

Supplementary Tables

Supplementary Table 1. Post Cancer Resection Surveillance Colonoscopy Studies: Qualitative Aspects							
First author, year	Setting/sampling frame	Design	No. of subjects (no. of colonoscopies)	Preoperative clearing	Endoscopic follow-up schedule	Definition metachronous CRC	Definition anastomotic recurrence
Barillari, 1996 ³⁹	Italy/1980-1990	Retrospective	481	Preoperative colonoscopy	Group 1: First colonoscopy at 12 mo, then at mean intervals of 12 mo Group 2: First colonoscopy at 12 mo, then at mean intervals of 24 mo	Neoplasm arising >5 cm from anastomosis and more than 1 y after surgery	Intraluminal lesion within 5 cm from surgical anastomosis
Barrier, 1998 ⁴⁰	France/1986-1992	Retrospective	61 ^a	Preoperative colonoscopy on subgroup of 61 patients	First colonoscopy: 12 ± 6 mo Second colonoscopy: 30 ± 12 mo Third colonoscopy: 54 ± 12 mo		Intraluminal lesion within 5 cm from surgical anastomosis
Battersby, 2014 ⁷⁷	United Kingdom/1995-2012	Retrospective	538 (613)	Preoperative colonoscopy or within 3 mo after surgery if obstructive CRC	In accordance with 1997 AGA and ACS guidelines		
Castells, 1998 ⁸⁰	Spain/1987-1990	Prospective	199	Preoperative colonoscopy, or barium enema and flexible sigmoidoscopy if stenosis If inadequate preoperative clearing, repeat endoscopy within 3 mo postop	Annual colonoscopy		"Locoregional": restricted to anastomosis or region of primary operation
Chen, 1994 ⁵⁵	Australia/1972-1990	Prospective	231	Preoperative colonoscopy and/or colonoscopy at 1 y postop	Colonoscopy at first year postop, then every 3 y If adenomas, annual colonoscopy until clear	Not present at time of preop or first postop colonoscopy, then developed elsewhere in colon	
Cone, 2013 ⁸³	United States/2002-2010	Retrospective	155 (155)	Preoperative colonoscopy	First postoperative colonoscopy		
Couch, 2013 ⁷⁸	United Kingdom/2001-2003	Retrospective	86 in first cohort	Preoperative "luminal imaging"	Variable, 5-y follow up for first cohort, 2-y for second cohort		
	and 2006-2007		100 in second cohort				
Eckardt, 1994 ⁶⁸	Germany/1978-1987	Prospective	212	Preoperative colonoscopy, or barium enema and flexible sigmoidoscopy if stenosis If inadequate preoperative clearing, repeat endoscopy within 3 mo postop	Annual colonoscopy for 5 y, then every 3 y		Local recurrence

