Pulmonary Metastasectomy For 29 Patients With Colorectal Carcinoma: A Single Center Experience

Yirmidokuz Kolon Kanserli Hastada Akciğer Metastezektomi: Tek Merkez Deneyimi

Mehmet Serdar Cengizhan[1], İlhan Öztop[2], Tarık Salman[3], Aydın Şanlı[4], Olçun Ümit Ünal[5]

[1]Dokuz eylül üniversitesi Tıp Fakültesi İç Hastalıkları Ana Bilim Dalı, İzmir, Türkiye
[2]Dokuz eylül üniversitesi Onkoloji Enstitüsü Tıbbi Onkoloji Bilim Dalı, İzmir, Türkiye
[3]İzmir Katip Çelebi üniversitesi Tıp Fakültesi Tıbbi Onkoloji Bilim Dalı, İzmir, Türkiye
[4]Dokuz eylül üniversitesi Tıp Fakültesi Göğüs Cerrahisi Ana Bilim Dalı, İzmir, Türkiye
[5]Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye

Dergiye Ulaşma Tarihi: 7.5.2016 Dergiye Kabul Tarihi: 5.10.2016 Doi: 10.5505/aot.2016.80299

ÖZET

Amaç: Kolorektal kanserli hastaların yaklaşık olarak %50-60'ında senkron veya metakron uzak metastazlar izlenmektedir. Kolorektal kanserlerin hepatik ve pulmoner metastazlarının cerrahi rezeksiyonu hastalıksız sağkalım (DFS) ve genel sağkalımı (OS) anlamlı düzeyde uzatmakta ve böylece son yıllarda yaygın olarak uygulanmaktadır.

Yöntem: Bu araştırmada, Dokuz Eylül Üniversitesi Tıp Fakültesi Hastanesi'nde tedavi gören ve kolorektal kanserlere bağlı akciğer metastazları nedeniyle metastazektomi uygulanan 29 hasta değerlendirildi. Hastalara ait bilgiler retrospektif olarak elde edildi.

Bulgular: Hastaların 24'ü (%82.8) izole akciğer metastazı, gerikalan 5'i (%17.2) ise hem akciğer hem karaciğer metastazına sahipti. Çalışmaya alınan hastaların tümüne akciğer metastazına yönelik rezeksiyon uygulanırken, 5 (%17.2) hastaya ise akciğer+karaciğer metastazektomisi uygulanmıştı. Tüm hasta grubunda ortanca OSx 57 ay (SD± 4 ay), 1, 3 ve 5 yıllık sağkalım oranları sırasıyla %96, %92 ve %49 olarak tespit edildi. Metastazektomi operasyonu sonrası izlenen lezyonu olmayan hastalarda ortanca DFS 31 ay (SD± 3 ay), 1, 3 ve 5 yıllık DFS oranları sırasıyla %86, %42 ve %1 olarak saptandı. Metastazektominin şekline göre OS değerlendirildiğinde wedge rezeksiyon yapılanlarda ortanca OS 58 ay (SD± 5 ay), lobektomi yapılanlarda ise 50 ay (SD± 2 ay) olarak bulundu. Rezeksiyon türüne göre OS değerlendirildiğinde R0 rezeksiyon yapılanlarda ortanca OS 66 ay (SD± 5 ay), R1 rezeksiyon yapılanlarda ise ortanca OS 47 (SD± 7 ay) ay olarak bulundu.

Sonuç: Sonuçlarımız kolorektal kanser akciğer metastazlarının cerrahi rezeksiyonunun, özellikle R0 rezeksiyonun OS süresinin uzamasına katkı sağladığını göstermektedir.

Anahtar Kelimeler: Kolorektal kanser; Akciğer metastazektomi, Sağkalım

ABSTRACT

Aim: Synchronous or metachoronous distant metastasis develops in approximately 50-60% of patients with colorectal cancer during the clinical course. Surgical resection of the hepatic and/or pulmonary metastasis of colorectal cancers significantly extends disease-free survival (DFS) and overall survival (OS) rates, and thus has been applied more broadly in recent years.

Methods: In this study, 29 patients who were treated at the Dokuz Eylül University Medical Faculty Hospital and who had received a metastasectomy due to a lung metastasis related to colorectal cancer were evaluated. Information on the patients was obtained retrospectively.

