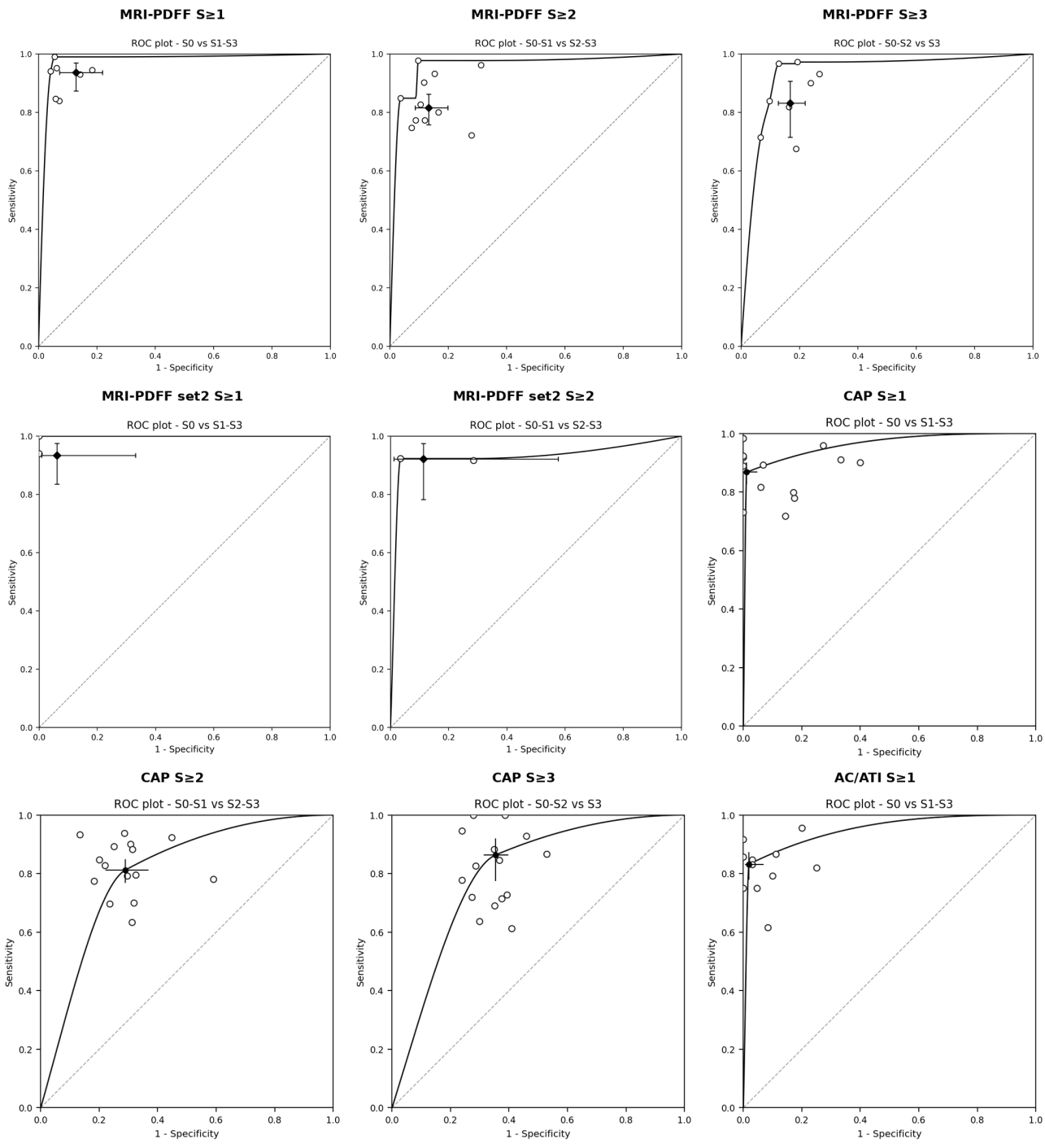
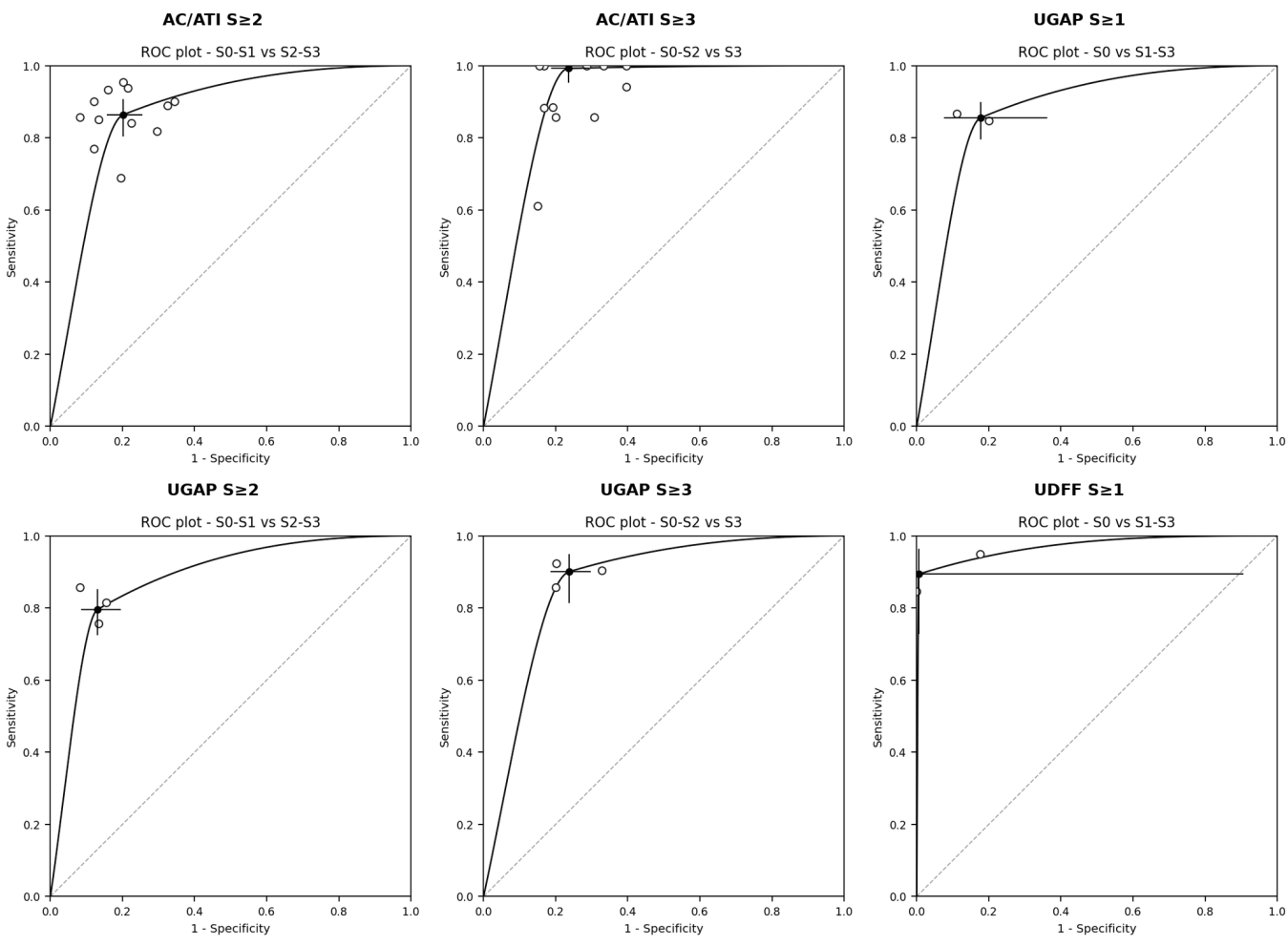
Supplementary Figures

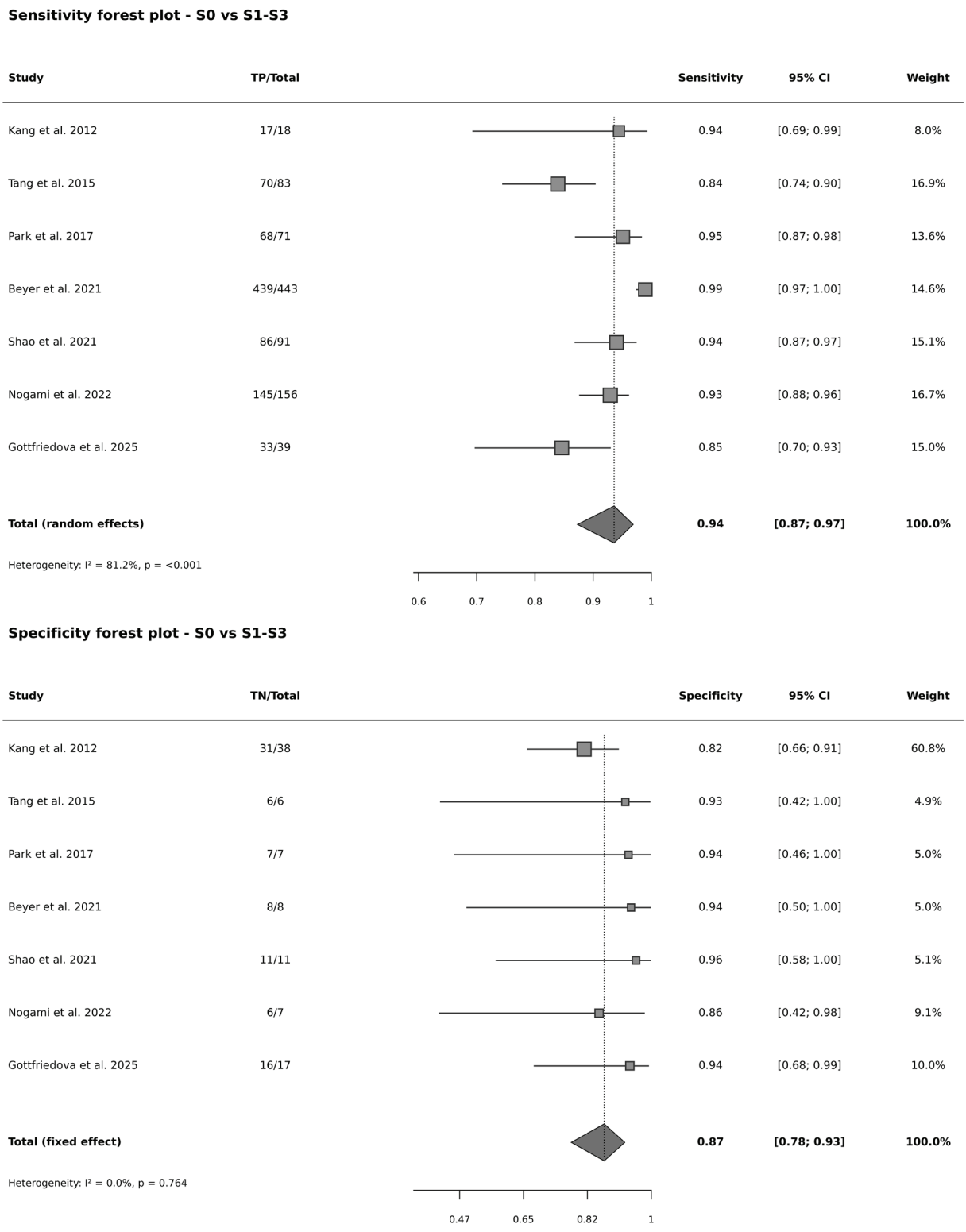
Receiver operating characteristic plots for all diagnostic analyses are consolidated into a single supplementary figure, grouped by imaging method and histologic threshold; each panel retains the original study-level and summary points.



