

Supplementary Table S1. Patient demographics and treatment information

Study	Country	Years of study	Type of cohort study	Recurrences only included in study Y/N	Mean or median age (years) (Total population (TP) or recurrences (R))	No. of patients followed / included in study	Male : Female (TP or R)	Stage of primary tumours (TP or R)	Lymph node status (TP or R)	Perioperative treatment of primary tumour (TP or R)	No. of local recurrences (included / classified)	Method of diagnosis of recurrence	Classification system used	Operation performed for primary cancer leading to recurrence (TP or R)
Adachi et al. 1999 ⁽¹⁸⁾	Japan	11	Retrospective	N	(R): 61.9	135	(R): 4M : 5F	Depth of invasion (R): Shallow part of adventitia = 5 Submucosa = 1 Muscularis propria = 3	(R): N-ve = 2 N+ve = 7	Not reported	21 (10)	Clinical and radiological	Anatomical	(R): Pull-through = 2 LAR = 5 APER = 2
Adloff M et al. 1985 ⁽¹⁹⁾	France	7	Prospective	N	(R): 66	113	(R): 10M : 26F	Dukes stage (R): B = 16 C = 20	(R): N-ve = 21 N+ve = 15	Not reported	36 (36)	Clinical/radiological/histopathological	Anatomical	(R): APER = 36
Baek JY et al. 2017 ⁽²⁰⁾	Seoul	9	Retrospective	N	(TP): 67	122	(TP): 67M : 55F	(R): pT3 = 6	(R): pN0 = 6	(R): No neoadjuvant/adjuvant treatment = 6	6 (6)	Clinical/radiological/histopathological	Regional anatomical	(TP): APER: = 2 LAR: 120
Beppu N et al. 2017 ⁽²¹⁾	Japan	12	Retrospective	N	(TP): 63.5	119	(TP): 84M :35F	TNM (R): T3 = 9	(TP): N -ve = 44 N+ve = 75	(R): Neoadjuvant radiotherapy = 9	9 (9)	Clinical/radiological/histopathological	Regional anatomical	(R): Intersphincteric resection = 6 APER = 3
Beppu N et al. 2018 ⁽²²⁾	Japan	13	Retrospective	N	(TP): 62	216	(TP): 144M : 72F	(R): T3 = 16	(TP): N-ve = 156 N+ve = 60	(R): Neoadjuvant short-course radiotherapy = 16	16 (16)	Clinical/biochemical/radiological (confirmed with MRI/PET-CT)	Regional anatomical	(TP): All TME: Double-stapling technique = 94 Intersphincteric resection = 106 APER = 14 Hartmann's = 2 Additional PSD = 13
Bikhchandani J et. al 2015 ⁽²³⁾	USA	16	Retrospective	Y	(R): 66	27	(R): 9M : 18F	TNM (R): Tx = 2 Tis = 2 T1 = 16 T2 = 7	(R): N0 = 7 Unknown = 20	Not reported	32 (32)	EUS/MRI	Anatomical	(R): LE = 27
Bird T et al. 2018 ⁽²⁴⁾	Australia	19	Prospective	Y	(R): 63	98	(R): 61M : 37F	TNM (R): T1-T2 N0 = 14, T3N0 = 26, T2N+ve = 2, T3N+ve = 21, T4N0 = 9, T4N+ = 6, Unknown = 20	(R): N-ve = 49 N+ve = 29 Unknown = 20	(R): Adjuvant chemotherapy: Yes = 45 No = 48 Unknown = 5 Chemoradiation: Neoadjuvant = 34 Adjuvant = 6 None = 57 Unknown = 1	98 (98)	Radiological (MRI/CT/PET-CT)	Yamada ⁽⁸⁾ and regional anatomical	(R): Sphincter-preserving = 79 Non-sphincter-preserving = 19
Boyle K et al. 2005 ⁽¹²⁾	UK	7	Retrospective	Y	(R): 56	64	(R): 38M : 26F	Dukes (R): A = 8 B=19 C=26 Unknown = 11	Not reported	Not reported	64 (64)	Clinical/operative/radiological/histopathological	Regional anatomical (Leeds group) ⁽²¹⁾ and Symptoms & fixity (Mayo clinic) ⁽⁷⁾	(R): AR = 35 APER = 22 Proctectomy with end colostomy = 5 Total colectomy & end ileostomy = 1 Resection of rectal stump = 1
Brown W et al. 2017 ⁽²⁵⁾	Australia	4	Retrospective	Y	(R): 60	62	(R): 40M :22F	Not reported	Not reported	(R): Radiotherapy alone = 9 Chemotherapy only = 2 Chemoradiotherapy = 30 None = 11 Unknown = 10	164 (164)	2 of the following: MRI/Pet-CT/CEA/clinical assessment	Anatomical	(R): APER = 15 Non- APER = 47
Choi SH et al. 2018 ⁽²⁶⁾	Korea	7	Retrospective	N	Not reported	826	(TP): 500M : 326F	TNM (R): T1-2/N0 = 9 T3N0 = 8 T3/N1 = 2 T3/N2 = 6 T4/N1 = 1 T4/N2 = 2	(R): N0 = 17 N1 = 3 N2 = 8	No radiotherapy = 826	108 (31)	MRI	Anatomical	(R): Curative TME = 28

