Hepatic Resection of Metastasis from Colorectal Carcinoma

Morbidity, Mortality, and Pattern of Recurrence

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To identify the factors that determine the morbidity and mortality of liver resection of metastases from colorectal carcinoma and the variables that may influence the pattern of recurrence, the survival time and the disease-free rate, a univariate and-multivariate statistical analysis (30 variables using Student's t-test, Fischer's exact test, and chi square test) was performed. Intraoperative blood loss of > 3500 ml was found to be a significant risk factor to developing postoperative complications ($p < 0.05$ by x^2). After a mean follow-up of 25.8 months, 26 of the 35 patients studied (74%) had recurrent disease.In the univariate analysis, the following factors appear to be reliable predictors of early recurrence: poor degree of differentiation of the primary colorectal tumor, the presence of multiple liver metastases, the male gender, and the presence of tumor at the margin of the resected hepatic tissue ($p < 0.05$). However, only the latter two factors appeared also to affect the survival time and the disease-free rates at 2 years after hepatic resection of metastases ($p < 0.05$). In the multivariate analysis (factors tested simultaneously), presence of an advanced liver metastatic disease (Stage II or III) consistently indicated early recurrence and poor survival ($p < 0.005$). The liver was the most common site of recurrence—as the sole site of recurrence (54%) or in combination with other sites (88%)—followed by the lungs (31%) and the site of colonic resection (8%). Twenty-nine (83%), 14 (40%), and nine (26%) patients survived without recurrent disease at 1, 2, and 3 or more years, respectively, after hepatic resection of metastases. In six patients (17%), no significant palliation was noted, primarily because of early recurrence (< 6 months). From this data, resection of hepatic metastases from colorectal cancer appears to offer a realistic therapeutic option to a selected group of patients, but only if the resective procedure can be performed with an operative mortality rate of less than 5%.

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IT IS ESTIMATED that 130,000 people develop colorectal cancer every year in the United States.[1] Several clinical and autopsy studies have shown that at least 20% of those patients have liver metastases; in a small subset (5–15%) of these patients, the hepatic metastases are confined to a localized area of the liver, making these lesions amenable to excision with the potential for cure.[2-5]

Because recently published series have achieved reproducible 5-year survival rates of 20–30% with an operative mortality of less than 10% after resection of the primary colorectal tumor (PCRT) and the localized hepatic metastases, a keen interest in the resection of hepatic metastases has resurged.[6-9]

Because of the need for factual information that analyzes not only the risks and limitations of hepatic resection, but also the actual benefit of the procedures in terms of length and quality of life, this study was designed to identify the factors that determine the morbidity and mortality of liver resection of metastases from colorectal carcinoma and, more specifically, the prognostic value of some variables that influence the pattern of recurrence, the survival time, and the length of the disease-free interval.

Methods

The experience with 35 patients who underwent hepatic resection of metastases from PCRT during a 10-year period (1977–1986) at the Hospital of the University of Alabama at Birmingham was retrospectively analyzed. The following parameters of each case were compiled, tabulated, and analyzed: location of the PCRT, syncronicity or metachronicity of the hepatic metastases, their distribution, number and size; the type and extension of the hepatic resection, the pathology findings, the postoperative complications, the mortality, and the follow-up data.

To evaluate the extent of the hepatic metastases expressed in percentage of the total liver volume ($H_1 < 25\%$,

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H_2: 25–50%, and H_3 > 50%), as well as the multiplicity of the metastases as to whether they were solitary (S), multiple (M), unilobar (U), or bilobar (B), the method proposed by Gennari et al.[10] and the Milan Staging, I: H_1s; II: H_1m H_1b - H_2s and, III: H_2m - H_2b - H_3s - H_3m - H_3b were used. The metastatic liver disease was also evaluated according to the system proposed by the group from the Memorial Sloan-Kettering Cancer Center[11] as: Stage I—metastatic disease confined to the resected portion of the liver; Stage II—regional spread from the liver, including positive margins of resection; and Stage III—metastases to extrahepatic sites. Additionally, careful analysis of the time of appearance, the location and the extent of the recurrent disease, as well as the survival period and the disease-free rates at 1, 2, and 3 or more years after the resection of the hepatic metastases. All values are expressed as means ($\bar{x}$) and variances; the latter stated as standard error of the mean (± 1 SEM). All variables were entered and selected stepwise in order of statistical significance; the analysis included Student's t-test (two-sample unpaired data) for disease-free intervals, Fischer's exact test (two-tail) for survival and disease-free rates, and the chi square test (x^2) for dichotomous variables. The variables were tested both separately (univariate analysis) and simultaneously (multivariate).