Supplementary Table 1. Continued

			No. of subjects				Definition
First author, year	Setting/sampling frame	Design	(no. of colonoscopies)	Perioperative clearing	Endoscopic follow-up schedule	Definition	anastomotic recurrence
Freeman, 2013 ⁶⁹	Canada/1980-2005	Retrospective	128 (all T1N0M0 CRC, 80% treated surgically, 20% by polypectomy) (941)	Preoperative colonoscopy or within 6 mo of resection	Annual colonoscopy for 5 y, then every 3 y if no polyps detected	metachronous CRC	Any subsequent cancer during follow-up period
Granqvist, 1992 ⁴¹	Sweden/1981-1990	Retrospective	390 (600)	Preoperative colonoscopy or within 6 mo postop	Colonoscopy at 2 y postop, then every fourth year		
Green, 2002 ⁶⁰	United States/1989-1993	Historical cohort	3278	Colonoscopy or barium enema and flexible sigmoidoscopy at diagnosis	Colonoscopy until clear Colonoscopy at 6, 12, 18 mo then annually (study guidelines), or at 6 mo then every 18-24 mo (physician discretion)	Arising from a preexisting polyp or found at a site distant from primary tumor (not at anastomosis), without evidence of penetration from bowel serosa	
Hassan, 2006 ⁴²	Italy/1999-2004	Prospective	318	Preoperative colonoscopy	Colonoscopy at 1-, 3-, and 5-y intervals postop		
Juhl, 1990 ⁴³	United States/1978-1985	Prospective	133 ^b (316)	Colonoscopy and barium enema perioperatively	Annual colonoscopy for 6 y		
Khoury, 1996 ⁷⁰	United States/1984-1994	Retrospective	389 (3889)	Perioperative colonoscopy	Variable, median interval between procedures 13 mo	At least 1 y postop	
Kjeldsen, 1997 ⁴	Denmark/1983-1994	RCT	597 (intensive subgroup: 290)	Complete colonoscopy or incomplete colonoscopy plus barium enema	Intensive: colonoscopy at 6, 12, 18, 24, 30, 36, 48, 60, 120, 150, 180 mo Control: colonoscopy at 60, 120, 180 mo	At least 12 mo after primary cancer	Local recurrence: tumor growth in the region of the primary radical operation, including surgical wound

Supplementary Table 1. Continued						
First author, Setting/sampling year frame	Design	No. of subjects (no. of colonoscopies)	Perioperative clearing	Endoscopic follow-up schedule	Definition	Definition
Lan, 2005 ⁷¹ Taiwan/1981-2001	Retrospective	3846	Preoperative colonoscopy or at 6 mo postop	Colonoscopy at 1 year If negative or 1 polyp <5 mm, then 2-3 y later If 1 polyp >5 mm, or >2 polyps, then 1 y after polypectomy If 2 negative colonoscopies, then 5-y intervals	metachronous CRC Arising from the mucosa at a site other than anastomosis line, after at least 12 mo from initial resection and/or at least a negative postoperative colonoscopic surveillance	anastomotic recurrence
Lee, 2014 ⁴⁶ Korea/2004-2007	Retrospective	1049	Preoperative or within 6 mo after surgery if obstructive CRC or poor bowel preparation	Colonoscopy every 1-2 y	At least 6 mo after resection, and at least 4 cm from anastomosis	
Makela, 1995 ¹⁸ Finland/1988-1990	RCT	106 (intensive subgroup: 52)	Preoperative colonoscopy or at 3 mo postop (intensive subgroup)	Intensive: Colonoscopy once a year, plus flexible sigmoidoscopy every 3 mo for rectal/sigmoid cancers Control: barium enema at 12 mo then once a year If rectal/sigmoid cancer, rigid sigmoidoscopy every 3 mo for 2 y, then every 6 mo for 3 y		"Local recurrence": restricted to the anastomosis and its surroundings
Mathew, 2006 ⁷³ United Kingdom/1998-2003	Retrospective	105 (140)	Preoperative colonoscopy or postop in emergency cases (up to 1 y after surgery)	Colonoscopy at 2 and 5 y postop		
McFarland, 1991 ⁷⁹ United Kingdom/1980-1991	Prospective	74 (237)	Colonoscopy as close as possible to time of resection	Annual colonoscopy for 5 y, then every 2 y		
Obrand, 1997 ⁴⁴ Canada/1976-1992	Retrospective	444	Perioperative colonoscopy	Colonoscopy every 3 y		"Local": Endoluminal at anastomosis site

