0.312 p = 0.006	R = 0.264 p = 0.022	R = -0.106 p = 0.379	R = -0.110 p = 0.349	R = 0.195 p = 0.089	R = 0.371 p < 0.001	R = 0.232 p = 0.065	R = 0.235 p = 0.057	R = 0.147 p = 0.431
Abnormal length sum (stricture length sum + dilatation length sum)	R = -0.071 p = 0.539	R = 0.041 p = 0.730	R = 0.143 p = 0.220	R = 0.178 p = 0.126	R = 0.006 p = 0.961	R = 0.126 p = 0.281	R = 0.089 p = 0.443	R = 0.446 p < 0.001	R = 0.357 p = 0.004	R = 0.102 p = 0.416	R = -0.195 p = 0.293
Percentage of tree centerline abnormal	R = 0.250 p = 0.028	R = 0.319 p = 0.005	R = 0.441 p < 0.001	R = 0.409 p < 0.001	R = -0.212 p = 0.075	R = -0.059 p = 0.614	R = 0.372 p = 0.001	R = 0.481 p < 0.001	R = 0.434 p < 0.001	R = 0.393 p = 0.001	R = 0.159 p = 0.392

Note: R= Spearman's rank correlation coefficient

Supplemental table 5. Distribution of MRCP derived metrics according ANALI score without gadolinium[2]

	ANALI without ≤ 2 N=35	ANALI without > 2 N=42	p
Total n. of modelled ducts	67(44-104)	111(57-155)	0.047
Biliary tree volume (mL)	11.5(6.5-18.4)	18.0(11.3-24.7)	0.048
Gallbladder volume (mL)	33.1(17.7-61.2)	62.1(20.5-94.4)	0.111
Mean duct length	19.2(16.8-21.6)	17.8(16.5-19.8)	0.108
Median duct length	12.4(11.5-14.5)	11.8(11.3-12.9)	0.127
Max duct length	105.2(82.9-137.0)	104(86-128)	0.720
Duct length sum	1455.7(835.4-2207.5)	2008.3(1038.4-2581.5)	0.138
Median diameter	2.4(2.2-2.5)	2.6(2.5-2.8)	0.000
% ducts with median diam. 0-1 mm	0(0-0)	0(0-0)	1.00
% ducts with median diam. 1-3 mm	79(73-85)	67(60-80)	0.000
% ducts with median diam. 3-5 mm	19(13-22)	28(18-36)	0.000
% ducts with median diam. 5-7 mm	1(0-4)	2(1-3)	0.095
% ducts with median diam. 7-9 mm	0(0-1)	0(0-1)	0.813
% ducts with median diam. > 9 mm	0(0-0)	0(0-0)	0.145
Total n. of strictures	8(4-13)	14(11-22)	0.001
N. of band strictures	0(0-1)	1(0-2)	0.005
N. of segmental strictures	7(4-9)	11(7-17)	0.002
N. of confluent strictures	1(0-3)	2.5(1-4)	0.030
Mean stricture length	6.7(5.8-8.4)	6.9(5.7-8.0)	0.682
Max stricture length	12.9(9.0-18.0)	15.6(10.7-21.1)	0.100
Sum of stricture length	46.8 (30.4-98.6)	95.0(68.6-156.5)	0.005
Minimum strict. diameter	1.3(1.2-1.4)	1.3(1.2-1.5)	0.963
Mean absolute strict. severity	1.5(1.4-1.7)	1.5(1.5-1.7)	0.782

Max absolute strict. severity	2.5(1.8-3.2)	2.7(2.2-3.7)	0.163
Sum absolute strict. severity	11.3(7.2-20.9)	23.4(16.9-36.7)	0.001
Mean relative strict. severity	42.8(40.3-44.7)	41.3(39.3-42.8)	0.019
Max relative strict. severity	55.0(48.9-62.7)	56.1(51.5-64.8)	0.201
Sum of relative strict. severity	352.2(208.9-517.1)	570.5(432.0-881.0)	0.001
Mean stricture score	2.9(2.5-3.6)	2.7(2.4-3.2)	0.197
Max stricture score	6.1(3.9-7.7)	7.1(5.0-9.1)	0.120
Sum of stricture score	20.9(13.9-36.6)	39.7(28.3-69.1)	0.006
Stricture score TSS	1.0(1.00-1.00)	1(1-1)	0.002
Number of dilatations	15(8-23)	30(18-37)	0.001
Mean length of dilatations	7.0(5.3-7.8)	6.2(5.3-6.6)	0.170
Max length of dilatations	17.3(12.5-23.4)	19.2(16.1-26.8)	0.187
Sum of length dilatations	105.2(49.0-146.7)	174.9(113.5-224.6)	0.001
Max dilatation diameter	7.6(6.3-9.7)	9.0(7.8-11.5)	0.004
Mean of absolute dilatation severity	1.7(1.5-1.9)	1.9(1.7-2.1)	0.000
Max of absolute dilatation severity	3.0(2.6-4.1)	4.9(3.7-6.4)	0.000
Sum of absolute dilatation severity	24.4(15.9-40)	52.6(37.4-83.3)	0.000
Mean relative dilatation severity	64.0(58.3-72.1)	68.4(61.5-75.7)	0.060
Max relative dilatation severity	121.3(94.0-156.6)	171.3(138.7-255.4)	0.000
Sum of relative dilatation severity	955.3(632.4-1552.2)	2017.1(1222.4-2501.8)	0.000
Mean score of dilatations	4.5(3.4-5.2)	4.3(3.8-5.3)	0.736
Max score of dilatations	13.6(8.5-22.0)	18.2(14.2-32.5)	0.000
Sum dilatation score	62.8(36.3-98.7)	123.8(83.5-175.2)	0.000
N. of ducts with stricture	7(4-10)	12(8.5-18.3)	0.001
N. of ducts with dilatation	13(7-18)	23(11.8-29.5)	0.002
N. of ducts with strictures or dilatations	15(10-21)	28.5(14.8-35.3)	0.002
N. of ducts with strictures and dilatations	4(2-7)	8(5-12)	0.003
% of ducts with strictures or dilatations	18(15-23)	25(21-28)	0.000

% of ducts with strictures and dilatations	6(4-9)	8(5-10)	0.032
Sum of abnormal length	158.3(83.3-219.6)	255.2(199.3-369.2)	0.001
% of abnormal length	11(8-13)	14.9(11.7-18.5)	0.000

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