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### The Role of Adjuvant Postoperative Radiotherapy in Curative Resectable Sigmoid Colon Carcinoma

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**Purpose** : To evaluate the role of postoperative radiation therapy after curative resection of sigmoid colon cancer

**Materials and Methods** : From 1988 to 1993, a total of 93 patients with curative resectable sigmoid colon cancer of modified Astler-Coller (MAC) stage B2, B3, C2, C3 was divided into two groups on the basis of those who received radiation treatment and those who did not. Forty-three patients who treated by surgery alone were classified as postop RT ( - ) group. The remaining 50 patients who underwent postoperative radiotherapy were classified as postop RT (+) group. In all patients in postop RT (+) group, radiation therapy was delivered using 4 or 10 MV linear accelerators to treat the tumor bed with approximately 5cm margin to a total dose 50.4-61Gy (median 54Gy) in 1.8Gy per fraction. Thirty-two patients were treated with 5- Fluorouracil based adjuvant chemotherapy at least 3 cycles, but these was no significant difference between two groups. Treatment failure pattern, 5year local failure-free survival rates (LFFS), and 5year disease-free survival rates (DFS) were compared between two groups.

**Results** : Five year LFFS and DFS were 85.1%, 68.5%, respectively. In postop RT (-) group, LFFS was 76.2%, compared with 91.7% in postop RT (+) group. Improved LFFS and DFS were seen for patients with stage C3 sigmoid colon carcinoma with postoperative radiation therapy compared with postop RT (-) group ( $P=0.01$ ,  $P=0.06$  respectively). In stage B3, LFFS was

higher in postop RT (+) group than that in postop RT (-) group, although it was not significant. Especially, local control was higher in stage T4 in postop RT (+) group than that in postop RT (-) group.

**Conclusion** : This study showed significantly improved LFFS and DFS in MAC Stage C3 and improved tendency of LFFS and DFS in MAC Stage B3 disease. Large scale prospective study is required to verify the role of adjuvant radiation therapy in resectable sigmoid colon cancer.

**Key Words** : Sigmoid colon cancer, Postoperative radiation therapy

가  
9-13)  
가  
가  
가  
가  
가  
30%  
1-8) , Modified Astler-Coller(MAC) Stage B2-C  
5-  
fluorouracil(5-FU) 가  
9-11)  
14-21% 10-13) , MAC Stage  
B3-C 30%  
가  
5-FU 가  
가  
MAC Stage C 5-FU levamisole Kopelson 가 23)  
가 14-19)  
natural history 가  
가 2023)  
가  
1988 1 1993 12  
가 1-3) , MAC Stage B  
가

가 23 , 가 3 1 2 , 5  
 3 , 4 가 93 가 40 , 가 53 (Table 1).  
 103 가 93 가 58 .

Table 1. Enrolled Patients in Resectable Sigmoid Colon Cancer

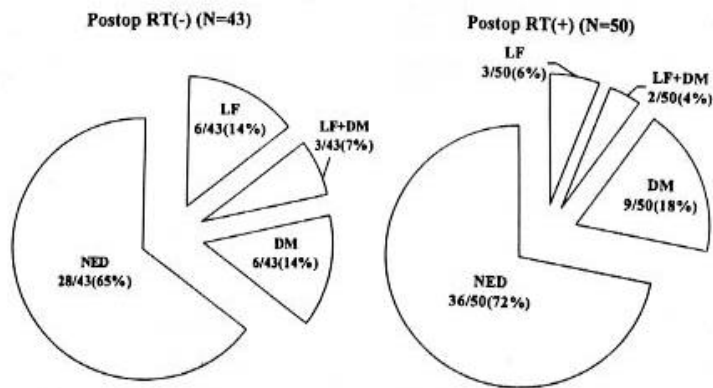
Cases	Number	( ) 43	( ) 50
Total number of cases	133		
Cases Excluded From Analysis	40		
Metastatic disease or palliative resection	23		
Operation refusal	3	85	Hartmann's
Preoperative radiation treatment	4	procedure가 8	
Synchronous/metachronous primary	3		
Postoperative death	2		
Positive resection margin	5	50	
Cases for analysis	93		

Table 2. Patients Characteristics Between Postop RT(-) Group and Postop RT(+) Group in Sigmoid Colon Cancer

	Postop RT(-) (N=43)	Postop RT(+) (N=50)	Statistical Significance*
Age(years)			NS
Range(median)	39-77(63)	35-78(60)	NS
Male/Female ratio	18/25	22/28	
Pathologic differentiation			NS
Well	7(16.3%)	14(28.0%)	
Moderate	30(69.8%)	27(54.0%)	
Poor	0	3( 6.0%)	
Unknown	6(14.0%)	6(12.0%)	
Tumor size			NS
5cm	27(62.8%)	32(64.0%)	
5cm<	11(25.6%)	13(26.0%)	
Unknown	5(11.6%)	5(10.0%)	
MAC stage			NS
B2	19(44.2%)	17(34.0%)	
B3	6(14.0%)	7(14.0%)	
C2	14(32.6%)	17(34.0%)	
C3	4( 9.3%)	9(18.0%)	
T stage			NS
T3	40(93.0%)	46(92.0%)	
T4	3( 7.0%)	4( 8.0%)	
LN number			NS
0	25(58.1%)	24(48.0%)	
1-3	12(27.9%)	18(36.0%)	
4	6(14.0%)	8(16.0%)	
Operation method			NS
Sigmoid colectomy	40(93.0%)	45(90.0%)	
Hartmann's procedure	3( 7.0%)	5(10.0%)	
Chemotherapy			NS
Yes	13(30.2%)	19(38.0%)	
No	30(69.8%)	31(62.0%)	