Dresen R et al. 2010 ⁽²⁷⁾	The Netherlands	3	Retrospective	Y	(R): 61	40	(R): 26M : 14F	Not reported	Not reported	(R): Neoadjuvant therapy: No = 13 Short course RT = 17 Long course RT = 10	49 (49)	MRI	Anatomical	(R): APER = 15 LAR = 25
Even-Sapir E et al. 2004 ⁽²⁸⁾	Israel	Not stated	Retrospective	N	(TP): 62	62	(TP): 37M : 25F	Not reported	Not reported	(TP): Neoadjuvant chemoradiotherapy = 7 Adjuvant chemotherapy = 16 Adjuvant radiotherapy = 3	44 (44)	Clinical/radiological (CT,PET-CT,MRI,EUS)/endoscopy/histopathology	Anatomical	(TP): 17 = APER 45 = AR with pelvic anastomosis
Fujii S et al. 2009 ⁽²⁹⁾	Japan	20	Retrospective	Y	(R): 59	61	(R): 39M : 22F	Not reported	Not reported	Not reported	61 (61)	Not reported	Regional anatomical	Primary operative procedure not stated
Gilbertsen V et al. 1960 ⁽⁶⁹⁾	USA	10	Prospective	N	(R): 57.4	89	(R): 21M : 11F	Dukes (R): A = 4 B = 4 C = 20 Unknown = 4	(R): N-ve = 8 N+ve = 20 Unknown = 4	Not reported	39 (39)	Histopathological (Biopsy/surgical exploration/autopsy)	Anatomical	(R): APER = 32
Gleeson F et al. 2012 ⁽³⁰⁾	USA		Retrospective	N	(TP): 67	155	(TP): 98M : 57F	TNM (TP): PT0 = 44 pT1 = 61 pT2 = 38 pT3 = 11 pT4 = 1	Not reported	(TP): Neoadjuvant therapy = 6	16 (16)	Clinical/CEA/radiological (CT,MRI,EUS),histopathological	Anatomical	(R): Transanal LE = 16
Hahnloser D et al. 2003 ⁽³¹⁾	USA	15	Retrospective	Y	(R): 60.8	304	(R): 192M : 112F	Astler-Coller (R): A=15 B1=54 B2=76 B3=15 C1=19 C2=72 C3=15 Unknown = 38	(R): N-ve = 160 N+ve = 106 Unknown = 38	Not reported	304 (304)	CT/MRI/endoscopy/clinical	Symptoms & fixity (Mayo Clinic) ⁽⁷⁾	(R): Sphincter-preserving = 200 Stoma = 104
Hasegawa S et al. 2016 ⁽³²⁾	Japan	8	Retrospective	N	(TP): 64.8	212 (207 with previous R0 resection)	(TP): 145M : 67F	UICC (R): I = 2 II = 16	(R) of 11 patients with LR other than pelvic sidewall nodes: N-ve = 2 N+ve = 9	(TP): Neoadjuvant treatment: Chemotherapy = 30 Chemoradiotherapy = 7 In those with R0 resection: Adjuvant treatment: Chemotherapy = 81	19 (19)	Tumour markers/clinical examination/colonoscopy/contrast enema/CT/MRI	Regional anatomical	(TP): Sphincter-preserving = 178 Non-sphincter-preserving = 34 (PSD = 18, no PSD = 194)
Hruby G et al. 2003 ⁽³³⁾	New Zealand	13	Retrospective	Y	(R): 70	269	(R): 150M : 119F	TNM (R): T1 = 4 T2 = 29 T3 = 198 T4 = 23 Unknown = 15	(R): N-ve = 129 N+ve = 140	(R): No radiotherapy = 269 Adjuvant chemotherapy = 36	268 (267)	(R): Biopsy = 156 Combination of radiological/clinical findings = 113	Regional anatomical (Hruby) ⁽³¹⁾	(R): APER = 100 LE = 8 LAR = 154 Other = 6 Unknown = 1
Ingle P et al. 2019 ⁽³³⁾	India	3	Retrospective	Y	(R): 30	10	(R): 2M	TNM (R): T3 = 2	(R): N1 = 2	(R): Neoadjuvant treatment: Chemoradiotherapy then chemotherapy = 1 Short course radiotherapy = 1	2 (2)	Not reported	Anatomical	(R): APER = 1 Intersphincteric resection = 1
Iversen H et al. 2017 ⁽⁶⁸⁾	Sweden	10	Retrospective	Y	(R): 65	95	(R): 59M : 36F	Not reported	Not reported	(R): Neoadjuvant radiotherapy = 54	184 (184)	MRI	Regional anatomical (Memorial Sloan Kettering) ⁽¹⁰⁾	Primary operative procedure not stated
Kanemitsu Y et al. 2010 ⁽³⁴⁾	Japan	25	Retrospective	Y	(R): 57	101	(R): 57M : 44F	Dukes (R): A = 18 B = 21 C = 52 D = 5 Unknown = 5	(R): N-ve = 39 N+ve = 52 Unknown = 10	(R): Adjuvant treatment: Chemotherapy = 33 Radiotherapy = 3	101 (101)	CEA/PET CT/CT-guided biopsy/MRI (MRI for location of pelvic recurrence)	Reginal anatomical Modified Yamada ⁽⁶⁾	(R): LE = 4 HAR = 15 LAR = 46 APR = 32 Hartmann's = 4
Killingback M et al. 2001 ⁽³⁵⁾	Australia	30	Prospective	N	(TP): Male = 61.3 Female = 61.9	532	(TP): 304M : 228F	Dukes (R): A = 5 B = 6 C = 30	(R): N-ve = 11 N+ve = 30	(TP): Radiotherapy: ^ Neoadjuvant = 28 Adjuvant = 5 Adjuvant chemotherapy = 1	Sphincter-saving resections: 49 (49)	Clinical examination & CT	Anatomical	(TP): APER = 58 Sphincter-saving resection = 472 Proctocolectomy = 2 (R): HAR = 1