Supplementary Table 1. Continued						
		No. of subjects				Definition

First author, year	Setting/sampling frame	Design	(no. of colonoscopies)	Perioperative clearing	Endoscopic follow-up schedule	Definition metachronous CRC	anastomotic recurrence
Ohlsson, 1995 ¹⁹	Sweden/1983-1986	RCT	107 (intensive subgroup: 53)	Preoperative barium enema, then colonoscopy and barium enema within 3 mo postop	Intensive: colonoscopy at 3, 15, 30, 60 mo, plus endoscopic control of anastomosis (flexible sigmoidoscopy or colonoscopy) at 9, 21, and 42 mo		Intraluminal recurrence within 5 cm of anastomosis
Patchett, 1993 ⁷⁴	Ireland/1983-1988	Prospective	132	Colonoscopy after operation	Colonoscopy at 6, 12, 18, 30, 48 mo		
Pietra, 1998 ²⁰	Italy/1987-1990	RCT	207 (intensive subgroup: 104)	Preoperative colonoscopy or at 3 mo postop	Annual colonoscopy		Intraluminal local recurrence": Involves only suture or staple line of bowel anastomosis
Platell, 2005 ⁸⁵	Australia/1996-2002	Prospective	253 (227)	Preoperative colonoscopy or at 3 mo postop	Colonoscopy at 12 mo or every 3 y		
Rodriguez- Moranta, 2006 ²¹	Spain/1997-2001	RCT	259 (intensive subgroup: 127)	Preoperative colonoscopy or postoperative if preoperative colonoscopy could not be performed	Intensive: annual colonoscopy for 5 y Control: colonoscopy at first and third year if family history of HNPCC or synchronous neoplasms, otherwise only if symptoms or abnormal labs		ocoregional": Restricted to anastomosis or region of primary operation
Shoemaker, 1998 ²²	Australia/1984-1990	RCT	325 (intensive subgroup: 167) (733)	Perioperative colonoscopy	Intensive: Annual colonoscopy for 5 y Control: colonoscopy only if clinical or screening test abnormality, and after 5 y of follow-up		
Skaife, 2003 ⁷⁵	Singapore	Prospective	611 (609)	Colonoscopy at time of cancer resection	Annual colonoscopy until no polyps, then every 3-5 y	Remote from anastomosis	located at, or adjacent to, anastomotic line
Stigliano, 2000 ⁷⁶	Italy/1970-1988	Retrospective	322	"Clean colon before surgery"	Annual colonoscopy or on request for first 5 y, then every 2 y	At least 2 y after surgery	
Togashi, 2000 ⁴⁵	Japan/1992-1995	Retrospective	341 (1569) ^c	Preoperative colonoscopy or barium enema If stenosis, barium enema	Variable	All cases detected after surgery	
First author, year frame	Setting/sampling	Design	No. of subjects (no. of colonoscopies)	Perioperative clearing	Endoscopic follow-up schedule	Definition metachronous CRC	Definition anastomotic recurrence

Wang, 2009 ²⁶	China/1995-2001	RCT	326 (intensive subgroup: 165) (1561)	Preoperative colonoscopy or within 6 mo postop	Intensive colonoscopy: every 3 mo for a year, then every 6 mo for the next 2 y, then annually for the next 2 y Routine colonoscopy: At 6, 30, and 60 mo postop	Second primary CRC after exclusion of synchronous cancer by complete colon evaluation preoperatively or within 6 mo postop	Intraluminal recurrence within 5 cm of the anastomosis. Local recurrence included anastomotic and extraluminal recurrence
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NOTE. Modified with permission from Wiley-Blackwell.¹¹⁹

AGA, American Gastroenterological Association; ACS, American Cancer Society; HPNCC, hereditary nonpolyposis colorectal cancer.

^aSubgroup that underwent complete preoperative colonoscopy (total patients, n = 175).

^bSubgroup excludes patients with rectal cancer treated by abdominoperineal resection (total patients, n = 174).

^cMean number of procedures per patient reported as 4.6 (range, 2-15).