Results

Of the 35 patients studied, 20 (57%) were women and 15 (43%) were men; their ages ranged from 42 to 84 years (58.2 ± 1.9 years). All primary tumors were adenocarcinomas; 29 (83%) were located in the colon, and six (17%) were located in the rectum. The distribution, the histologic differentiation and locoregional stage of the PCRT are summarized in Table 1.

The diagnosis of the PCRT and the liver metastases was synchronous in 15 patients (43%), whereas in 20 patients (57%), the presence of the hepatic metastases was detected from 3 to 24 months (10.1 ± 1 months) after the resection of their PCRT (metachronous metastases).

Operative Procedures

The hepatic metastases were resected simultaneously with the PCRT in eight patients (23%), whereas another 27 patients (77%) underwent metachronous resection. The location and extent of the hepatic metastases determined the type and extention of the hepatic resection; a wedge resection was performed in twelve patients (34%) and an anatomic resection was performed in 23 (66%). Further details of the operative procedures, the margin of hepatic resection, and the staging of the liver metastatic disease are summarized in Table 2.

TABLE 1. *Characteristics of the Primary Tumors and Liver Metastases*

Variables	No. of Patients (%)
Colorectal Cancer	
Primary location	
Ascending colon	8 (23)
Transverse	3 (9)
Descending	7 (20)
Sigmoid	11 (31)
Rectum	6 (17)
Differentiation	
Well	3 (9)
Moderate	8 (23)
Poor	24 (68)
Stage of tumor (TNM classification)	
I	
II	6 (17)
III	14 (40)
IV	15 (43)
Liver Metastases	
Distribution	
Unilobar	27 (77)
Bilobar	8 (23)
Tumors	
Solitary	11 (31)
Multiple (2–4)	24 (69)*
Diameter	
<5 cm	29 (83)
5–10 cm	5 (14)
>10 cm	1 (3)

* In eight of these patients, the metastases were located in both lobes.

Morbidity and Mortality

Postoperative complications occurred in 16 patients (46%), four of whom experienced these complications after minor liver resections and twelve of whom experienced complications after major resections. Of the 23 patients who had major resections, complications developed in twelve (52%), compared with only four (33%) of the twelve patients who underwent wedge resections.

Most complications were minor, but of the six major complications (37%), five occurred after formal anatomic liver resections. The most common complications observed were atelectasis in five patients (31%), prolonged jaundice in three (19%), and bile leakage in two (12%). In addition, none of the patients underwent reoperation because of complications; the hospital convalescence ranged from 6 to 22 days (12.31 ± 0.66 days), and the 30-day operative mortality was 0%.

Intraoperative blood loss as estimated by the anesthesiologist ranged from 650 to 6600 ml (3400 ± 718 ml). Of the 14 patients (40%) whose blood loss was >3500 ml, postoperative complications developed in ten (71%), as compared to only six (28%) of the 21 (60%) patients

TABLE 2. *Type of Operation, Pathology, and Case Distribution According to the Percentage of Hepatic Replacement by Tumor and Staging of the Liver Metastatic Disease*

Variables	No. of Patients (%)
Minor resection	
Right wedge	3
Left wedge	5 12 (34)
Combined wedge*	4
Major resection	
Left lateral segmentectomy	7
Right lobectomy	9
Left lobectomy	3 23 (66)
Right trisegmentectomy*	2
Any major resection plus wedge*	2
Margin of hepatic resection involved with tumor	
Negative	25 (71)
Positive	10 (29)
Hepatic replacement by tumor	
H_1	18 (54)
H_2	16 (43)
H_3	1 (3)
Staging (Milan)	
I	10 (28)
II	9 (26)
III	16 (46)
Staging (Sloan-Kettering)	
I	19 (54)
II	15 (43)
III	1 (3)

* Performed for bilobar disease.

whose blood loss was < 3500 ml ($p < 0.05$). Tables 3 and 4 shows the postoperative complications, and the range and mean of the intraoperative blood loss according to the type of liver resection performed.

Recurrence

The postoperative follow-up ranged from 12 to 60 months (25.8 ± 2.2 months). Twenty-six patients (74%) had recurrence after liver resection for colorectal metastatic carcinoma; all of these patients were asymptomatic before relapse. The location of recurrence and the disease-free interval (DFI) for each single and/or combined variable are shown in Table 5.