														LAR = 6 Extended LAR = 5 AR with coloanal anastomosis = 3 Unknown = 26
Kim T et al. 2008 ⁽³⁶⁾	Korea	4	Prospective	N	(TP): 57	366	(TP): 247M : 119F	TNM (TP): cT3 = 354 cT4 = 12 ypT0 = 53 ypTis = 2 ypT1 = 19 ypT2 = 96 ypT3 = 182 ypT4 = 14 (R): ypT<3 = 5 ypT≥3 = 19 Unknown = 5	(TP): cN-ve = 58 cN +ve = 308 ypN0 = 250 ypN1 = 79 ypN2 = 37 (R): ypN-ve = 8 ypN+ve = 16 Unknown = 5	(TP): Neoadjuvant chemoradiotherapy = 366 Adjuvant chemotherapy = 357 (R): Neoadjuvant chemotherapy = 24 Adjuvant chemotherapy = 23 Unknown = 5	30 (30)	Clinical/radiological (CT/MRI)/histopathological	Regional anatomical	(TP): Sphincter-preserving = 303 APER = 63 (R): Sphincter-preserving = 18 APER = 6 Unknown = 5
Kim T et al. 2014 ⁽³⁷⁾	Korea	10	Prospective	N	Not reported	443	(TP): 292 M : 151 F	TNM (TP): T1/2 = 26 T3/4 = 417	(TP): N0 = 132 N+ve = 311	(TP): Neoadjuvant chemoradiotherapy = 443 Adjuvant chemotherapy = 383	53 (53)	Biopsy/surgery/clinical imaging analysis (CT/PET- CT/MRI)	Regional anatomical	(TP): APER = 77 LAR = 366
Kusters M et al. 2009 ⁽³⁸⁾	Japan * & The Netherlands	9	Retrospective	N	(TP): 58	324	(TP): 215M : 109F	(TP): pT1 = 52 pT2 = 107 pT3 = 160 pT4 = 5	(TP): pN0 = 192 pN1 = 80 pN2 = 52	(TP): Neoadjuvant therapy = 0 Adjuvant therapy: Radiotherapy = 5 Chemotherapy = 23 None = 297	23 (21)	Clinical/radiological/histopathological	Regional anatomical (Kusters ⁽³⁹⁾ and Roels ⁽⁴⁰⁾)	(TP): APER = 113 Hartmann's = 3 LAR = 195 PE = 13 LLND: Standard TME = 134 Unilateral LLND = 69 Bilateral LLND = 121
Kusters M et al. 2009 ⁽³⁹⁾	The Netherlands	12	Prospective	N	(TP): 63	290 (247 with previous R0 resection)	(TP): 179M : 111F	(TP): cT3+ = 113 cT4 = 177	Not reported	(TP): Neoadjuvant treatment: RT only = 86 Chemoradiotherapy = 204 IORT = 290 Adjuvant chemotherapy = 39	Out of 247 patients with R0 resection: 18 (18) [34 LR in TP]	Clinical/radiological/histopathological	Regional anatomical (Kusters) ⁽³⁹⁾	(TP): APER = 138 Abdominotranssacral resection = 12 LAR = 132 PE = 8
Kusters M et al. 2010 ⁽⁴⁰⁾	The Netherlands	Not stated	Prospective	N	(R): 65	1417	(R): 69M : 45F	TNM (R): pT2 = 15 pT3 = 90 pT4 = 9	(R): pN0 = 29 pN1 = 46 pN2 = 39	(R): Neoadjuvant radiotherapy: Yes = 36 No = 78	114 (114)	Clinical/radiological/histopathological	Regional anatomical (Kusters) ⁽³⁹⁾	(R): APER = 47 Hartmann = 6 LAR = 61
Lambrechts D et al. 2011 ⁽⁴¹⁾	Netherlands	3	Retrospective	Y	(R): 68	42 (33 R0 resections)	(TP): 26M : 16F (R): 13M : 6F	Not reported	Not reported	(TP): Radiotherapy = 7 Neoadjuvant chemo+/- radiotherapy = 26 (R): Radiotherapy = 2 Neoadjuvant chemo+/- radiotherapy = 11	19 (19)	MRI	Anatomical	(TP): TME = 36 TEMS = 6 (R): TME = 14 TEMS = 5
Luna-Perez P et al. 1999 ⁽⁴²⁾	Mexico	18	Prospective	N	(TP): 56.8	412 Group 1: 259 Group 2: 153	(TP): 230M : 182F Group 1: 142M : 117F Group 2: 88M : 65F	Astler-Coller and Gunderson-Sosin If tumour infiltrated into pelvic viscera (TP): Group 1: No residual tumour = 12 A = 38 B1 = 37 B2 = 85	(TP): Group 1: N-ve = 183 N+ve = 64 Unknown = 12 Group 2: N-ve = 99 N+ve = 54	(TP): Group 1 (neoadjuvant radiotherapy) = 259 (R): Neoadjuvant RTx = 32	86 (85 (group 1 = 31, group 2 = 54)	CT	Anatomical	(TP): Group 1: APER = 149 LAR = 74 PE = 36 Group 2: APER = 62 LAR = 82 PE = 9

