Supplementary materials

Appendix 1. Search terms entered into Pubmed

1. Lung cancer surgery
2. Lung surgery
3. Pulmonary surgery
4. Lung resection
5. Pulmonary resection
6. Sublobar resection
7. Anatomical resection
8. Pneumonectomy
9. Lobectomy
10. Wedge
11. Segmentectomy
12. Thoracic surgery

13. Predict*
14. Correlat*
15. Quanti*

16. Postoperati*
17. Post operati*
18. Post surg*
19. After surgery
20. After pneumonectomy
21. After lobectomy
22. After thoracotomy
23. After VATS

24. Respiratory function test
25. Respiratory function
26. Pulmonary function test
27. Pulmonary function
28. Lung function test
29. Lung function
30. Gas transfer
31. Diffus* capacity
32. Spiromet*

33. All surgical terms 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
34. All prediction terms 13 or 14 or 15
35. All postoperative terms 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23
36. All lung function terms 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32
37. **32 and 33 and 34 and 35**

Appendix 2 Risk of bias assessments for eligible full papers

Author Code	Paper	Risk of bias					Applicability		
		Participant selection	Predictors	Outcome	Sample size and flow	Analysis	Participant selection	Predictors	Outcome
2042	Hara et al, 2017 [1]	unclear	low	low	unclear	unclear	unclear	low	low
2011	Fourdrain et al, 2017[2]	low	low	low	low	low	low	low	low
2021	Suh et al, 2017 [3]	low	low	unclear	high	high	high	low	low
2031	Usuda et al, 2017 [4]	high	low	low	unclear	high	low	low	low
115	Yoo et al, 2016 [5]	unclear	low	unclear	unclear	high	low	low	low
116	Nomori et al, 2016 [6]	low	unclear	low	high	high	low	low	low
117	Yabuuchi et al, 2016 [7]	low	low	low	low	unclear	low	low	low
2	Ueda et al, 2015 [8]	high	low	low	high	unclear	low	low	low
3	Murakami et al, 2015 [9]	high	low	low	high	high	unclear	low	low
11	Kovacevic-Kusmierek, et al 2015 [10]	unclear	low	low	unclear	low	low	low	low
118	Ohno et al, 2015 [11]	low	low	low	low	low	low	low	low
122	Hashimoto et al, 2015 [12]	unclear	low	unclear	unclear	unclear	unclear	low	unclear
123	Choi et al, 2015 [13]	unclear	low	unclear	unclear	unclear	low	low	low
124	Edvardsen et al 2015 [14]	unclear	low	high	unclear	low	low	low	low
127	Rangarajan et al, 2015 [15]	unclear	unclear	low	unclear	low	low	low	low
12	Simsek Veske et al, 2014 [16]	low	low	high	unclear	high	high	low	low
14	Saito et al, 2014 [17]	low	low	high	low	unclear	low	low	low
16	Seok et al, 2014 [18]	high	low	low	unclear	high	low	low	low
128	Takahashi, 2014 [19]	unclear	low	high	unclear	high	low	low	low
129	Vos et al, 2014 [20]	unclear	low	unclear	low	unclear	low	low	low
130	Marinov et al, 2014 [21]	low	low	high	unclear	unclear	low	low	low
131	Franchi et al, 2014 [22]	unclear	low	unclear	unclear	unclear	unclear	low	low
163	Li et al, 2014 [23]	high	low	low	low	high	low	low	low
15	Mizobuchi et al, 2014 [24]	high	low	low	high	unclear	low	low	low
17	Yanagita et al, 2013[25]	low	low	low	low	unclear	low	low	low
19	Detterbeck et al, 2013 [26]	high	low	low	high	high	high	low	low
21	Westhoff et al, 2013 [27]	low	low	high	low	low	low	low	low
132	Chae et al, 2013[28]	low	low	low	low	low	low	low	low
134	Marinov et al, 2013 [29]	unclear	low	high	unclear	unclear	low	low	low
136	Janssens et al, 2013 [30]	unclear	low	unclear	unclear	low	low	low	low
18	Cukic, 2012 [31]	high	low	high	unclear	high	high	low	low
20	Kim et al, 2012 [32]	low	low	high	unclear	high	high	low	low
22	Comce et al,	low	low	high	unclear	high	high	low	low