Supplementary Figure 1. Receiver operating characteristic plots for all diagnostic meta-analyses. MRI-PDFF, magnetic resonance imaging proton density fat fraction; CAP, controlled attenuation parameter; AC/ATI, attenuation coefficient/attenuation imaging.



Supplementary Figure 2. Publication-bias and forest plots for MRI-PDFF at histologic threshold S ≥ 1. AC/ATI, attenuation coefficient/attenuation imaging; UGAP, ultrasound-guided attenuation parameter; UDFF, ultrasound-derived fat fraction; MRI-PDFF, magnetic resonance imaging proton density fat fraction.



Sensitivity forest plot - S0 vs S1-S3

Study	TP/Total	Sensitivity	95% CI	Weight
Kang et al. 2012	17/18	0.94	[0.69; 0.99]	8.0%
Tang et al. 2015	70/83	0.84	[0.74; 0.90]	16.9%
Park et al. 2017	68/71	0.95	[0.87; 0.98]	13.6%
Beyer et al. 2021	439/443	0.99	[0.97; 1.00]	14.6%
Shao et al. 2021	86/91	0.94	[0.87; 0.97]	15.1%
Nogami et al. 2022	145/156	0.93	[0.88; 0.96]	16.7%
Gottfriedova et al. 2025	33/39	0.85	[0.70; 0.93]	15.0%
Total (random effects)		**0.94**	**[0.87; 0.97]**	**100.0%**

Heterogeneity: I^2 = 81.2%, p = <0.001

0.6 0.7 0.8 0.9 1

Specificity forest plot - S0 vs S1-S3

Study	TN/Total	Specificity	95% CI	Weight
Kang et al. 2012	31/38	0.82	[0.66; 0.91]	60.8%
Tang et al. 2015	6/6	0.93	[0.42; 1.00]	4.9%
Park et al. 2017	7/7	0.94	[0.46; 1.00]	5.0%
Beyer et al. 2021	8/8	0.94	[0.50; 1.00]	5.0%
Shao et al. 2021	11/11	0.96	[0.58; 1.00]	5.1%
Nogami et al. 2022	6/7	0.86	[0.42; 0.98]	9.1%
Gottfriedova et al. 2025	16/17	0.94	[0.68; 0.99]	10.0%
Total (fixed effect)		**0.87**	**[0.78; 0.93]**	**100.0%**

Heterogeneity: I^2 = 0.0%, p = 0.764

0.47 0.65 0.82 1

DOR forest plot - S0 vs S1-S3

Study	TP/FP/FN/TN	DOR	95% CI	Weight
Kang et al. 2012	17/7/1/31	75.29	[8.53; 664.15]	19.7%
Tang et al. 2015	70/0/13/6	67.89	[3.61; 1277.56]	10.8%
Park et al. 2017	68/0/3/7	293.57	[13.80; 6246.33]	10.0%
Beyer et al. 2021	439/0/4/8	1660.33	[82.70; 33335.25]	10.4%
Shao et al. 2021	86/0/5/11	361.73	[18.75; 6978.88]	10.7%
Nogami et al. 2022	145/1/11/6	79.09	[8.73; 716.65]	19.2%
Gottfriedova et al. 2025	33/1/6/16	88.00	[9.75; 793.91]	19.3%
Total (fixed effect)		**144.51**	**[55.01; 379.66]**	**100.0%**

Heterogeneity: I^2 = 0.0%, p = 0.649

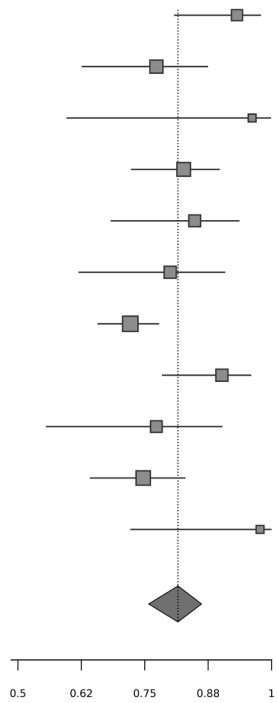
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Supplementary Figure 3. Publication-bias and forest plots for MRI-PDFF at histologic threshold S≥2. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; MRI-PDFF, magnetic resonance imaging proton density fat fraction.

Sensitivity forest plot - S0-S1 vs S2-S3

Study	TP/Total	Sensitivity	95% CI	Weight
Idilman et al. 2013	41/44	0.93	[0.81; 0.98]	6.2%
Tang et al. 2015	34/44	0.77	[0.63; 0.87]	11.3%
Idilman et al. 2015	12/12	0.96	[0.60; 1.00]	1.4%
Middleton et al. 2017	62/75	0.83	[0.72; 0.90]	13.1%
Paige et al. 2017	28/33	0.85	[0.68; 0.94]	8.2%
Park et al. 2017	24/30	0.80	[0.62; 0.91]	8.8%
Beyer et al. 2021	158/219	0.72	[0.66; 0.78]	18.5%
Shao et al. 2021	46/51	0.90	[0.79; 0.96]	8.5%
Kim et al. 2022	17/22	0.77	[0.56; 0.90]	7.7%
Nogami et al. 2022	62/83	0.75	[0.64; 0.83]	14.9%
Gottfriedova et al. 2025	21/21	0.98	[0.72; 1.00]	1.4%
Total (random effects)		**0.82**	**[0.76; 0.86]**	**100.0%**

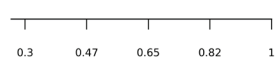
Heterogeneity: I^2 = 52.0%, p = 0.022



Specificity forest plot - S0-S1 vs S2-S3

Study	TN/Total	Specificity	95% CI	Weight
Idilman et al. 2013	22/26	0.85	[0.65; 0.94]	8.7%
Tang et al. 2015	41/45	0.91	[0.79; 0.97]	9.0%
Idilman et al. 2015	5/7	0.69	[0.33; 0.91]	6.2%
Middleton et al. 2017	34/38	0.89	[0.75; 0.96]	9.0%
Paige et al. 2017	26/27	0.96	[0.78; 0.99]	4.2%
Park et al. 2017	40/48	0.83	[0.70; 0.91]	11.1%
Beyer et al. 2021	167/232	0.72	[0.66; 0.77]	14.6%
Shao et al. 2021	45/51	0.88	[0.76; 0.95]	10.4%
Kim et al. 2022	22/25	0.88	[0.69; 0.96]	7.8%
Nogami et al. 2022	74/80	0.93	[0.84; 0.97]	10.5%
Gottfriedova et al. 2025	32/35	0.90	[0.76; 0.97]	8.5%
Total (random effects)		**0.87**	**[0.80; 0.91]**	**100.0%**

Heterogeneity: I^2 = 68.1%, p = <0.001



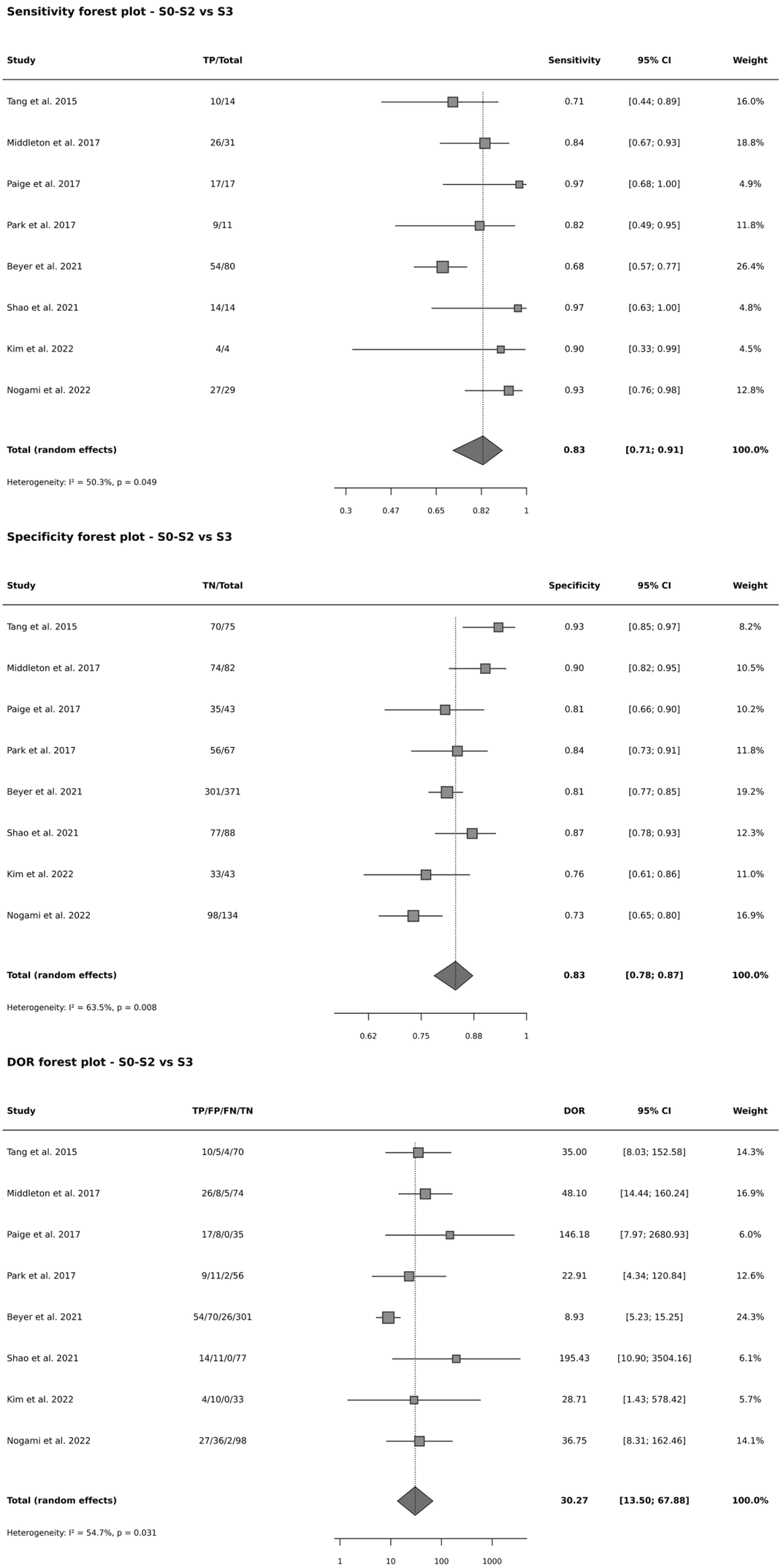
DOR forest plot - S0-S1 vs S2-S3

Study	TP/FP/FN/TN	DOR	95% CI	Weight
Idilman et al. 2013	41/4/3/22	75.17	[15.42; 366.42]	8.9%
Tang et al. 2015	34/4/10/41	34.85	[10.03; 121.09]	10.3%
Idilman et al. 2015	12/2/0/5	55.00	[2.25; 1346.26]	4.2%
Middleton et al. 2017	62/4/13/34	40.54	[12.26; 134.08]	10.5%
Paige et al. 2017	28/1/5/26	145.60	[15.93; 1330.49]	6.6%
Park et al. 2017	24/8/6/40	20.00	[6.19; 64.65]	10.6%
Beyer et al. 2021	158/65/61/167	6.65	[4.41; 10.04]	13.5%
Shao et al. 2021	46/6/5/45	69.00	[19.65; 242.28]	10.3%
Kim et al. 2022	17/3/5/22	24.93	[5.21; 119.26]	9.0%
Nogami et al. 2022	62/6/21/74	36.41	[13.83; 95.87]	11.5%
Gottfriedova et al. 2025	21/3/0/32	399.29	[19.62; 8124.15]	4.5%
Total (random effects)		**37.42**	**[17.14; 81.67]**	**100.0%**