								B3 = 23 C1 = 23 C2 = 28 C3 = 13 Group 2: A = 12 B1 = 14 B2 = 66 B3 = 7 C1 = 5 C2 = 42 C3 = 7						
McDermott FT et al. 1985 ⁽⁴³⁾	Australia	33	Prospective	N	(TP): Male= 59.1 Female = 60.9	1008	(TP): 552M : 456F	Astler-Coller (TP): A = 276 B = 350 C1 = 285 C2 = 25 C unspecified = 7 D1 = 10 Unknown = 55	(TP): N-ve = 626 N+ve = 317 Unknown = 65	Not reported	320 (320)	Not reported	Anatomical	(TP): Restorative resection = 644 Total excision = 364
Mendenhall W et al. 1983 ⁽⁴⁴⁾	USA	17	Retrospective	N	Not stated	90	Not stated	Astler-Coller (R): B1=6 B2=12 C1=12 C2=11	(R): N-ve = 18 N+ve = 23	(TP): Surgery alone = 90	42 (41)	Clinical/radiological/histopathological	Anatomical	(TP): APER = 54 AR = 28 Other = 7 (Hartmann's, partial colectomy, transverse colostomy, transrectal excision) (R): APER = 24 AR = 11 Other = 5 Unknown = 1
Messiou C et al. 2008 ⁽⁴⁵⁾	UK	6	Prospective	Y	(R): 57.1	49	(R): 28M : 21F	Not reported	Not reported	(R): Perioperative radiotherapy = 17	75 (75)	MRI/ tumour markers/Biopsy (image-guided/colonoscopic/EUA)	Anatomical	(R): APER = 19 AR = 25, Excision of rectal stump = 1 Transanal excision = 4
Moore H et al. 2004 ⁽⁹⁾	USA	6	Retrospective	Y	(TP): 59	119 (101 pelvic recurrence of rectal cancer, 18 pelvic recurrence of colon cancer)	(TP) 64M: 55F	TNM (TP): ** T0-2 = 37 T3-4 = 71	(TP): ** N0-X = 66 N1-2 = 46	(TP): Adjuvant radiotherapy +/- chemotherapy = 59	(R): In 101 pelvic recurrence of rectal cancer: 174 (174)	Retrospectively established by review of operative & histopathological reports	Regional anatomical (Memorial Sloan-Kettering) ⁽¹⁰⁾	(R): In 101 pelvic recurrence of rectal cancer: APER = 15 LAR = 77 TAE = 8 Kraske = 1
Nagasaki T et al. 2014 ⁽⁴⁶⁾	Japan	8	Retrospective	Y	Not reported	30	(R): Lap - 9M : 4F Open - 12M : 5F	JSCCR (R): Lap: I = 2 II = 4 III = 6 IV = 1 Open: I = 4 II = 3 III = 7 IV = 3	(R): Lap: N-ve = 6 N+ve = 6 Unknown = 1 Open: N-ve = 7 N+ve = 7 Unknown = 3	(R): Adjuvant chemotherapy Lap = 6 Open = 9	30 (30)	Not reported	Anatomical	(R): Lap: LAR = 11 LAR with LLND = 1 Subtotal colectomy = 1 Open: LAR = 14 APER = 2 Intersphincteric resection = 1
Novell F et al. 1997 ⁽⁴⁷⁾	Spain	7	Prospective	N	(TP): 67	140	(TP): 66M : 74 F	TNM (R): T3-4, N0 = 5 T2-T4, N1 = 16	(R): N0 = 5 N1 = 16	Not reported	21 (21)	(TP): EUS & biopsy = 140 DRE= 14 Colonoscopy = 16 CT Abdomen = 18 CEA = 13	Anatomical	(R): AR = 21
Pergolizzi S et al. 1999 ⁽⁴⁸⁾	Italy	7	Retrospective	Y	(R): 64.5	39	(R): 24M : 15F	Dukes (R): A = 13 B = 14 C = 12	(R): N-ve = 27 N+ve = 12	(R): No previous perioperative treatment = 39	39 (39)	Clinical/radiological/histopathological	Anatomical	(R): 19 = APER 20 = AR