\* : Independent samples T-test, NS : not significant

가  
45Gy  
: 54Gy)  
clipping  
samples T-test  
Kaplan-Meier method  
Log rank test  
Independent  
가  
. 93 32  
4  
3  
5-FU(500mg/m<sup>2</sup>/day), leukovorin(20mg/m<sup>2</sup>/day)  
levamisole  
1.  
93 29  
31.2%  
3-68 ( : 17 )  
26 (89.7%)가 36  
(41.4%)  
43  
40%,  
가 가 20% 60%  
가 가 14%  
35%  
가  
(Table 2).  
3  
carcinoembryonic antigen 1  
X  
53 ( : 51 )  
가 93 90  
96.8%  
2.5  
(Fig. 1).



**Fig. 1.** Analysis of failure patterns in resectable sigmoid colon cancer (NED : no evidence of disease, LF : local failure, DM : distant metastasis)

85.1%  
 MAC Stage B2, B3, C2, C3  
 93.9%, 85.1%, 76.9%, 69.2%  
 가  
 가  
 5  
 87.5% 가 57.1% ,  
 가 (P=0.02).  
 가

3.5  
 68.5%  
 MAC Stage B2, B3, C2, C3  
 88.1%, 61.5%, 56.7%, 51.9% 가  
 (P=0.05),  
 가

76.2% 91.7% 가 15%  
 가

MAC , T  
 5 Table 3

MAC Stage B2, C2  
 가 , MAC Stage B3  
 19%  
 MAC Stage C3  
 88.9%  
 25.0%  
 (Fig. 2).  
 (T4 Stage)

Table 3. Comparison of Five year Local Failure-Free Survival Rate between Postop RT (-) Group and Postop RT (+) Group in Sigmoid Colon Cancer

	Postop RT(-) (N=43)(%)	Postop RT(+) (N=50)(%)	Statistical Significance
MAC stage			
B2	17/19(87.4)	16/17(91.7)	NS
B3	4/6(66.7)	6/7(85.7)	NS
C2	12/14(82.5)	15/17(87.4)	NS
C3	1/4(25.0)	8/9(88.9)	P=0.01
T stage			
T3	33/40(79.8)	36/46(93.3)	NS
T4	1/3(33.3)	3/4(75.0)	NS
Number of involved LN			
0	21/25(81.7)	22/24(95.8)	NS
1-3	9/12(69.3)	16/18(87.7)	NS
4	4/6(66.7)	7/8(87.5)	NS

\* : Log rank test  
 NS : not significant

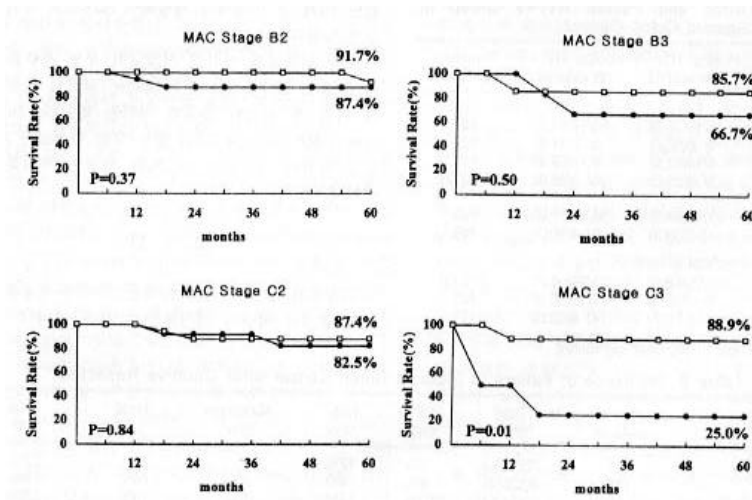
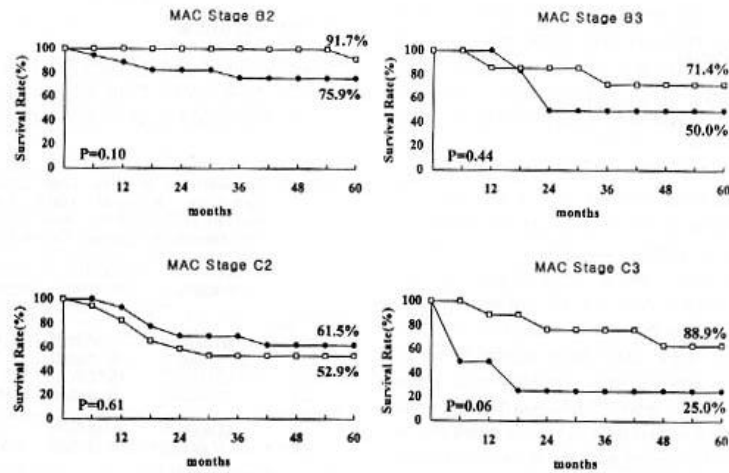