	2011 [33]								
23	Comce et al, 2011 [34]	high	unclear	high	low	low	low	low	low
120	Zhu et al, 2011 [35]	low	low	high	low	high	low	low	low
138	Ohno et al, 2011 [36]	unclear	low	low	unclear	low	low	low	low
139	Holvoet et al, 2011 [37]	high	low	low	unclear	low	high	low	low
140	Papageorgiou et al, 2011 [38]	unclear	low	low	unclear	unclear	unclear	low	low
144	Kovacevic-Kusmierek et al, 2011 [39]	unclear	low	unclear	unclear	unclear	unclear	low	low
25	Pancieri et al, 2010 [40]	low	low	low	unclear	low	high	low	low
26	Morice et al, 2010 [41]	low	low	high	high	low	low	low	low
28	Jimenez et al, 2010 [42]	high	low	high	low	low	low	low	low
145	Caglar et al, 2010 [43]	unclear	low	high	unclear	high	low	low	low
146	Yamashita, 2010 [44]	low	low	low	low	low	low	low	low
150	Eberhardt et al, 2010 [45]	unclear	low	low	unclear	unclear	low	low	low
153	Lian et al, 2010 [46]	high	low	unclear	high	low	high	low	low
30	Ueda et al, 2009 [47]	unclear	low	low	unclear	high	low	low	low
155	Yoshimoto, 2009[48]	low	low	low	low	low	low	low	low
157	Maestre et al, 2009 [49]	unclear	low	high	unclear	high	low	low	low
36	Brunelli et al, 2007 [50]	unclear	low	high	low	unclear	low	low	low
37	Brunelli et al, 2007 [51]	low	unclear	low	low	high	low	low	low
160	Ohno, 2007[52]	low	low	low	low	low	low	low	low
4	Beyer et al, 2006 [53]	high	low	high	unclear	low	high	low	low
38	Mineo et al, 2006 [54]	unclear	low	high	unclear	low	low	low	low
39	Win et al, 2006 [55]	unclear	low	high	low	low	low	low	low
40	Varela et al, 2006 [56]	high	unclear	high	low	high	low	low	low
43	Wang, 2006 [57]	low	low	low	low	low	unclear	low	low
162	Sudoh, 2006 [58]	low	low	low	low	high	low	low	low
33	Brunelli et al, 2005 [59]	low	low	high	low	high	low	low	low
45	Sverzellati et al, 2005 [60]	unclear	low	low	unclear	low	low	low	low
46	Sekine et al, 2005 [61]	low	low	high	low	high	low	low	low
47	Liu et al, 2005 [62]	unclear	low	high	unclear	low	low	low	low
48	Win et al, 2004 [63]	unclear	low	high	unclear	low	high	low	low
49	Smulders et al, 2004 [64]	high	low	low	low	high	low	low	low
82	Yasukawa et al, 2004 [65]	high	low	low	high	high	high	low	low
164	Piai et al, 2004 [66]	low	low	high	low	high	low	low	low
165	Ohno et al, 2004 [67]	unclear	low	low	unclear	low	low	low	low
50	Koizumi et al, 2003 [68]	high	low	low	low	high	high	low	low
52	Sekine et al, 2003 [69]	high	low	high	high	unclear	low	low	low
53	Bolliger et al, 2002 [70]	unclear	low	low	unclear	low	low	low	low
54	Foroulis et al,	unclear	low	low	unclear	high	low	low	low