Supplementary Table 2. Post Cancer Resection Surveillance Colonoscopy Studies: Results and Outcomes

Author, year	Synchronous CRC	Time to CRC diagnosis	Metachronous CRC	Anastomotic CRC	Metachronous adenomas	Outcomes	Comments
Barillari, 1996 ³⁹	3.3%	Median 25 mo (range, 10-73 mo)	2 Dukes A or B: 9 Reoperated ^a : 7	4 All rectal Intraluminal only: 10 Reoperated: 10		5-y survival: Metachronous CRC: 50% Anastomotic: 45.4% Asymptomatic recurrence: 41% Symptomatic recurrence: 12.5%	Second CRC within 24 mo: 24 of 46 (52%) ^b Asymptomatic: 22 of 46 (48%) ^b ; 81% of rectal recurrences detected within 18 mo
Barrier, 1998 ⁴⁰	6.6%	Mean, 14 mo (range, 7-26 mo)	0	All distal colon/ upper rectum All within 26 mo All asymptomatic Reoperated: 73% ^c	TA All <10 mm		
Battersby, 2014 ⁷⁷		Median, 7 y and 6 mo (range, 2-14 y)	5 Early: 0 AJCC stage I or II: 12 Reoperated: 13 Asymptomatic: 9				
Castells, 1998 ⁸⁰		Compliant patients: 13 ± 21 mo Noncompliant: 15 ± 9		2 Locoregional Asymptomatic: 5 Reoperated: 13		5-y survival: Compliant: 63% Noncompliant: 37%	Systematic postoperative surveillance increases rate of tumor recurrence amenable to curative-intent surgery, and improves overall and cancer-related survival
Chen, 1994 ⁵⁵		Mean, 7.75 y (range, 3-17 y)	Early ^d : 0 Reoperated: 4		130 TA	Metachronous CRC incidence: 1 per 324.5 patient-year of follow-up	

Cone, 2013 ⁸³			Asymptomatic: 40		24 patients, 5 with polyps >1 cm		2 of 3 anastomotic recurrences were found in the rectum after LAR
Couch, 2013 ⁷⁸		1-5 y	4	3	27	All 4 CRC found within 2 y underwent re-resection for cure	In group with complete preop imaging in both cohorts (n=186), there were 7 CRCs, 5 of 7 found within 2 y
Eckardt, 1994 ⁶⁸			26 ^e Reoperated: 7 Asymptomatic: 13	e		5-y survival: Compliant: 80% Noncompliant: 59% Asymptomatic recurrence: 42% Symptomatic recurrence: 8%	stop endoscopic surveillance leads to early tumor detection and improves survival
Freeman, 2013 ⁶⁹	0.8%	7-13 y	6 ^f Dukes A or B: 6 Early: 0 Reoperated: 6 Asymptomatic: 6		217 adenomas, of which 33 (15%) were advanced		
Granqvist, 1992 ⁴¹	2.8%	5-7 y	2 Early: 7 Reoperated: 10	4 Rectal/Sigmoid: 9 Early: 14 Reoperated: 8	106 >10 mm: 24 HGD: 11	metachronous: 7 of 10 reoperated alive after 1-5 y Anastomotic: 6 of 8 reoperated alive after 0.5 y	ymptomatic: 14 of 26 (7 Dukes A or B) ^b Symptomatic: 12 of 26 (3 Dukes A or B) ^b
Green, 2002 ⁶⁰		Median, 18.4 mo (range, 3.4-70.1 mo)	42 Dukes A or B: 23 Early: 24			14 of 42 (33%) died within study period CRC incidence: 274/100,000 patient-years; cumulative incidence 1.5% at 5 y	More than half of patients did not adhere to surveillance protocol
Hassan, 2006 ⁴²	1.6%	1-5 y	10 At 1 y: 4 At 3 y: 5 At 5 y: 1		104 nonadvanced adenomas 19 advanced adenomas	Cumulative incidence CRC and advanced adenomas (excluding 1-y lesions): 3 y: 2.9% 5 y: 5.6% (2.2/100 patient-years)	
Juhl, 1990 ⁴³	1.7%	Metachronous: >2 y Anastomotic: 12-30 mo	4 Dukes A or B: 4 Early: 0 Reoperated: 4 Asymptomatic: 4	9 All LAR Reoperated: 5 for palliation (4 inoperable) All symptomatic	<1 cm: 123 >1 cm: 37 (7 villous polyps)		
Khoury, 1996 ⁷⁰		13-56 mo ^g	1	2	240 neoplastic polyps >10 mm: 4 (all at first colonoscopy)		
Kjeldsen, 1997 ⁴		Intensive: 18 mo Control: 27 mo	0 Reoperated: 8 Asymptomatic: 8	^h Reoperated: 14 Asymptomatic: 16		5-y survival: Intensive: 70% Control: 68% (P = NS)	Intensive follow-up led to earlier diagnosis of recurrence (by 9 mo) and more reoperations, but no improvement in survival