Pilipshen S et al. 1984 ⁽¹¹⁾	USA	8	Prospective	N	(TP): 62	412	(TP): 243M : 169F	Dukes (R): A = 18 B = 32 C = 55	(R): N-ve = 50 N+ve = 55	(TP): Neoadjuvant irradiation = 113 Adjuvant irradiation = 17 (R): Neoadjuvant irradiation = 33	105 (105)	Clinical/biochemical/radiological/histopathological	Regional anatomical +/- fixation (Previous Memorial Sloan Kettering) ⁽⁵⁰⁾	(R): APER = 39 LAR = 66
Rahbari N et al. 2011 ⁽⁴⁹⁾	Germany	7.5	Prospective	Y	(R): 62	92	(TP): 62M : 30F	UICC (R): I = 17 II = 33 III = 35 IV = 7	(R): N-ve = 50 N+ve = 35 Unknown = 7	(R): Previous (chemo)radiotherapy = 51	92 (92)	Clinical/endoscopic/radiological/histopathological	Regional anatomical	(R): Sphincter-preserving = 71 Non-sphincter-preserving = 21
Rich T et al. 1983 ⁽⁵⁰⁾	USA	4	Retrospective	N	Not reported	166 (142 with curative resection)***	(TP): 99M : 67 F	Dukes (R): A = 3 B = 18 C = 22	(R): N-ve = 21 N+ve = 22	(TP): No previous perioperative treatment = 166	51 (51)	Clinical/endoscopic/radiological/histopathological	Anatomical	(TP): CAPR = 110 LAR = 8 Hartmann's = 1 Abdominosacral resection = 3 (R): CAPR = 34 LAR = 8 Hartmann's = 1
Roodbeen S et al. 2020 ⁽⁵¹⁾	The Netherlands	7	Retrospective	N	(TP): 64	767	(R): 21M : 3F	(TP): T1 = 23 T2 = 196 T3 = 421 T4 = 52 Tx = 4 Unknown = 71	(TP): N0 = 214 N1 = 303 N2 = 175 Nx = 4 Unknown = 71	(R): Previous neoadjuvant treatment = 17 Unknown = 7	24 (24)	Clinical/biochemical/radiological	Regional anatomical (Royal Marsden group) ⁽¹¹⁾	(TP): TaTME: APER/ELAPE = 91 Hartmann's = 5 LAR = 659 Proctocolectomy = 12
Safioleas M et al. 2005 ⁽⁵²⁾	Greece	13	Retrospective	N	(TP): 64	66 (52 had curative resection)	(TP): 29M : 37F	Astler-Coller (R): B1 = 1 B2 = 4 C1 = 4 C2 = 3 Dukes (R): B = 5 C = 7	(R): N-ve = 5 N+ve = 7	(R): Adjuvant chemoradiotherapy = 11	12 (12)	Radiological/histopathological	Anatomical	(R): LAR = 12
Scialpi M et al. 1993 ⁽⁵³⁾	Italy	3	Prospective	N	(TP): 62.9	22	(TP): 12M: 10F	Astler-Coller (TP): B1=4 B2=8 C1=1 C2=9 (The recurrences were both C2 pre-op)	(TP): N-ve = 12 N+ve = 10 (R): N+ve = 2	Not reported	2 (2)	TRUS/histopathological	Anatomical	(R): LAR = 2
Sinaei M et al. 2013 ⁽⁵⁴⁾	Canada	11	Retrospective	Y	(R): 61	42	(R): 26M : 16F	Not stated	Not reported	Not reported	65 (65)	MRI	Regional anatomical (Memorial Sloan-Kettering) ⁽¹⁰⁾ and anatomical	(R): APER = 16 Rectal anastomosis = 26
Suzuki K et al. 1996 ⁽⁶⁾	USA	7	Prospective	Y	(R): 62.9	65	(R): 38M : 27F	Astler-Coller (R): A = 6 B1 = 18 B2 = 11 B3 = 1 C1 = 4 C2 = 14 C3 = 3 Unknown = 8	(R): N-ve = 36 N+ve = 21 Unknown = 8	Not reported	65 (65)	CT/CEA/biopsy	Symptoms and fixity (Mayo clinic) ⁽⁷⁾	(R): LAR = 34 APER = 15 Local excision = 15 Hartmann's = 1
Syk E et al. 2008 ⁽⁵⁵⁾	Sweden	9	Retrospective	N	(R): 73	2315	(TP): 1340M : 975F (R): 89M : 66F	TNM (TP): T1 = 575 T2 = 688 T3 = 719 T4 = 310 Unknown 23 TNM (R): T1 = 14 T2 = 52 T3 = 70 T4 = 17 Unknown = 2	Not reported	(TP): Neoadjuvant treatment: RT 5x5 Gy + immediate surgery = 1155 RT 5x5 Gy + delayed surgery = 114 RT 25 x 2 Gy + surgery = 80 Chemoradiotherapy + surgery = 32 No adjuvant radiotherapy = 2315	155 (124)	CT/MRI	Regional anatomical	(TP): APER = 618 LAR = 1362 HAR (partial mesorectal excision) = 335 (R): APER = 53 LAR = 72 HAR (partial mesorectal excision) = 30