	2002 [71]								
56	Wu et al, 2002 [72]	low	low	low	low	high	low	low	low
57	Edwards et al, 2001 [73]	low	low	low	unclear	low	low	low	low
58	Beccaria et al, 2001[74]	low	low	low	low	high	low	low	low
166	Young et al, 1999 [75]	high	low	low	unclear	high	high	low	low
63	Furrer et al, 1997 [76]	high	low	low	unclear	high	high	low	low
64	Giordano et al, 1997 [77]	unclear	low	high	unclear	low	unclear	low	low
65	Leone et al, 1997 [78]	unclear	low	high	low	high	unclear	low	low
66	Larsen et al, 1997[79]	low	low	low	low	low	low	low	low
67	Weiner et al, 1997 [80]	unclear	low	low	unclear	high	low	low	low
69	Bolliger et al, 1996 [81]	low	low	low	low	high	high	low	low
168	Gaissert et al, 1996 [82]	high	low	high	high	high	unclear	low	low
172	Kikuchi et al, 1996 [83]	unclear	low	high	unclear	high	low	low	low
70	Imaeda et al, 1995 [84]	unclear	low	low	low	high	low	low	low
71	Izquierdo et al, 1995 [85]	unclear	high	high	low	low	low	low	low
72	Zeiher et al, 1995 [86]	low	low	high	unclear	high	low	low	low
73	Hosokawa et al, 1995 [87]	unclear	low	low	unclear	high	low	low	low
74	Giordano et al, 1995 [88]	unclear	low	high	unclear	high	low	low	low
169	Bolliger, 1995[89]	low	low	low	low	high	low	low	low
170	Romessis et al, 1995 [90]	unclear	low	low	low	high	low	low	low
76	Khargi et al, 1994 [91]	high	low	low	unclear	high	high	low	low
77	Wu et al, 1994 [92]	low	low	low	low	high	low	low	low
171	Cheon et al, 1994 [93]	unclear	low	high	low	high	low	low	low
78	Hirose et al, 1993 [94]	unclear	low	low	unclear	high	unclear	low	low
79	Omote et al, 1992 [95]	unclear	low	low	unclear	high	high	low	low
80	Sangalli et al, 1992 [96]	high	low	low	high	low	high	low	low
174	Cangemi et al, 1992 [97]	high	low	high	unclear	high	unclear	unclear	low
81	Cordiner et al, 1991 [98]	high	low	low	unclear	high	high	low	low
176	Koizumi et al, 1991 [99]	high	low	unclear	high	high	low	low	low
177	Ashino et al, 1991 [100]	unclear	low	high	unclear	high	unclear	low	low
195	Wang, 1991 [101]	high	low	low	high	high	unclear	low	low
86	Mende et al, 1990 [102]	unclear	low	low	unclear	high	unclear	low	low
88	Markos et al, 1989 [103]	low	low	low	unclear	high	low	low	low
89	Huang et al, 1989 [104]	unclear	low	low	low	high	high	low	low
90	Nonoyama et al, 1988 [105]	low	low	high	low	high	high	low	low
178	Yoshikawa, 1988 [106]	unclear	low	high	unclear	high	low	low	low
179	Nonoyama et al, 1988 [107]	unclear	low	low	unclear	high	low	low	low
92	Julius et al,1987 [108]	unclear	low	low	high	high	high	low	low

95	Veneskoski & Sovijärvi, 1986 [109]	high	low	high	unclear	high	low	low	low
96	Egeblad et al, 1986 [110]	unclear	low	high	low	high	low	low	low
180	Ladurie & Ranson-Bitker, 1986 [111]	high	low	low	unclear	high	high	low	low
98	Veneskoski & Sovijärvi, 1985 [112]	unclear	low	low	unclear	high	high	low	low
183	Nakahara et al, 1985 [113]	unclear	low	low	unclear	high	high	low	low
185	Hara, 1985 [114]	unclear	low	high	low	high	low	low	low
100	Williams et al, 1984 [115]	high	low	low	high	high	high	low	low
101	Bins et al, 1984 [116]	high	low	low	unclear	high	high	low	low
103	Bria et al, 1983 [117]	high	low	high	high	high	high	low	low
104	Ali et al, 1983 [118]	high	low	high	high	high	high	high	low
192	Nakahara et al, 1983 [119]	unclear	low	low	unclear	high	low	low	low
193	Loddenkemper et al, 1983 [120]	low	low	low	high	low	low	low	low
99	Nakahara et al, 1982 [121]	high	low	low	low	high	low	low	low
194	Konishi, 1982 [122]	unclear	low	high	high	high	low	low	low
106	Ali et al, 1980 [123]	high	low	high	unclear	high	unclear	low	low
189	Taube & Konietzko, 1980[124]	low	low	low	low	high	low	low	low
196	Taube & Konietzko, 1980 [125]	low	low	low	unclear	high	low	low	low
197	Walkup et al, 1980 [126]	unclear	low	high	unclear	high	unclear	low	low
198	Cooper et al, 1980 [127]	low	high	high	low	high	high	low	low
199	Wernly et al, 1980 [128]	unclear	low	high	unclear	low	unclear	low	low
108	Nicoli et al, 1979 [129]	unclear	unclear	low	high	high	high	low	low
110	Lipscomb & Pride, 1977 [130]	high	low	low	high	high	unclear	low	low
111	Malm et al, 1977 [131]	unclear	low	low	unclear	high	unclear	low	low
112	Juhl & Frost, 1975 [132]	unclear	low	high	high	high	low	low	low
191	Wever et al, 1975 [133]	high	low	high	low	high	low	low	low
113	Kristersson et al, 1973 [134]	high	low	low	high	high	low	low	low
114	Kristersson et al,1972 [135]	unclear	low	high	high	high	low	low	low