Lan, 2005 ⁷¹		Mean 71 ± 47 mo (range, 14-240 mo)	43 Early (20-mo interval): 5 Dukes A or B: 31 Reoperated: 35			Metachronous CRC group: 5-y survival: 90% 10-y survival: 71% Annual incidence: 0.18%	
Lee, 2014 ⁴⁶	3.7%	12-41 mo	6 Early: 5 6/6 stage II or III		454 (43.3%) of patients developed metachronous adenomas, including 46 (4.4%) with advanced adenoma or CRC		Older age, synchronous adenoma, and diabetes mellitus associated with risk of metachronous neoplasia
Makela, 1995 ¹⁸		Intensive: 10 ± 5 mo Control: 15 ± 10 mo	Reoperated: 1	Rectal/sigmoid: 2 Dukes B: 1 Dukes C: 2 Reoperated: 3 Asymptomatic: 2	TA 4 TVA (including 2 polyps with HGD)	5-y survival: Intensive: 59% Control: 54% (P = NS)	Intensive follow-up led to earlier detection of recurrence, but not significantly increased resectability or improved 5-y survival
Mathew, 2006 ⁷³		Metachronous: 2 and 5 y Recurrence: 2 y	2	3	TA in 24 patients (5 patients with advanced adenomas)		
McFarland, 1991 ⁷⁹		At 2 y	0	2 Reoperated: 2	31 TA >1 cm: 12		
Obrand, 1997 ⁴⁴	4%	Mean, 16.2 mo	0	44 Rectal: 29 Reoperated: 20		47% of re-resected patients alive at mean of 80 mo	Anastomotic recurrence higher for rectal than colon cancer (20.3% vs 6.2%, P = .001)
Ohlsson, 1995 ¹⁹		Median 1.7 y (range, 0.3-7.6 y)	0 ¹	Reoperated: 2 Asymptomatic: 1 Re-recurrence: 2	patients with "adenomas with varying degrees of	5-y survival: Intensive: 75% Control: 67% (P > .05)	Intensive follow-up did not prolong survival
Patchett, 1993 ⁷⁴		range, 7-43 mo	Asymptomatic: 0	Asymptomatic: 0	atypia" 22 TA		Intensive: 4 of 8 ^b Reoperated: 4 of 8 ^b Dukes B: 5 of 8 ^b Dukes C: 5 of 8 ^b
Pietra, 1998 ²⁰		Intensive: 10.3 ± 2.7 mo Control: 20.2 ± 6.1 mo	1	Rectal: 1	21 patients with adenomas	5-y survival: Intensive: 73.1% Control: 58.3% (P < .02)	Intensive follow-up led to improved survival, primarily because local recurrences are more resectable when detected early
Platell, 2005 ⁸⁵		12 mo	0	3 All rectal All metastatic	62 TA (>1 cm: 6) TVA VA Overall prevalence advanced adenomas: 7.9%		65% of preoperative colonoscopies performed outside study center and reports not available to authors
Rodriguez-		Intensive: 39 ± 21 mo	6	24		After median	Intensive