										(R):Neoadjuvant treatment : RT 5x5 Gy + immediate surgery = 49 RT 5x5 Gy + delayed surgery = 6 RT 25 x 2 Gy + surgery = 7 Chemoradiotherapy + surgery =3 No adjuvant radiotherapy = 155				
Uehara K et al. 2015 ⁽⁵⁶⁾	Japan	7	Retrospective	Y	(R): 66	35	(R): 27M : 8F	UICC (R): I = 5 II = 15 III = 14 IV = 1	(R): N-ve = 20 N+ve = 14 Unknown = 1	(R): Previous radiotherapy: For primary tumour = 2 For other disease = 1 None = 32	35 (35)	Not stated but CT/MRI/PET-CT for assessment of resectability	Regional anatomical (Hruby) ⁽³¹⁾	(R): Sphincter-preserving = 19 Non-sphincter-preserving = 16
Valentini V et al. 1999 ⁽⁵⁷⁾	Italy	8	Prospective	Y	(R): 62	47	(R): 29M : 18F	Not reported	Not reported	(R): External beam RT: Neoadjuvant = 7 Adjuvant = 6 Adjuvant chemotherapy = 6	47 (47)	CT/histopathological	Regional anatomical Modified Pilipshen (Memorial Sloan-Kettering) ⁽⁵⁸⁾ and fixity (modified Mayo clinic) ⁽⁷⁾	(R): LAR = 33 APER = 14
Vigliotti A et al. 1987 ⁽⁵⁸⁾	USA	8	Retrospective	N	(TP): 56	105	(TP): 58M : 47F	Modified Astler-Coller (R): B2=1 B3=4 C1=1 C2=8 C3=1	(R): N-ve = 5 N+ve = 10	(R): Adjuvant radiotherapy = 105	23 (23)	CT/histopathological	Anatomical in relation to radiotherapy field	(R): AR = 6 CAPR = 9
Westberg K et al. 2017 ⁽⁵⁹⁾	Sweden	7	Retrospective	Y	(TP): 72	149 ⁵	(R): 80M : 69F	Stage (R): I = 26 II = 52 III = 68 Unknown = 3	(R): N-ve = 78 N+ve = 68 Unknown = 3	(R): Neoadjuvant treatment: None = 93 Chemoradiotherapy = 56	149 (149)	Clinical/radiological/histopathological	Regional anatomical – combination of Leeds ⁽²¹⁾ and Memorial Sloan-Kettering ⁽¹⁰⁾	(R): APER = 26 Hartmann's = 16 LAR = 107
Wieldraaijer et al. 2018. ⁽⁶⁰⁾	The Netherlands	7	Retrospective	N	(TP): 65 ⁵⁵	64* ⁵⁵	(TP): 44M : 20F	Stage (TP): pCR = 1 I = 9 II = 8, III = 46	(TP): N-ve = 18 Unknown = 46	Not reported ⁵⁵	10 (10)	Clinical/radiological/histopathological/ endoscopic	Regional anatomical	(TP): APER = 25 LAR = 39
Wiig JN et al. 1999 ⁽⁶¹⁾	Norway	6	Prospective	Y	(R): 65	46	(R): 27M : 19F	Not reported	Not reported	Not reported	77 (77)	Clinical/radiological (CT)/endoscopic/histopathological	Regional anatomical	(R): LAR = 46
Wong C et al. 1998 ⁽⁶²⁾	Canada	10	Retrospective	Y	(R): 55	519	(R): 290M : 229F	TNM (R): T1N0 = 14 T2N0 = 59 T3-T4N0 = 173 T1-T2,N1-N2 = 14 T3-T4, N1-N2 = 201 Unknown = 58	(R): N0 = 246 N1-N2 = 215 Unknown = 58	(R): No previous adjuvant chemotherapy / irradiation = 519	519 (519)	Not stated. Histological confirmation = 261	Regional anatomical	(R): APER = 326 LAR = 151 LE/electrocoagulation = 42
Yamada K et al. 2001 ⁽⁷⁾	Japan	16	Retrospective	Y	Not reported	60	(R): 38M : 22F	Dukes (R): A = 7 B = 16 C = 37	(R): N-ve = 23 N+ve = 37	(R): Most patients received adjuvant chemotherapy Adjuvant radiotherapy = None	60 (60)	Radiological (CT/MRI/US/bone scintigraphy) and confirmed histopathologically	Regional anatomical (Yamada et. al) ⁽⁸⁾	(R): APER = 28 Sphincter-sparing = 32
You Y et al. 2012 ⁽⁶³⁾	USA	18	Retrospective	Y	(R): 57	46	(R): 22M : 24F	(R): cT1 = 21 cT2 = 3 cT3 = 10 Unknown = 12 pT1 = 21 pT2 = 11 pT3 = 3 ypT2 = 7 ypT3 = 4	Not reported	(R): Neoadjuvant chemoradiotherapy: No = 35 Yes = 11 Adjuvant treatment: (chemotherapy/radiation/CR T) = 13	47 (47)	First mode of diagnosis: Imaging = 20 Endoscopy = 13 CEA = 5 Pelvic pain = 5	Anatomical	(R): Transanal LE = 46