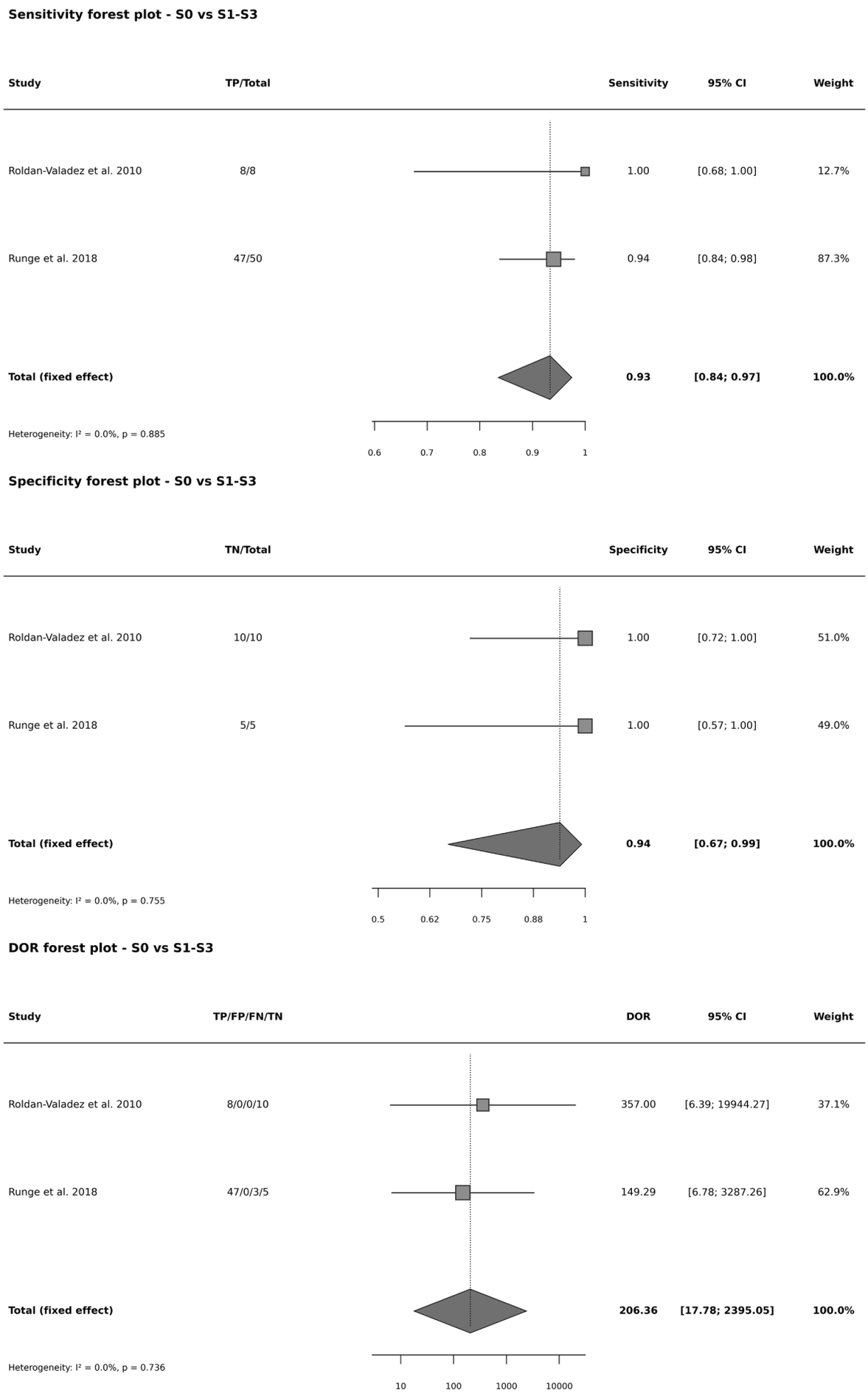
Heterogeneity: I^2 = 76.2%, p = <0.001



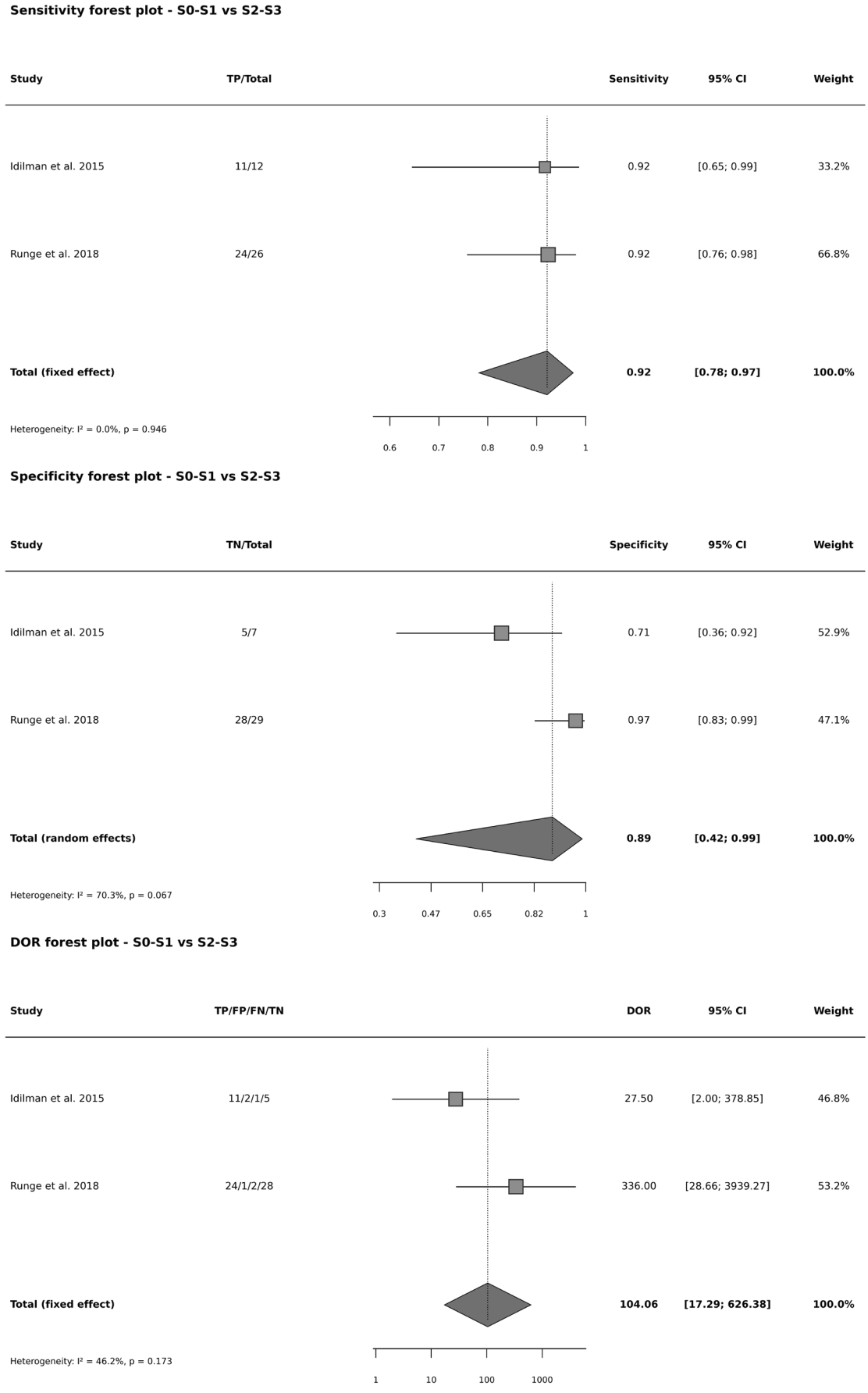
Supplementary Figure 4. Publication-bias and forest plots for MRI-PDFF at histologic threshold S ≥ 3. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; MRI-PDFF, magnetic resonance imaging proton density fat fraction.



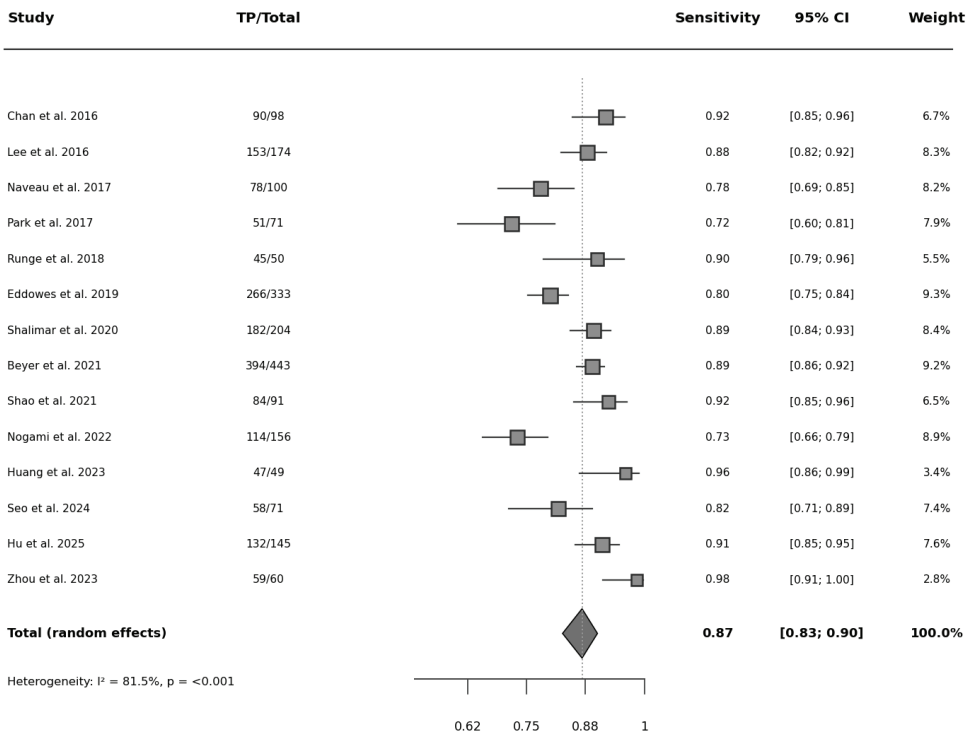
Supplementary Figure 5. Publication-bias and forest plots for MRI-PDFF analysis at histologic threshold S ≥ 1. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; MRI-PDFF, magnetic resonance imaging proton density fat fraction; DOR; diagnostic odds ratio.