Fig. 2. Local failure-free survival rates according to MAC Stage in respectable sigmoid colon cancer (postop RT (-) : - - - - postop RT (+) : - - - -)



**Fig. 3.** Disease free-survival rates according to MAC Stage in resectable sigmoid colon cancer  
 (postop RT( - ) : - - - - postop RT( + ) : - - - -)

**Table 4.** Comparing of Five year Disease-Free Survival Rate between Postop RT( - ) Group and Postop RT( + ) Group in Sigmoid Colon Cancer

	Postop RT( - ) (N=43)(%)	Postop RT( + ) (N=50)(%)	Statistical Significance*
MAC stage			
B2	15/19(75.9)	16/17(91.7)	NS
B3	3/ 6(50.0)	5/ 7(71.4)	NS
C2	9/14(61.5)	9/17(52.9)	NS
C3	1/ 4(25.0)	6/ 9(88.9)	P=0.06
T stage			
T3	27/40(64.3)	36/46(75.8)	NS
T4	1/ 3(33.3)	2/ 4(50.0)	NS
Number of involved LN			
0	18/25(68.8)	21/24(91.7)	P=0.09
1-3	6/12(45.5)	11/18(59.8)	NS
4	4/ 6(66.7)	4/ 8(50.0)	NS

\* : Log rank test NS : not significant

44 19 가  
 55.4% 49 10  
 80.6% 가  
 (P=0.02).  
 61.9%, 73.7% T Stage,  
 MAC Stage C3 (Table 4).  
 63.5% 25.0%  
 (Fig. 3).

**Table 5.** Incidence of Failure in Sigmoid Colon Cancer after Curative Resection

	No. of patients	Total failure	LF <sup>*</sup> only	DM <sup>†</sup> only	Abdomen only	Total LF	Total DM
Willet <sup>10, 11)</sup>	211	70(33%)	5%	12%		21%	28%
Minsky <sup>12)</sup>	115	30(26%)	4%	4%	9%	14%	13%
Malcolm <sup>13)</sup>	88	30(34%)	10%	11%	1%	19%	22%
Park <sup>‡</sup>	43	15(35%)	14%	14%		21%	21%

\* : Local Failure † : Distant Metastasis ‡ : This study

가 , levamisole 5-FU  
 가 66% 74%  
 가 levamisole  
 가 15, 16)  
 가 5-FU levamisole 가  
 가 17, 18), levamisol leukovorin  
 가 19)  
 가  
 가  
 . Gunderson  
 1 2nd look operation  
 91 48%(  
 22%), 30%(  
 21%(  
 : 7.7%),  
 : 7%)  
 가  
 1, 2, 9), 20-22),  
 23),  
 Duttonhaver 9, 20) 32  
 80  
 43-63Gy . 80  
 26 (33%) 16%(  
 : 9%)  
 가 MAC Stage B3-C  
 6-25% , 5  
 가 MAC Stage B3 51%  
 78% , C2 39% 57% , C3 29%  
 49% MAC Stage  
 B3-C  
 가  
 . Willet 21, 22) 98  
 203  
 50.4-54Gy  
 MAC Stage B3, C3 93%,  
 72% 69%, 47%  
 14% 가  
 MAC Stage B3 가  
 94%, 91% ,  
 50%, levamisole 5-FU 가 60%  
 52%, 43% ,  
 가  
 MAC Stage B 가 53%  
 14). Intergroup study 1296  
 MAC Stage C 가  
 929 levamisole  
 49% 65% , 1cm

Table 5

Table

가 5-FU 가 가

Kopelson<sup>23)</sup> 85 17

4-6 45-51Gy

30% , MAC Stage B2-3

가 9% , MAC Stage C2-3 (P<0.05), MAC Stage C2-3

64% 100%

MAC Stage B2, B3

가 MAC Stage B3, C3

가 MAC Stage B3 86%

가 , MAC Stage C3 89%

가 , MAC Stage C3

가 가

가 18%

가 Willet<sup>21, 22)</sup>

가 가

30%

가 가

가 MAC

Stgae B3, C3 - 가

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:

가 ,  
 가

: 1988 1 1993 12  
 93 가

43

가 가 50

1-2

가

5cm

4 MV

10 MV

가

1.8Gy

50.4Gy-

61Gy

5-Fluorouracil

32

가

:5

85.1%, 68.5%

76.2%

91.7%

MAC Stage C3

( $P=0.01$ ,  $P=0.06$ ). MAC Stage B3

가

(Stage T4),

:

MAC Stgae B3, C3 -

가

가