Yu T et al. 2008 ⁽⁶⁴⁾	USA	12	Retrospective	N	(R): 55	554	(R): 14M : 22F	(R): cT1-T2 = 4 cT3 = 21 cT4 = 7 Unknown = 4 pT1-T2 = 14 pT3 = 15 pT4 = 4 Unknown = 3	(R): cN0 = 16 cN1-2 = 18 Unknown = 2 pN0 = 14 pN1-2 = 15 Unknown = 7	Not reported	46 (46) 36 patient images available (43)	(R): CT = 36	According to radiotherapy field	(R): APER = 9 LE = 8 LAR = 12 Pelvic exenteration = 2 Proctectomy/coloanal anastomosis = 4 Other = 1
Yun J et al. 2016 ⁽⁶⁵⁾	Korea	14	Retrospective	N	(R): 58	2050	(TP): 1233 M: 817F (R): 84M : 63F	(R): T0 = 2 T1 = 3 T2 = 22 T3 = 111 T4 = 9	(R): N0 = 62 N1 = 44 N2 = 41	(R): Neoadjuvant treatment CCRT = 29 Adjuvant chemotherapy Yes = 84 No = 34 Adjuvant radiotherapy: Yes = 67 No = 51	147 (147)	Radiological (CT,PET-CT,MRI,EUS)/tumour markers/ histopathological	Regional anatomical (Kusters) ⁽³⁹⁾	(R): TME - sphincter-preserving = 108 Non-sphincter-preserving = 39
Zhao J et al. 2012 ⁽⁶⁶⁾	Japan	8	Retrospective	N	(R): 59.4	1079	(R): 54M :36F	(R): I = 6 IIA = 8 IIB = 11 IIIA = 10 IIIB = 20 IIIC = 26 Unknown = 9	(R): N-ve = 25 N+ve = 56 Unknown = 9	(R): Neoadjuvant chemoradiotherapy Yes = 18 No = 72	90 (79)	CT/MRI	Regional anatomical (Memorial Sloan-Kettering) ⁽¹⁰⁾	(R): APER = 32 AR = 54 Hartmann's = 2 LE = 2
Zhu X et al. 2016 ⁽⁶⁷⁾	Japan	5	Retrospective	Y	(R): 56	135	(R): 73M : 62F	TNM (R): T1 = 2 T2 = 35 T3 = 68 T4 = 30	(R): N0 = 43 N1 = 62 N2 = 30	(R): Radiotherapy: Neoadjuvant = 19 Adjuvant = 6	135 (135)	Clinical/radiological (CT,PET-CT,MRI,EUS)/tumour markers/ histopathological	Regional anatomical based on Kusters ⁽³⁹⁾ & Memorial Sloan-Kettering ⁽¹⁰⁾	(R): APER = 78 LAR = 57