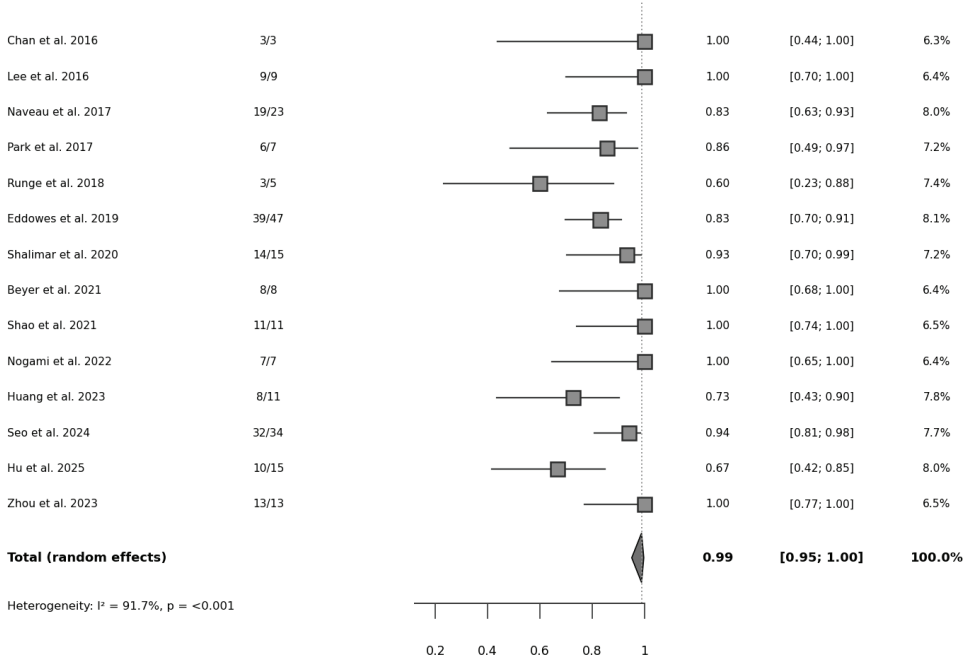
Supplementary Figure 6. Publication-bias and forest plots for MRI-PDFF analysis at histologic threshold S ≥ 2. CI, confidence interval; MRI-PDFF, magnetic resonance imaging proton density fat fraction; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative.



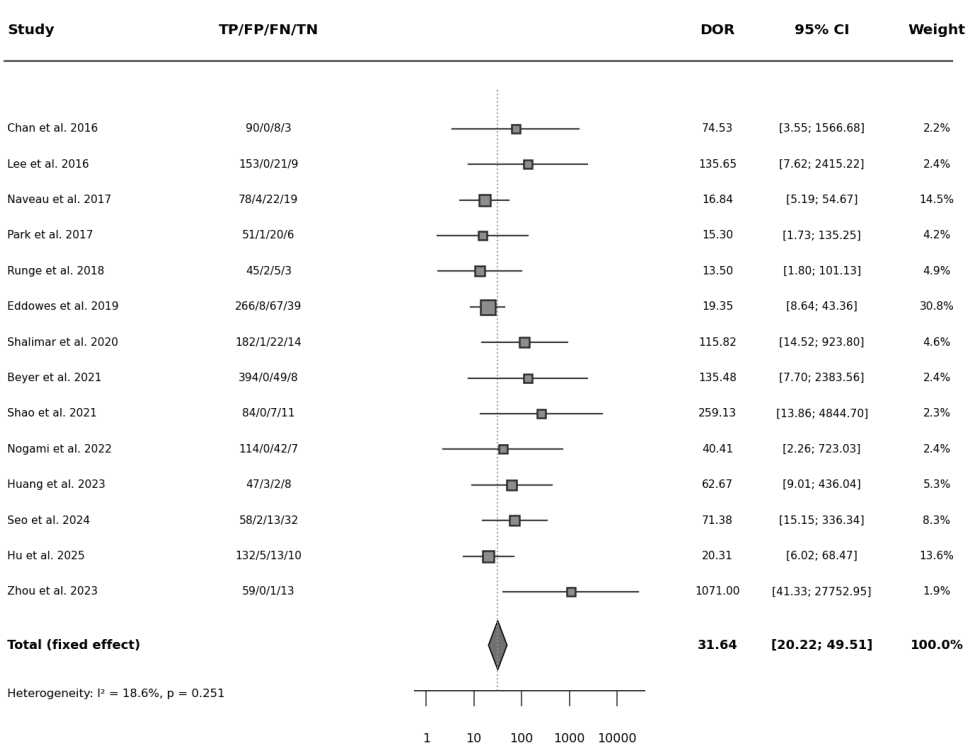
Supplementary Figure 7. Publication-bias and forest plots for CAP at histologic threshold S ≥ 1. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; CAP, controlled attenuation parameter; DOR, diagnostic odds ratio; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative.



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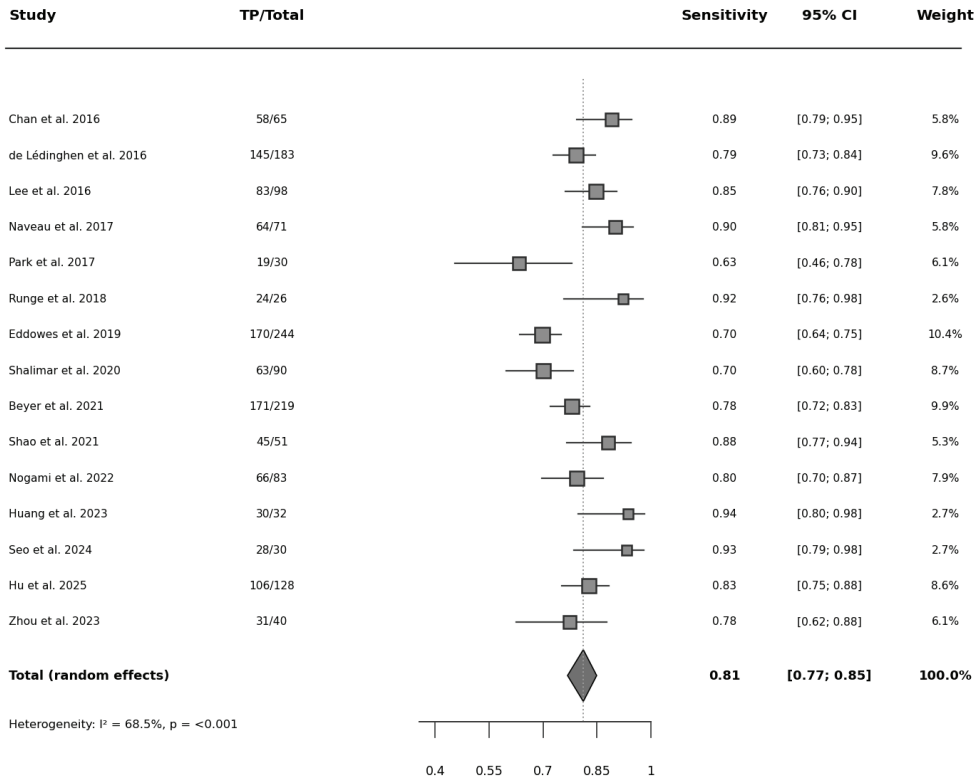


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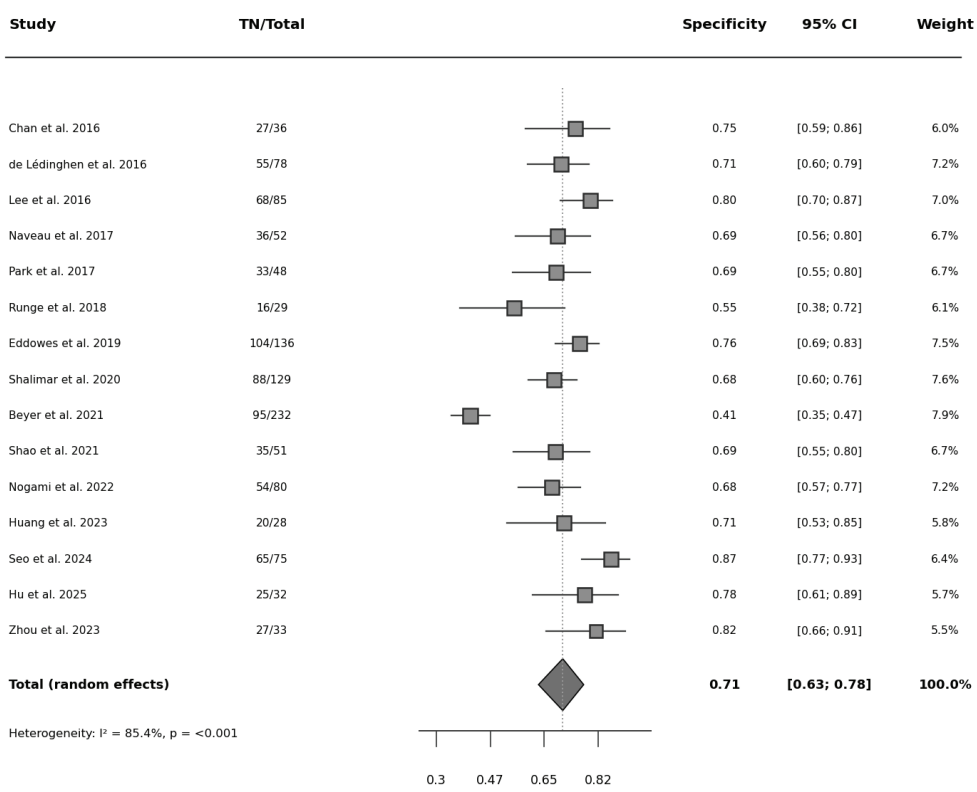