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Appendix 3 Forest plots for mean difference in FEV_1

Figure A. Forest plot for segment counting

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI	Year
Egeblad 1986	124.76	55.751	24.7%	124.76 [15.49, 234.03]	1986
Beccaria 2001	110	49.21	26.3%	110.00 [13.55, 206.45]	2001
Yanagita 2013	200	61.17	23.4%	200.00 [80.11, 319.89]	2013
Foudrain 2017	332	52.337	25.6%	332.00 [229.42, 434.58]	2017
Total (95% CI)			**100.0%**	**191.45 [87.54, 295.36]**	

Heterogeneity: $Tau^2 = 8261.40$; $Chi^2 = 11.40$, df = 3 (P = 0.010); $I^2 = 74\%$
Test for overall effect: Z = 3.61 (P = 0.0003)

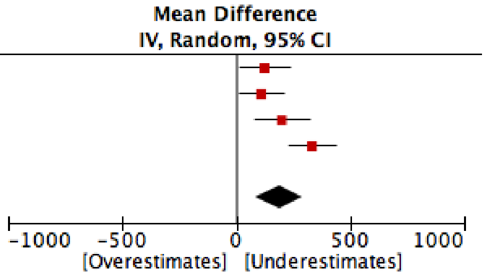


Figure B. Forest plot for subsegment counting

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI	Year
Sudoh 2006	240	53.683	32.3%	240.00 [134.78, 345.22]	2006
Yoshimoto 2009	150	46.032	35.8%	150.00 [59.78, 240.22]	2009
Foudrain 2017	320	54.631	31.9%	320.00 [212.93, 427.07]	2017
Total (95% CI)			**100.0%**	**233.29 [134.74, 331.85]**	

Heterogeneity: $Tau^2 = 4943.96$; $Chi^2 = 5.75$, df = 2 (P = 0.06); $I^2 = 65\%$
Test for overall effect: Z = 4.64 (P < 0.00001)

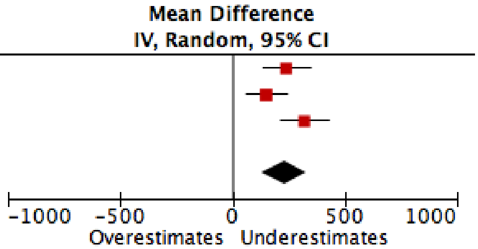


Figure C. Forest plot of perfusion scintigraphy

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI	Year
Taube 1980	0	63.479	12.3%	0.00 [-124.42, 124.42]	1980
Bolliger 1995	170	41.92	13.5%	170.00 [87.84, 252.16]	1995
Larsen 1997	360	66.34	12.2%	360.00 [229.98, 490.02]	1997
Wu 2002 (lobectomy)	-70	34.26	13.8%	-70.00 [-137.15, -2.85]	2002
Wu 2002 (pneumonectomy)	-10	69	12.0%	-10.00 [-145.24, 125.24]	2002
Yasmashita 2010	46.43	80.68	11.3%	46.43 [-111.70, 204.56]	2010
Chae 2013	20	59.655	12.5%	20.00 [-96.92, 136.92]	2013
Foudrain 2017	304	61.51	12.4%	304.00 [183.44, 424.56]	2017
Total (95% CI)			**100.0%**	**101.35 [-10.90, 213.59]**	

Heterogeneity: $Tau^2 = 22584.71$; $Chi^2 = 59.25$, df = 7 (P < 0.00001); $I^2 = 88\%$
Test for overall effect: Z = 1.77 (P = 0.08)