TABLE 3. *Postoperative Morbidity*

Type of Complication	Type of Resection: Wedge	Major
Minor		
Atelectasis	2	3
Prolonged jaundice		3
Prolonged ileus	1	1
Major		
Bile leakage		2
Enterocutaneous fistula		1
Pneumonia	1	1
Hemidiaphragm paralysis		1

TABLE 4. *Postoperative Blood Loss*

Type of Operation	Blood Loss (ml)
Wedge resection	650–2100 (1658 ± 106)
Left lateral segmentectomy	2100–4900 (3216 ± 406)
Combined procedure	4900–5500 (5133 ± 186)
Formal lobectomy	2700–6600 (4070 ± 341)

The overall DFI from the time of the liver resection of metastases to the time of appearance the recurrence ranged from 5 to 36 months (15.63 ± 2.17 months). Seventeen patients (65%) had recurrence at one single site (17.2 ± 2.78 months); in 14 patients (82%), the liver was involved, and in three (18%), the lungs were involved. Nine patients (35%) had recurrence at multiple sites (12.8 ± 3.47 months); in nine patients (100%), the liver and other organs were involved), in five patients (56%), the lungs and other organs were involved, in two (22%), the colon and other sites were involved, and in one (11%), the bones plus other sites were involved. In total, the liver was the site of recurrence in 23 patients (83%), the lungs was the site of recurrence in eight (31%), and the colon was site of recurrence in two (8%).

The single variables that were associated with early recurrence in order of statistical significance were: degree of histologic differentiation of the primary tumor (poor *vs.* well or moderate; $p < 0.005$), the patient-gender (men *vs.* women; $p < 0.01$), the number of liver metastases (multiple tumors *vs.* solitary; $p < 0.01$), and the presence of tumor in the margin of hepatic resection (positive *vs.* negative; $p < 0.05$). All of the other single variables failed to show any significant variation on the DFI and were not statistically significant.

When the extent of liver metastatic disease was analyzed by the Milan and Sloan-Kettering systems, it was found that the patients categorized as Stage III had early recurrence when compared with those patients in Stage I, ($p < 0.05$).

The following categories were associated with a high recurrence rate (> 85%): bilobar liver metastatic involvement, margins of hepatic resection involved with tumor, wedge resection, poor differentiation of the PCRT, locoregional Stage IV, and presence of Stage II or III liver metastatic disease by the Sloan-Kettering classification. The patients who underwent major hepatic resection had a considerably lower recurrence rate (65%) than those patients who underwent wedge resection (92%); however, the DFI was not significantly different for each category.

Survival and Disease-Free Rates

Of the 35 patients studied, all (100%) were alive at 1 year after resection of the hepatic metastasis; 20 patients

TABLE 5. *Analysis of Recurrence: Location and DFI*

Variables	Category	No. of Patients With Recurrence* (%)	Location of Relapse: Isolated: Liver	Location of Relapse: Isolated: Lung	Location of Relapse: Multiple Sites	DFI Months	p-value
Gender	Women	14 (70)	9	1	4	20.14 ± 2.36	
	Men	12 (80)	5	2	5	11.83 ± 1.76	0.010
Primary tumor							
Site	Colon	23 (79)	12	3	8	16.08 ± 1.94	
	Rectum	3 (50)	2		1	14.33 ± 1.20	0.752
Differentiation	Well or Moderate	19 (70)	12	2	5	17.89 ± 2.07	
	Poor	7 (87)	2	1	4	7.14 ± 1.03	0.005
Stage	II + III	13 (65)	8	1	4	15.38 ± 3.09	
	IV	13 (87)	6	2	5	15.00 ± 1.47	0.911
Liver metastases							
Timing disease	Synchronous	12 (80)	6	2	4	15.00 ± 1.82	
	Metachronous	14 (70)	8	1	5	16.07 ± 2.86	0.763
Distribution	Unilobar	18 (67)	7	3	8	16.94 ± 2.21	
	Bilobar	8 (100)	7		1	12.12 ± 1.94	0.192
Metastases	Solitary	7 (64)	4	1	2	22.14 ± 3.38	
	Multiple	19 (79)	10	2	7	12.63 ± 1.76	0.013
Tumor diameter	<5 cm	21 (72)	12	2	7	16.04 ± 2.01	
	>5 cm	5 (83)	2	1	2	15.40 ± 2.71	0.883
Hepatic replacement	H_1	12 (67)	5	1	6	18.25 ± 2.98	
	$H_2 + H_3$	14 (82)	9	2	3	15.14 ± 1.98	0.382
Milan stage	I	6 (60)	4		2	23.83 ± 3.46	
	II	7 (78)	3	1	3	14.14 ± 3.36	0.005
	III	13 (81)	7	2	4	13.15 ± 1.60	
Sloan-Kettering	Stage I	12 (63)	8	1	3	19.83 ± 2.63	
	Stage II + III	14 (87)	6	2	6	13.21 ± 1.79	0.044
Operation							
Timing operation	Simultaneous	6 (75)	4		2	15.87 ± 1.91	
	Metachronous	20 (74)	10	3	7	16.22 ± 2.31	0.926
Type resection	Wedge or Partial	11 (92)	6	2	3	18.63 ± 2.88	
	Major	15 (65)	8	1	6	16.06 ± 2.21	0.478
Margin resection	Negative	16 (64)	5	3	8	19.28 ± 1.20	
	Positive	10 (100)	9		1	12.88 ± 2.07	0.049