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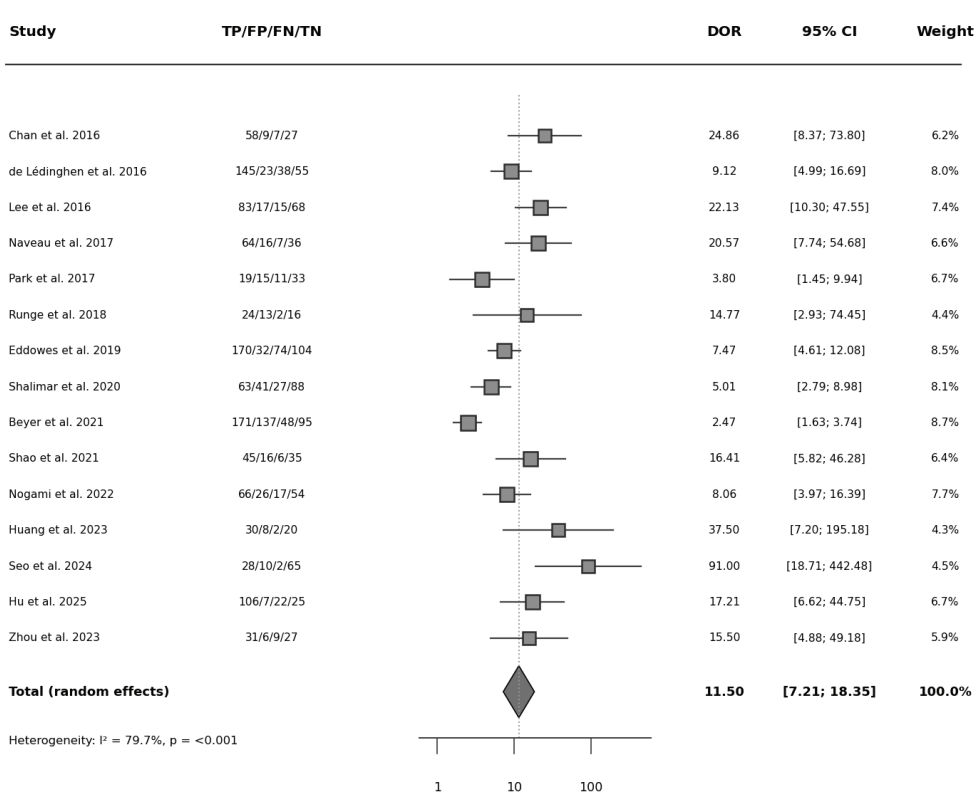
Supplementary Figure 8. Publication-bias and forest plots for CAP at histologic threshold S ≥ 2. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CAP, controlled attenuation parameter; CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative.



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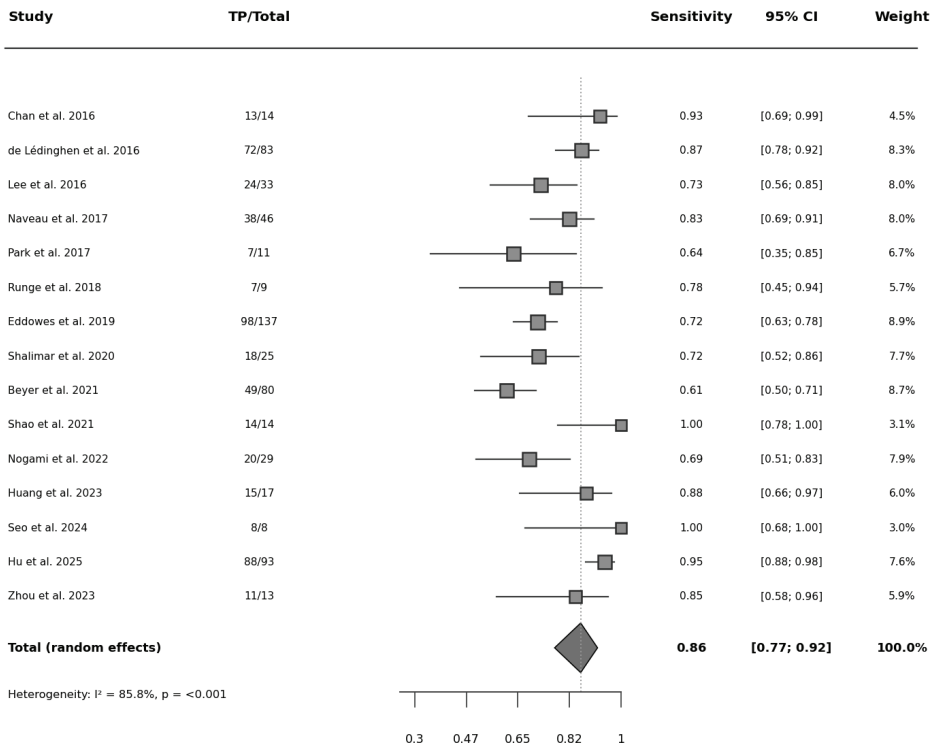


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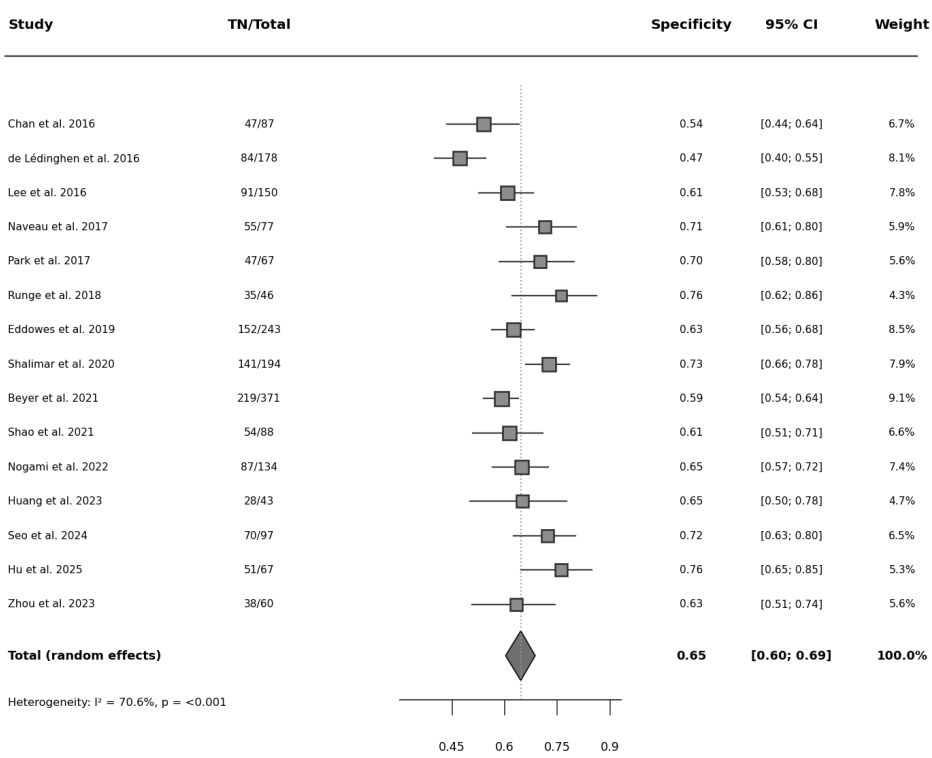


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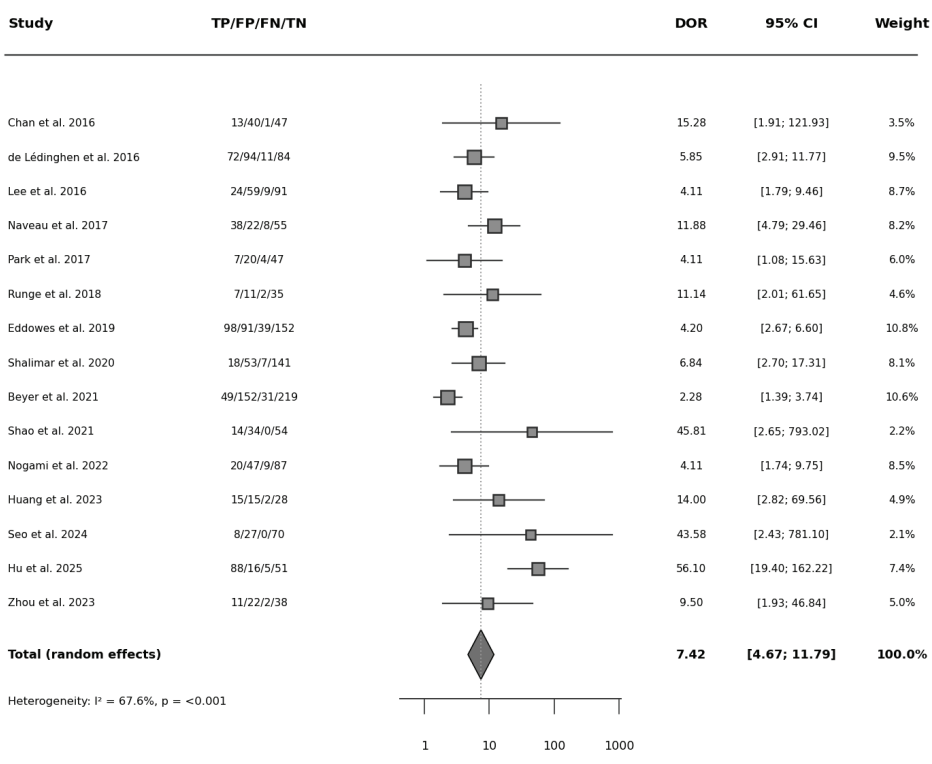
Supplementary Figure 9. Publication-bias and forest plots for CAP at histologic threshold S ≥ 3. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CAP, controlled attenuation parameter; CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative.