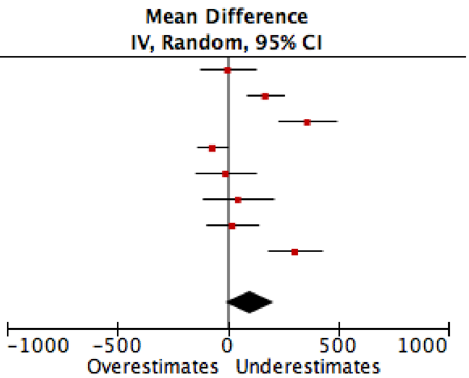


Figure D. Forest plot of CT perfusion

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI	Year
Yasmashita 2010	122.14	87.63	24.0%	122.14 [-49.61, 293.89]	2010
Chae 2013	150	49.295	76.0%	150.00 [53.38, 246.62]	2013
Total (95% CI)			**100.0%**	**143.30 [59.10, 227.51]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.08$, df = 1 (P = 0.78); $I^2 = 0\%$
Test for overall effect: Z = 3.34 (P = 0.0009)

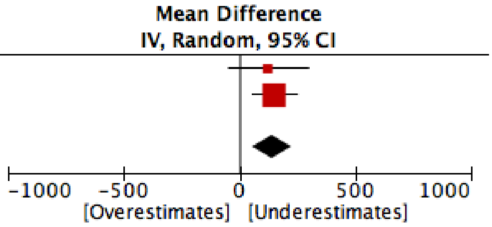


Figure E. Forest plot of CT density and volume

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI	Year
Wu 1994	93.68	29.08	32.5%	93.68 [36.68, 150.68]	1994
Wu 2002 (pneumonectomy)	40	52.9	9.8%	40.00 [-63.68, 143.68]	2002
Wu 2002 (lobectomy)	60	26.18	40.1%	60.00 [8.69, 111.31]	2002
Yoshimoto 2009	70	39.456	17.6%	70.00 [-7.33, 147.33]	2009
Total (95% CI)			**100.0%**	**70.74 [38.26, 103.22]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.13$, df = 3 (P = 0.77); $I^2 = 0\%$
Test for overall effect: Z = 4.27 (P < 0.0001)

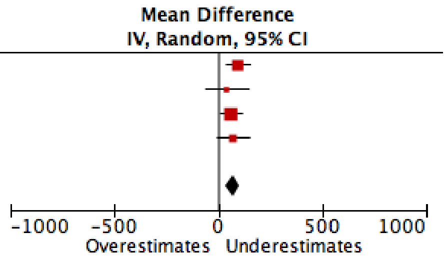
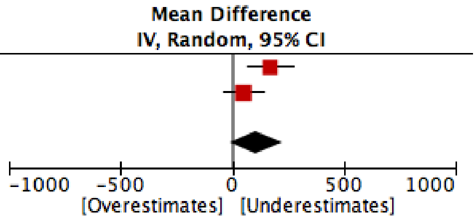


Figure F. Forest plot of SPECT-CT

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI	Year
Sudoh 2006	170	52.915	47.6%	170.00 [66.29, 273.71]	2006
Yoshimoto 2009	50	46.03	52.4%	50.00 [-40.22, 140.22]	2009
Total (95% CI)			**100.0%**	**107.16 [-10.30, 224.63]**	

Heterogeneity: $Tau^2 = 4740.62$; $Chi^2 = 2.93$, df = 1 (P = 0.09); $I^2 = 66\%$
Test for overall effect: Z = 1.79 (P = 0.07)



Appendix 4. Qualitative information about studies that could not be meta-analysed

Study	Outcome	Techniques reported by smallest mean difference	Author conclusion
Yabuuchi, 2016 [1]	Change in FEV1	1. CT volumetry & densitometry 2. Subsegment counting 3. CT volumetry	CT volumetry & densitometry more strongly correlated with postopative FEV1 than subsegment counting or CT volumetry.
Ohno, 2015 [2]	FEV1 % expected	1. Plain MRI 2. Dynamic contrast MRI 3. CT volumetry & densitometry 4. Segment counting 5. Perfusion scintigraphy	Plain MRI, dynamic contrast MRI and CT volumetry & densitometry equally useful. These are more accurate than segment counting and perfusion scintigraphy.
Ohno, 2007 [3]	FEV1 % expected	1. SPECT-CT 2. SPECT 3. Ventilation scintigraphy 4. Perfusion scintigraphy	SPECT-CT and SPECT more accurate and reproducible than ventilation or perfusion scintigraphy

References

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