* Of the total number of patients per each category.

(57%) were alive at 2 years, and eleven (31%) were alive at 3 or more years. Table 6 shows the statistical analysis on survival and disease-free rates at 2 years after operation.

The single variables that significantly affected the survival and disease-free rates at 2 years after liver resection of metastases were the patient-gender (27% and 20% for men *versus* 80% and 55% for women for survival and disease-free rates, respectively; $p < 0.05$), and the margin of hepatic resection (20% and 10% for positive *versus* 72% and 52% for negative for survival and disease-free rate, respectively; $p < 0.05$).

The analysis of combined variables to evaluate the role of the stage of the liver metastatic disease on survival and disease-free rates showed that the presence of Stage III liver disease (Milan classification) was accompanied by a limited 2-year survival rate of 37% and a disease-free rate of 19%, compared with the survival and disease-free rates of 80% observed in patients with Stage I liver disease ($p < 0.05$ for survival, and $p < 0.005$ for DFI, respectively). Furthermore, the presence of Stage II or III liver metastatic disease (Sloan-Kettering classification) was accompanied by a 2-year survival rate of 31% and a disease-free rate of 12%, compared with a survival rate of 79% and a disease-free rate of 63% found in patients with Stage I liver disease ($p < 0.005$ for both categories).

There was no significant difference in the survival and disease-free rates of more than 2 years for the patients who underwent simultaneous resection (survival rate of 50% and disease-free rate of 25%), compared with those who had separate operations (survival rate of 59% and disease-free rate of 44%). The type of liver resection performed neither influenced the survival time (65% for major *versus* 42% for wedge) nor the disease-free rate (43% for major *versus* 33% for wedge) (p-value not significant NS by x^2, for both categories).

The single and multivariate analysis allowed the categorization of the patients into three groups: Group 1—patients alive and free of disease; Group 2—patients free of disease for a short time (< 1 year), including those who were lost to follow-up; and Group 3—patients with poor survival and/or earlier recurrence (< 6 months). The numerical data of this categorization is shown in Table 7.

TABLE 6. *Survival and Disease-Free Rates at 2 Years*

Variables	Category	Total No. of Patients	No. of Survivals (%)	p-value	Disease-Free No. of Patients (%)	p-value
Gender	Women	20	16 (80)		11 (55)	
	Men	15	4 (27)	0.002	3 (20)	0.046
Primary tumor						
Site	Colon	29	16 (55)		11 (38)	
	Rectum	6	4 (67)	0.680	3 (50)	0.664
Differentiation	Well or Moderate	27	15 (56)		11 (41)	
				1.000		1.000
	Poor	8	5 (62)		3 (37)	
Stage	II + III	20	13 (65)	0.32	10 (50)	0.296
	IV	15	7 (47)		4 (27)	
Liver metastases						
Timing disease	Synchronous	15	7 (47)	0.321	4 (27)	0.296
	Metachronous	20	13 (65)		10 (50)	
Distribution	Unilobar	27	17 (63)	0.246	13 (48)	0.108
	Bilobar	8	3 (37)		1 (12)	
Metastases	Solitary	11	8 (73)	0.281	7 (64)	0.073
	Multiple	24	12 (50)		7 (29)	
Tumor diameter	<5 cm	29	17 (59)	1.000	12 (41)	1.000
	>5 cm	6	3 (50)		2 (33)	
Hepatic replacement	H_1	18	13 (72)	0.082	10 (55)	0.075
	$H_2 + H_3$	17	7 (41)		4 (24)	
Milan stage	I	10	8 (80)	0.628	8 (80)	0.070
	II	9	6 (67)		3 (33)	
	III	16	6 (37)	0.050	3 (19)	0.004
Sloan-Kettering Stage	I	19	15 (79)	0.005	12 (63)	0.005
	II + III	16	5 (31)		2 (12)	
Operation						
Timing operation	Simultaneous	8	4 (50)	0.700	2 (25)	0.431
	Metachronous	27	16 (59)		12 (44)	
Type resection	Wedge or Partial	12	5 (42)	0.282	4 (33)	0.721
	Major	23	15 (65)		10 (43)	
Margin resection	Negative	25	18 (72)	0.008	13 (52)	0.028
	Positive	10	2 (20)		1 (10)	