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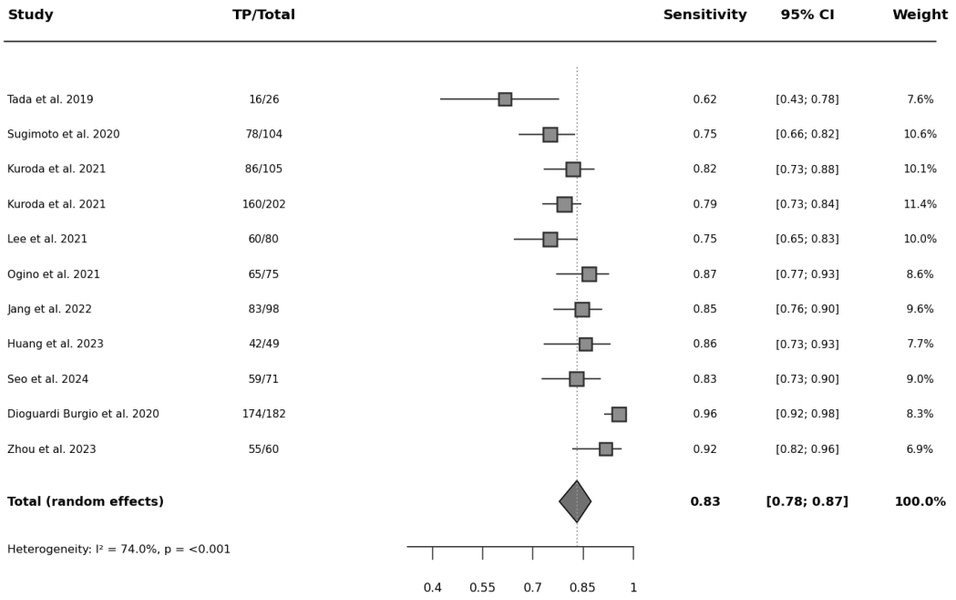


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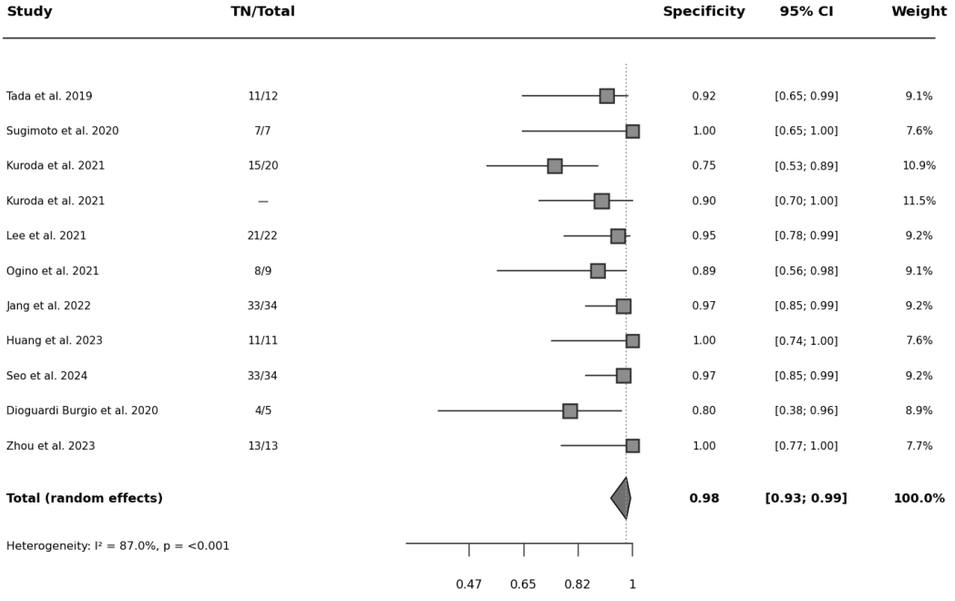


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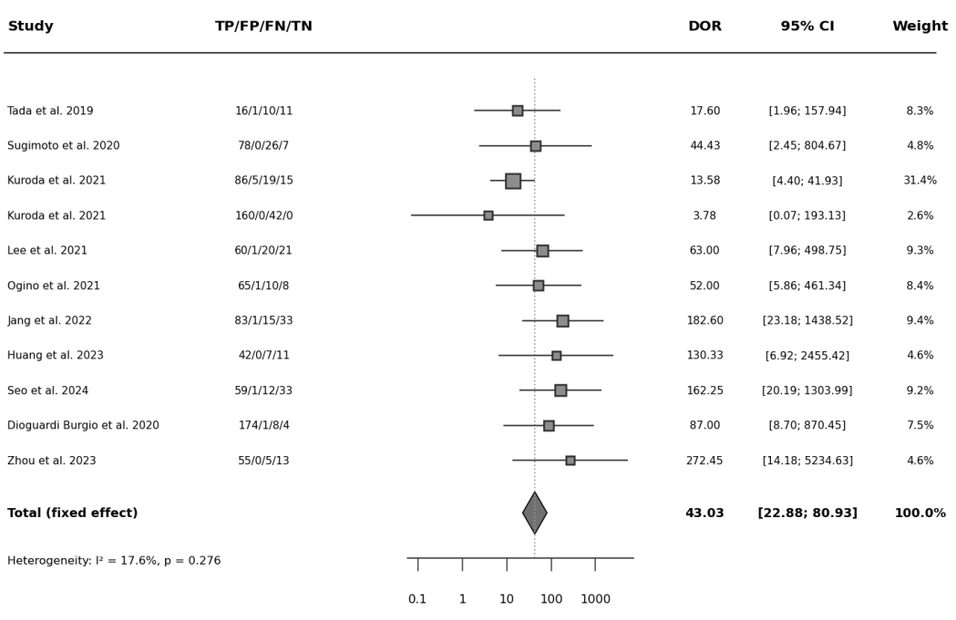
Supplementary Figure 10. Publication-bias and forest plots for AC/ATI at histologic threshold S ≥ 1. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative; AC/ATI, attenuation coefficient/attenuation imaging.



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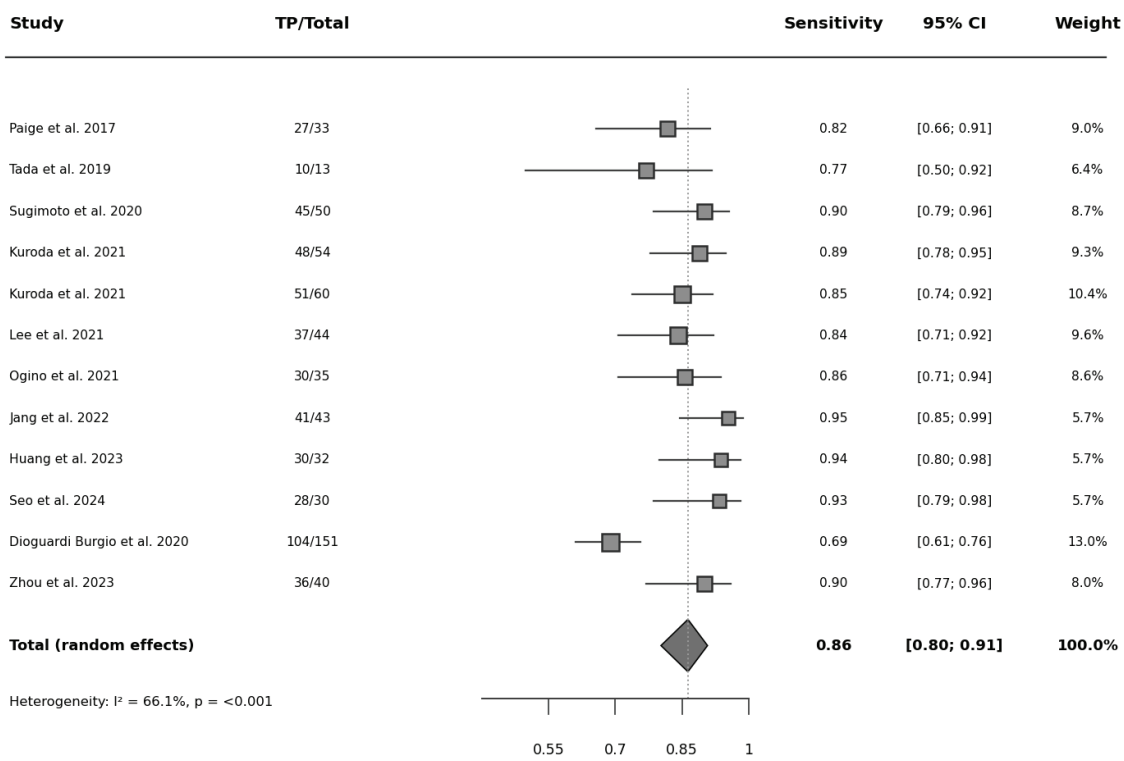


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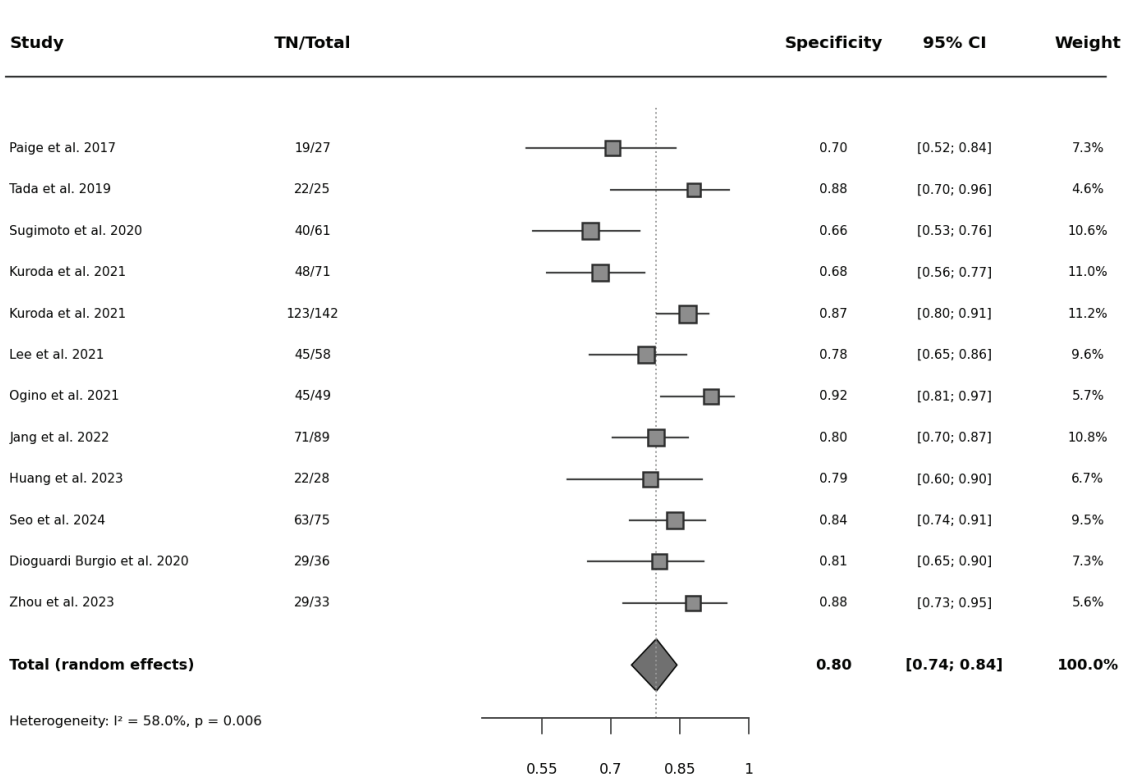