Moranta, 2006 ²¹		Control: 38 ± 19 mo				follow-up of 48 mo, no difference in probability of overall survival (HR = 0.87, 95% CI: 0.49-1.54; P = .62)	follow-up associated with higher survival in patients with stage II tumors (HR = 0.34, 95% CI: 0.12-0.98; P = .045) and those with rectal lesions (HR = 0.09; 95% CI: 0.01-0.81; P = .03), due to higher rate of re-resectability Colonoscopy responsible for detection of highest proportion (44%) of resectable recurrences in intensive arm
Shoemaker, 1998 ²²		7-42 mo	5	3	18 TA 39 TVA 1 VA	5-y survival: Intensive: 75% Control: 70 % (P = .2)	metachronous or locally recurrent tumors detected by colonoscopy ^b Early: 5 Dukes A or B: 5 Asymptomatic: 1
Skaife, 2003 ⁷⁵		Median 36 mo (range, 6-67)	5 Early: 1 5 with no "extracolonic disease"	4 Early: 1 2 with no "extracolonic disease"			
Stigliano, 2000 ⁷⁶		3 rd or 8 th y	5 Early: 0 Dukes A: 5	22 All rectal/distal sigmoid Early: 20 Reoperated: 16	24 patients with denomas (all <1 cm)	Overall 5-y survival: 65% (Rectal: 57%, colon: 71%)	
Togashi, 2000 ⁴⁵	6.7%	<4 mo: 9 25-60 mo: 9 >61 mo: 4	22 ^k Early: 9 Dukes A or B: 10 Reoperated: 22 ^k				

Wang, 2009 ²⁶		Intensive: 22.0 ± 17.6 mo Routine: 35.0 ± 23.9 mo	9 Early: 1 (5 if including 1 st 3 y)	2 Early: 9		Patients in intensive colonoscopy group more likely to be asymptomatic, undergo reoperation with curative intent, and survive longer (69.9 vs 24.4 mo, <i>P</i> = .03)	76.5 % of patients with asymptomatic recurrence able to undergo repeat surgery, vs 35.7% of symptomatic patients Patients with asymptomatic recurrence survived longer (71.6 vs 18.6 mo, <i>P</i> = .005) ³ complications in the intensive colonoscopy group: 2 hemorrhages requiring hospitalizations, 1 perforation requiring laparotomy.
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NOTE. Modified with permission from Wiley-Blackwell.¹¹⁹

HGD, High-grade dysplasia; HR, hazard ratio; LAR, low anterior resection; TA, tubular adenoma; TVA, tubulovillous adenoma; VA, villous adenoma.

^aReoperations with curative intent, unless otherwise specified.

^bCombined metachronous CRCs and local recurrences.

^cEight of 11 (73%) total anastomotic recurrences in both patient subgroups (with and without preoperative colonoscopy).

^d"Early": Within 24 mo of primary curative-intent resection, unless otherwise specified.

^eAll tumor recurrences (separate data for metachronous and anastomotic not presented).

^fOne metachronous poorly differentiated neuroendocrine carcinoma of the colon not included.

^gMedian time from preceding colonoscopy. Metachronous cancer found at first colonoscopy (median, 13 mo from surgery), anastomotic recurrences found at second colonoscopy (median, 15 mo from first colonoscopy) and fourth colonoscopy (median, 14 mo from third colonoscopy).

^hLocal recurrence with or without distant spread (local recurrence without distant spread: 74 patients)

ⁱIntensive follow-up group undergoing scheduled endoscopic surveillance (n = 53). One symptomatic metachronous cancer occurred after 3 y and 2 anastomotic recurrences in the control group (n = 54).

^jExcluding synchronous stage 0 (Tis) cancers.

^kTwenty-two metachronous cancers, including 12 stage 0 (Tis) cancers confined to the mucosa. Nine of 12 Tis cancers treated by endoscopic resection (3 of 12 required colectomy).

^lData for all postoperative cancers, including metachronous and local recurrences.