Discussion

In most series, the mean survival time of patients with untreated hepatic metastases from colorectal carcinoma is approximately 6 months, and although there are some reports of long-term survivors, virtually all untreated patients die within 24 months after liver metastases are detected.[12-16]

Resection of hepatic metastases from colorectal carcinoma is a realistic therapeutic option that offers the best prospect of survival in a selected group of patients. In the experience of a single institution as reported by Wilson and Adson,[17] the overall survival rate at 5 years was 28%; Hughes et al.,[18] using data from multiple institutions, reported a 5-year survival of 24%.

TABLE 7. *Analysis of Groups*

Groups	No. of Patients (%)
Group 1 (patients alive and disease-free interval)	
1 year	29 (83)
2 years	14 (40)
>3 years	9 (26)
Group 2 (patients with probable surgical failure)	
Short time of DFI	6 (17)
No good controls	4 (11)
Group 3 (patients with no significant palliation)	4 (11)

The operative mortality rate for liver resection of metastases secondary to colorectal carcinoma has varied from 0 to 10%.[2,3,6,9] In the present study, there were no operative deaths; however, the morbidity rate was 46%; lobectomies and extended lobectomies had higher and more serious morbidity. Another factor associated with high morbidity was blood loss of more than 3500 ml.

The reported incidence of recurrence after the resection of the hepatic metastases from colorectal tumors has varied from 48% to 80%, the liver being the most common site of recurrence, followed by the lungs and the peritoneum.[9,7,11,19-23]

The DFI after resection of hepatic metastases has been reported by Ekberg et al.[21] to be 9 months on average; in their study, the liver was the site of recurrence in 83% of the cases, the lungs was the site of recurrence in 22%, and the site of the colonic resection was the site of recurrence in 15%.

In the present study, the overall incidence of recurrence (74%), the DFI (15.63 ± 2.17 months), the initial sites of recurrence (65% for single-organ sites and 35% for multiple sites), and the rate of extrahepatic recurrence (46%) were similar to those reported in previously published series.[7,9,11,21,23]

Several published studies[11,20-23] have shown that patients who have bilobar hepatic metastases, extensive replacement of their liver by tumor, extrahepatic metastases, and/or margins of resection involved with tumor are more likely to have early recurrence, and thus, postresection survival periods of less than 1 year. Because of controversial findings in other studies,[6,9,11,18,21,22] the degree of differentiation and the locoregional stage of the PCRT cannot be considered as valid determining factors for long-term survival after resection of the hepatic metastases. There is little information regarding the influence of the gender of the patients; Adson et al.[24] reported that women had a far more favorable prognosis.

The true meaning of the presence of multiple hepatic metastases *versus* single lesions as regards prognosis deserves comment. It has been reported that the survival period of patients with multiple liver metastases is shorter than the that of patients with solitary metastases after their resection; the 2-year survival rate for patients with multiple metastases has ranged from 20% to 73%.[20-22] Nevertheless, more recent studies[6,11] have not found a statistically significant difference in survival rates after liver resection in patients with single *versus* multiple hepatic metastases.

The findings of the present series suggest that the factors predicting early recurrence were poor histologic differentiation of the primary tumor, the male gender, the presence of multiple metastases, and a margin of liver resection involved with tumor. However, the two variables that appeared to significantly affect the prognosis (*i.e.*, 2-year survival and disease-free rates) were the male gender and a positive margin of hepatic resection. In concurrence with other studies,[6,11,20,22] the site of the primary tumor, the time of detection of the hepatic metastases, and the size of the largest metastases have not been found to be important prognostic factors.