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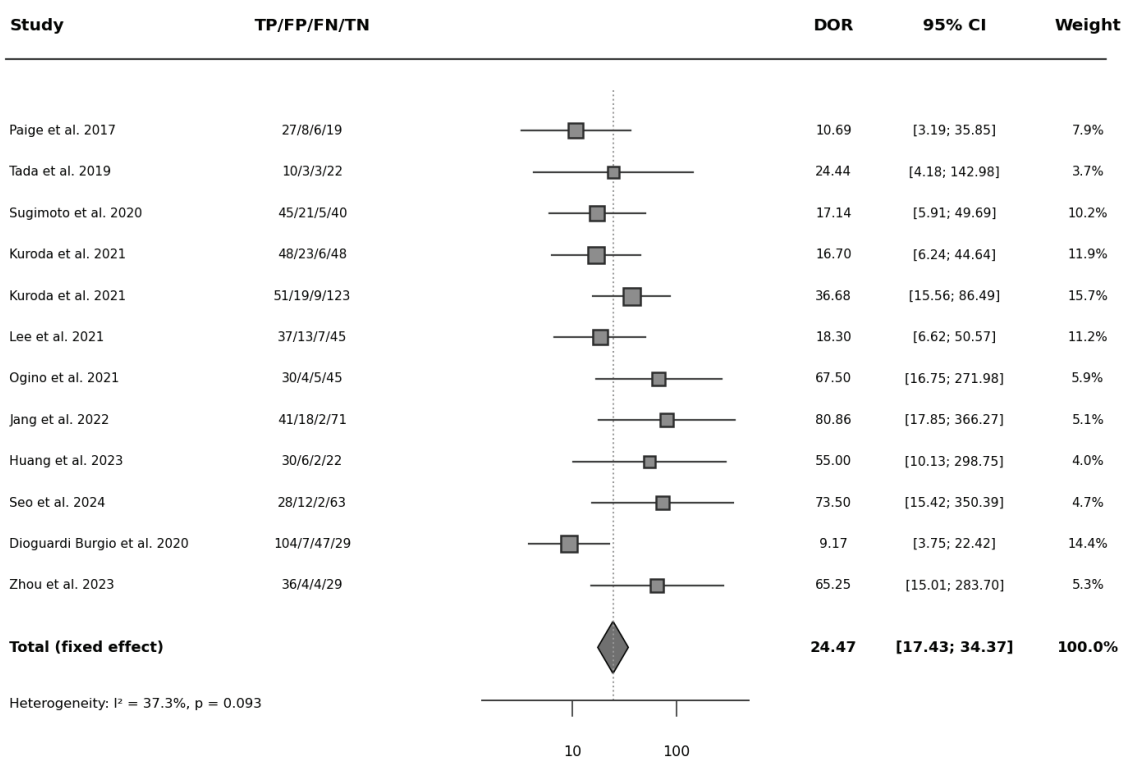
Supplementary Figure 11. Publication-bias and forest plots for AC/ATI at histologic threshold S ≥ 2. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative; AC/ATI, attenuation coefficient/attenuation imaging.



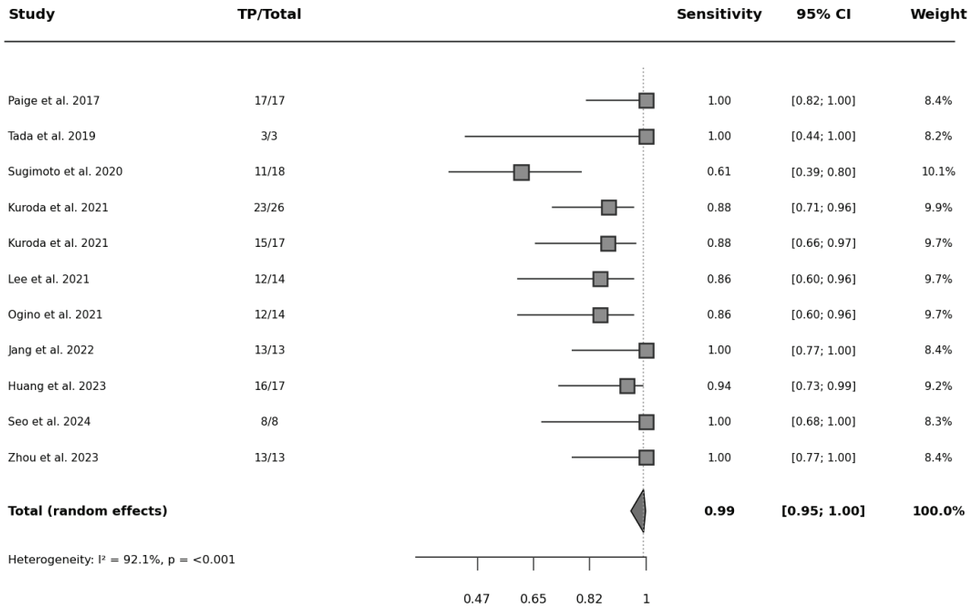
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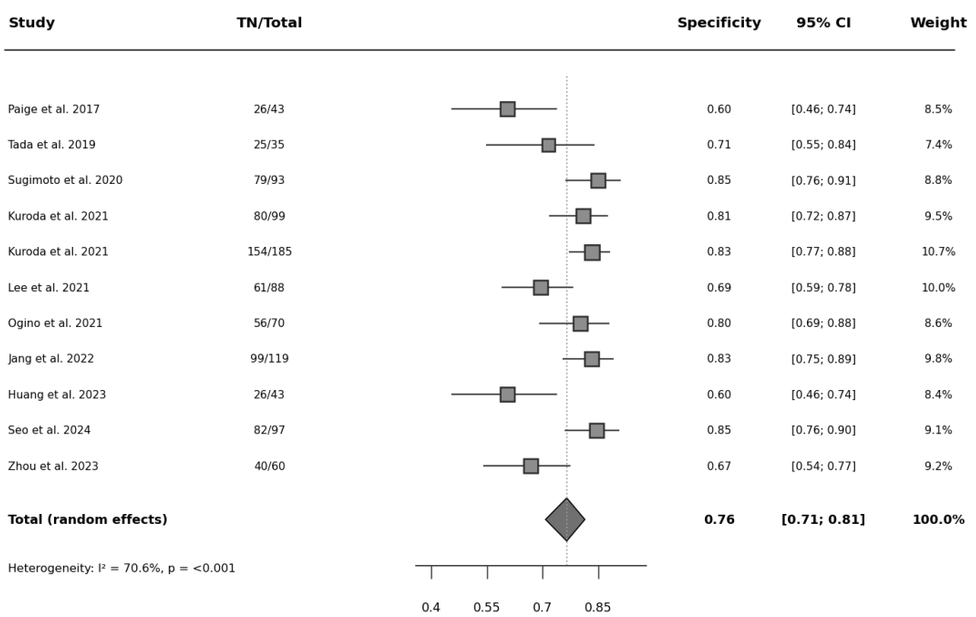
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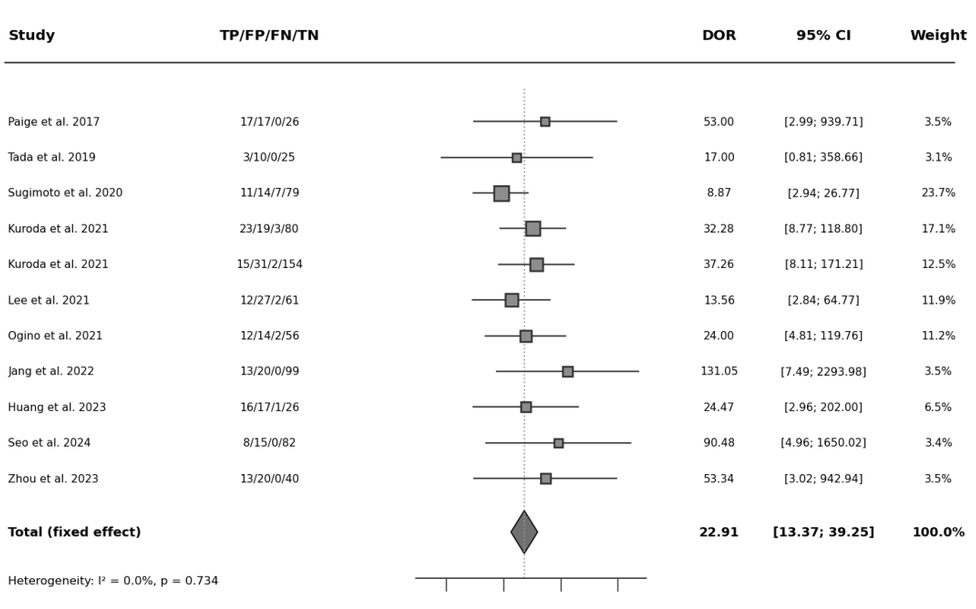
Supplementary Figure 12. Publication-bias and forest plots for AC/ATI at histologic threshold S ≥ 3. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative.



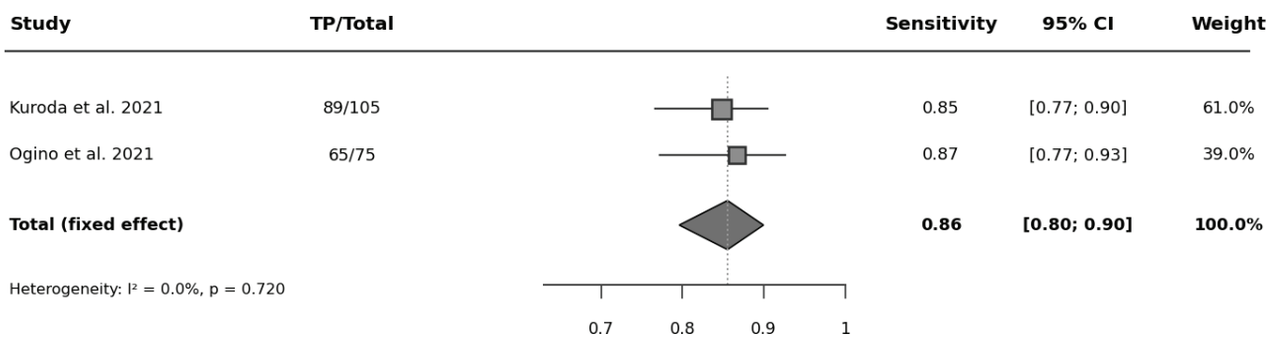
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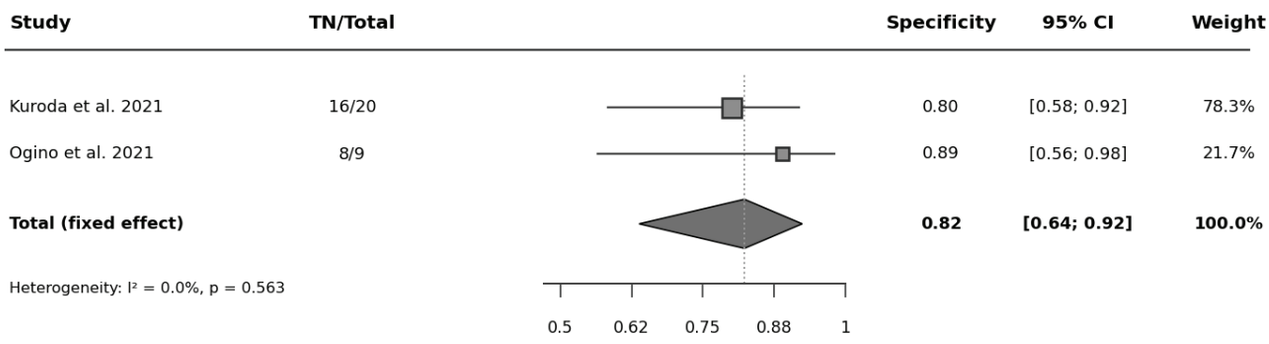
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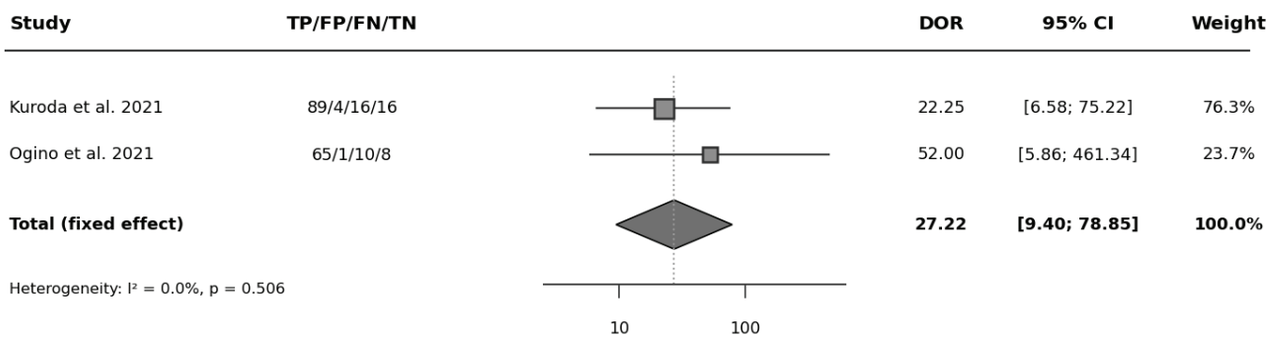
Supplementary Figure 13. Publication-bias and forest plots for UGAP at histologic threshold S ≥ 1. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative.