Key: APR/APER = Abdominoperineal excision of rectum, AR = anterior resection, CAPR = Combined abdominoperineal resection, CCRT = concurrent chemoradiotherapy, EUS = Endorectal Ultrasound, HAR = High anterior resection, IORT = Intra-operative radiotherapy, is = in situ, JSCCR = Japanese Society for Cancer of the Colon and Rectum, Lap = laparoscopic, LAR = low anterior resection, LE = local excision, LLND = lateral lymph node dissection, pCR = pathological complete response, PE = pelvic exenteration, PSD = pelvic sidewall dissection, RT = radiotherapy, TAE = Transanal excision, TaTME = transanal TME, TME = total mesorectal excision, TNM = tumour, node, metastasis, TRUS = Transrectal ultrasound, UICC = Union for International Cancer Control, x = unassessable.

^ = None of these patients developed LR, * = Japanese patients only included here as Dutch TME trial patients already included above, ** = Data unavailable for all patients. Patients with R0 resection status only included, *** = The total population followed for recurrence, \$ = including 27 patients who had R1 resection at primary surgery, \$\$ = of the total number of patients with all recurrences. 378 patients in total, 64 with recurrence (local and distant) and 10 with LR.

Figure S1: Search strategy results

Search strategy 28th April 2020

MEDLINE (Pubmed)

(rectal cancer) AND (local recurrence) AND (patterns OR classification OR risk factors)

Studies identified: 1563

EMBASE (OvidSP)

1 (rectal cancer).af.

2 (local recurrence).af.

3 (patterns OR classification OR risk factors).af

4 1 AND 2 AND 3

Studies identified: 1091

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 rectal cancer

#2 local recurrence

#3 patterns OR classification OR risk factors

#4 (#1 AND #2 AND #3)

Studies identified: 183

Trials: 114

Science Citation Index Expanded (via the Web of Science)

#1 TS=(rectal cancer)

#2 TS=(local recurrence)

#3 TS=(patterns OR classification OR risk factors)

#4 #1 AND #2 AND #3

Studies identified: 1140

All search results at Endnote: 3908

Duplicates: 1891

Search results after removal of duplicates: 2017

Studies for full-text: 229 [201 abstracts identified and papers located]

Studies identified through other sources: 29

Articles for full-text review: 230

Articles excluded after full-text review with reasons:

- No English version/translation of paper
- Conference abstracts
- No subclassification of LRRC only 'locally recurrent'
- Some anal/prostatic cancer papers

Final number of articles for inclusion in analysis: 58

Figure S2: Study Flow diagram