Because adequate staging of the metastatic liver disease appears to be essential in attempting to predict the survival after resection of the hepatic metastases, it is highly desirable to use statistical methods that simultaneously analyze several factors. The multivariate analysis appears to be one of the best of such methods. It was used by Gennari et al.,[10] who found that the stage of the liver disease was the most important parameter in relation to the overall recurrence rate (47% for Stage I, 62% for Stage II, and 81% for Stage III). Using similar methods, Fortner et al.[11] reported a 3-year survival rate of 66%, 58%, and 0% in patients with Stage I, Stage II, and Stage III liver metastatic disease, respectively.

Using multivariate analysis (Milan stage) in the present study, we found that patients who had Stage III metastatic liver disease were at a significantly higher risk for early recurrence (13.15 ± 1.6 months) and that the duration of their survival and disease-free period at 2o years were markedly reduced (37% and 19%, respectively). Furthermore, when the liver metastatic disease was evaluated according to the location and extent of metastases (Sloan-Kettering staging), the presence of an advanced liver metastatic disease (Stage II or III) correlated with an earlier recurrence (13.21 ± 1.79 months), as well as with a limited 2-year survival rate (31%) and disease-free rate (12%). A very high recurrence rate in the remaining liver was observed in patients with bilobar disease (87%) and in those patients who had tumor in the margins of their liver resections (90%). It also should be noted that all of the patients of these two subgroups also had extrahepatic recurrences.

Therefore, from the findings of these two previously quoted analyses[11,23] and our own results, it appears clear that the presence of advanced metastatic liver disease, manifested mainly by involvement of both lobes and larger areas of involvement that cannot be resected with adequate margins (2 cm from the tumor), is the most significant determining factor for an unfavorable prognosis, and emphasizes the need for evaluation of the metastatic liver disease by multivariate analysis in order to more accurately assess the prognosis.

Our study concurs with other publications[3,6,11,20,24,27] in suggesting that the survival period and rate of recurrence are not different for simultaneous and metachronous resections of the liver metastases.

The extent of hepatic resection has been evaluated in several studies[14,20,21,28,29] and appears to have no bearing on survival time; some series[27,30] have found that performing a wedge excision can be as effective as extended or major resections, as long as adequate margins of resection are obtained and all of the metastatic deposits are removed. We concur with other reports[8,9,11,14,25,26] that despite adequate resection of the hepatic metastases, the threat of recurrence remains because of the possibility of multiple nondetectable neoplastic foci already present in the residual hepatic tissue, or because of circulating malignant cells that subsequently seed themselves in unpredictable sites. In this study, the type of liver resection performed did not influence the DFI or the recurrence rate in the remaining liver. Therefore, one can postulate that failure of resection of hepatic metastasis is more dependent on the biologic inherent behavior of the metastases than on the extensiveness of the hepatic resection performed. Nevertheless, our experience is in accordance with other studies[6,7,11,17,18,22,27] that clearly show that resection of hepatic metastases from colorectal tumors can significantly prolong survival when compared with the results observed in several control studies of untreated patients.[12-14] However, it must be recognized that not all survivors will remain free of disease, and that eventually some will succumb to the recurrence of their primary tumors. Thus,

the actual role of surgical resection of liver metastases should be evaluated by combining the survival and the disease-free rates.

In the present series, although all patients survived for at least 12 months after resection of their hepatic metastases, only 20 (57%) and 11 patients(31%) were alive at 2 and 3 or more years, respectively. The analysis of the disease-free rate among survivors permitted separation of those patients who truly benefited from the resection from those patients who had no significant palliation.

Twenty-nine patients (83%) remained alive and free of disease for at least 12 months, and 14 (40%) were disease-free for 2 years after the resection of their hepatic metastases. Because these patients had not reached the 3-year mark without recurrence when this study was completed, the role of surgical resection of liver metastases in this subset of patients can only be suggested as significant palliation. Nine patients (26%) are alive without recurrent disease at 3 or more years, and six (17%) had survived for 5 years; in this subset, the surgical resection can be established as truly beneficial in the former and/or possibly curative in the last patients mentioned.

Six other patients were free of disease for only a short time (< 1 year), and four of these patients had a very early recurrence (< 6 months). Thus, these patients did not receive any objective or substantial benefit from the operation, because no significant palliation was observed and because the expected survival time could have been the same with or without resection of their metastases.

All of this information suggests that, although resection of hepatic metastases from PCRT can prolong the survival period of most of the patients of a selected group, the delayed recurrences dictated that the possible cure of these patients must be judged with some degree of skepticism.

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