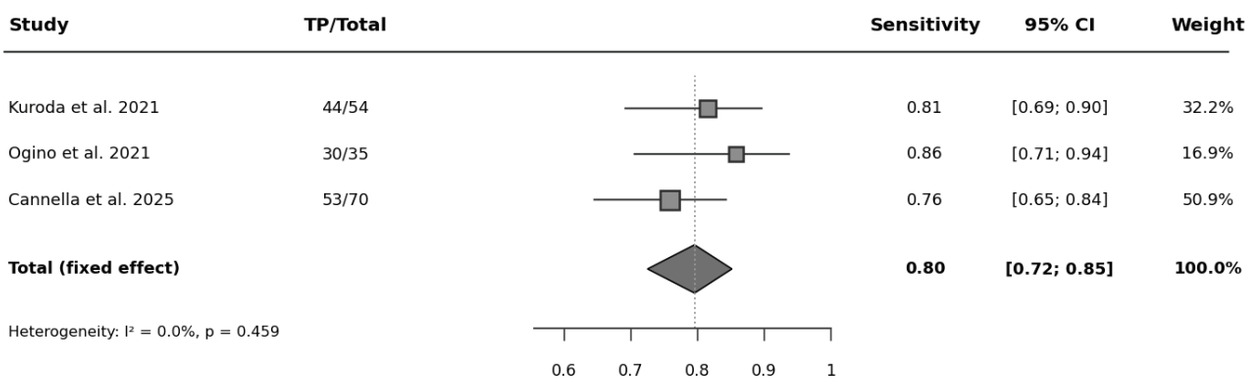
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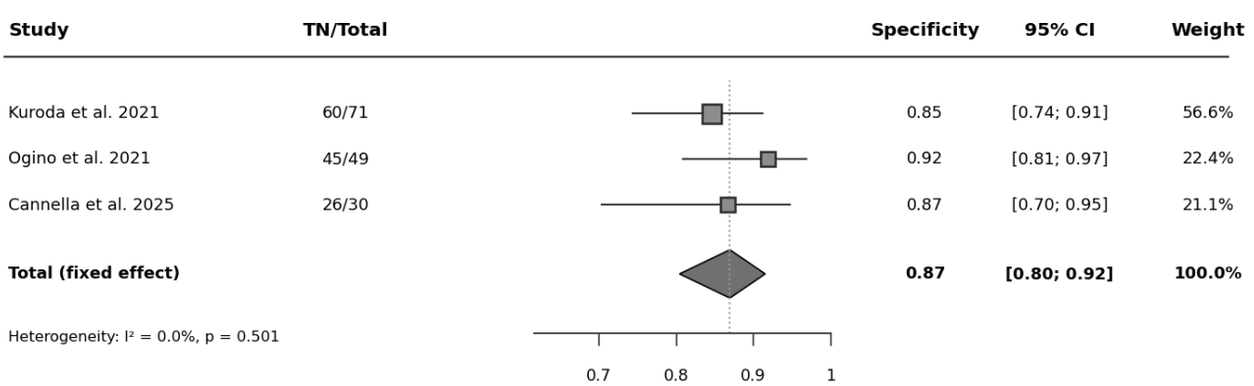
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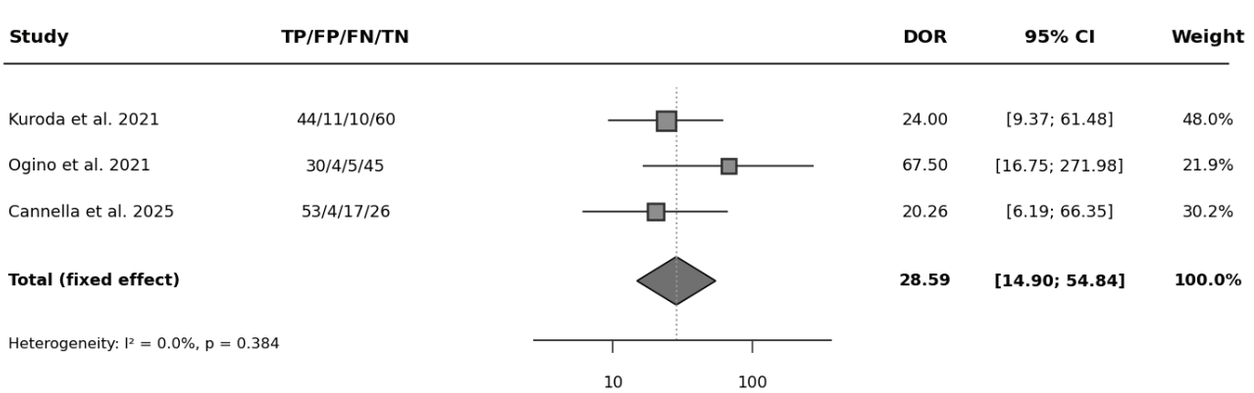
Supplementary Figure 14. Publication-bias and forest plots for UGAP at histologic threshold S ≥ 2. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative; UGAP, ultrasound-guided attenuation parameter.



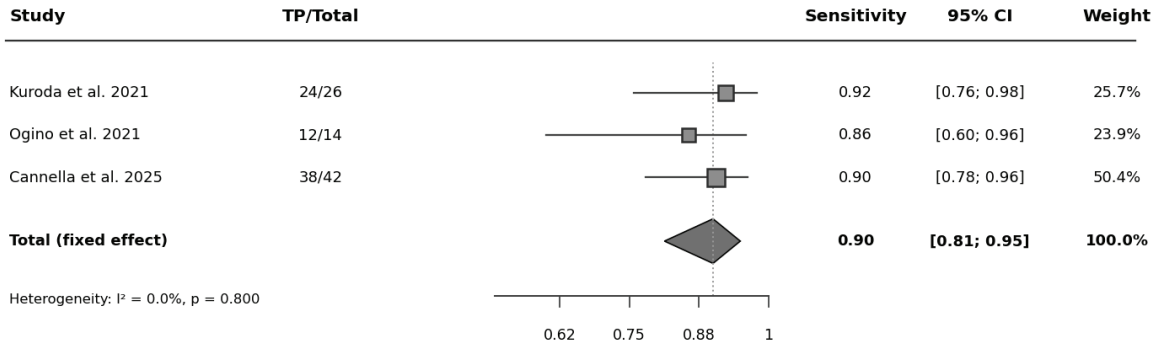
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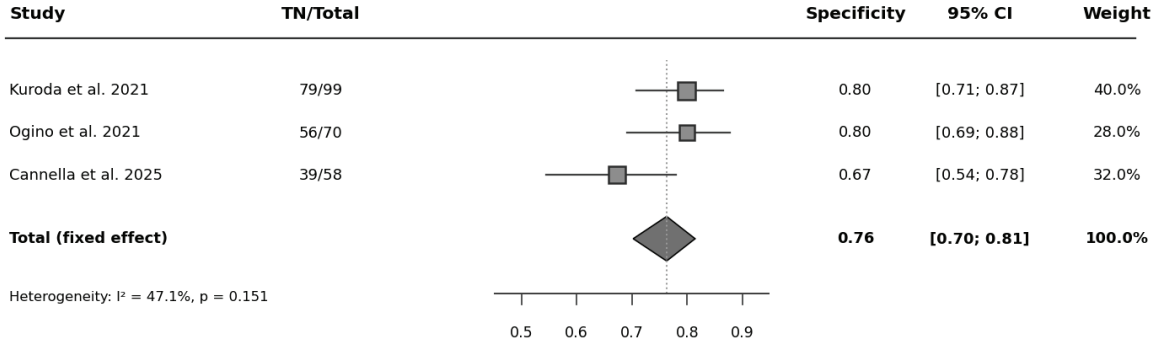
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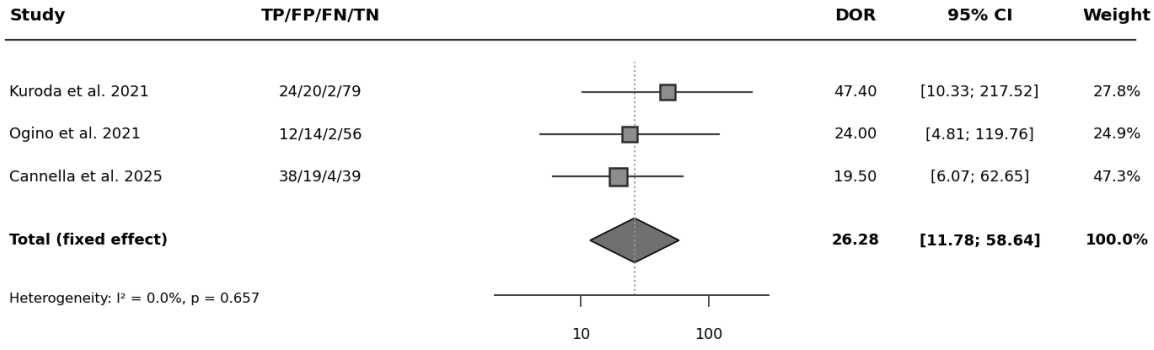
Supplementary Figure 15. Publication-bias and forest plots for UGAP at histologic threshold S ≥ 3. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative; UGAP, ultrasound-guided attenuation parameter.



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Supplementary Figure 16. Publication-bias and forest plots for UDFF at histologic threshold S ≥ 1. a, Sensitivity (top), specificity (middle), and diagnostic odds ratio (bottom) forest plots. CI, confidence interval; TP, true-positive; FP, false-positive; FN, false-negative; TN, true-negative; UDFF; ultrasound-derived fat fraction.