Results: Twenty-four (82.8%) patients had an isolated lung metastasis and 5 (17.2%) had both lung and liver metastasis. Resection was performed on all patients for lung metastasis, and a lung+liver metastasectomy was performed on 5 (17.2%). For the entire patient group, the median OS was 57 months (SD± 4 months), and 1, 3, and 5 year survival rates were 96%, 92% and 49%, respectively. In patients who received follow-up treatment after undergoing the metastasectomy operation and who did not have lesions, the median DFS was 31 months (SD± 3 months), and 1, 3, and 5 year DFS rates were 86.3%, 42% and 1%, respectively. In patients who received wedge resection treatment, the median OS was 58 months (SD± 5 months), and for the patients who received lobectomy treatment, the median OS was 50 months (SD± 2 months). In the evaluations made according to the resection type, median OS was 66 months (SD± 5 months) in patients who had R0 resection and 47 months (SD± 7 months) in patients who had R1 resection.

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

Conclusion: Our results show that surgical resection, particularly an R0 resection of lung metastasis in colorectal cancer patients contributes to extended patient OS time.
Keywords: Colorectal cancer; Pulmonary metastasectomy, Survival

Introduction

Colorectal cancer is one of most common type of cancer (1). Metastasis is the primary cause of death in these patients, with the most common metastasis areas being the liver, lung and peritoneum. Distant metastasis is present in approximately 20-25% of patients with colorectal cancer at the time of diagnosis (2). Metachronous metastasis develops during the course of disease in approximately 40-50% of patients who received a resection and adjuvant therapies (3).

When patients with metastatic colorectal cancer are not treated, the prognosis is poor, with a median survival rate of approximately 5-9 months (4). The primary treatment for metastatic colorectal cancer is systemic; however, when metastasis is present in only the liver or the lung, a metastasectomy can also be performed. In systemic treatments, combinations of chemotherapeutic agents, such as 5-fluorouracil (5-FU), oxaliplatin, and irinotecan, are typically used. With the recent addition of targeted agents that have been used, the level of efficiency has increased and due to their high response rates, they have become the agents of choice in induction treatments (5).

Among the colorectal cancer metastases, lung and liver metastases are particularly important, especially in terms of determining the treatment approach. In these patients, local ablative approaches are also commonly performed, in addition to systemic treatments. In liver metastases related to colorectal cancer, hepatic resection is the only curative treatment option, and 5-year survival rates are reported to have a ratio of 25-40%. Today, hepatic resection serves as the gold standard of treatment types (6, 7).

Patients with lung metastasis only are believed to have a more suitable biology in terms of local or systemic treatment options as compared to patients with multi-organ metastasis. In an autopsy study performed on patients who had died of metastatic lung disease, it was observed that the lungs were the single metastasis area in 20% of the patients. This lends strength to the idea that surgical resection of lung metastases can extend survival time. Among all metastases, patients who are able to receive complete resection have a longer survival rate as compared to patients who unable to receive resection. It has been shown that time of survival of over 5 years can be obtained in about 20 to 40% of patients who have resectable lung metastasis (8). It has also been reported that synchronous or sequential resection of liver and lung metastases can extend survival (9).

In this study, the objective is to evaluate the effects on survival and prognosis of patients with colorectal-cancer-related lung metastasis who have undergone a metastasectomy.

Methods

Patient Characteristics

Evaluations were conducted on colorectal cancer patients who had received a metastasectomy due to lung metastasis and who were receiving follow-up treatment at Dokuz Eylül University Medical Faculty, Department of Internal Diseases, Medical Oncology between January 2001 and May 2013. The files of the patients, including information on their metastasectomy operation, the efficiency and toxicity of the treatments performed, as well as their demographical data, were retrospectively evaluated. The staging of the patients involved in the study was performed according to the American Joint Committee on Cancer's (AJCC) Cancer Staging, 6th edition, 2002 TNM staging system.

Treatment Characteristics

In patients who had previously had stage II colon cancer or who have any of the high risk factors, the De Gramont regimen (Folinic acid 400 mg/m² + 5-FU 400 mg/m² bolus + 5-FU 2400 mg/m² 46-h infusion, fortnightly) was performed as the adjuvant chemotherapy, and for stage III patients, the mFOLFOX-4 (Folinic acid 400 mg/m² + 5-FU 400 mg/m² bolus + 5-FU 2400 mg/m² 46-h infusion+ Oxaliplatin 85 mg/m², fortnightly) regimens were performed. For patients who had rectal cancer and were

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

undergoing chemoradiotherapy (CRT), radiotherapy was delivered 45 Gy in 25 fractions, at a dose of 1.8 Gy fraction a day, and 5-FU 225 mg/m²/day was administered in a continuous infusion. Chemotherapy regimens applied due to metastatic diseases were also grouped.

Efficiency Evaluation

For patients receiving systemic treatment, a response evaluation was conducted once every 6 courses of treatments. The response evaluation was carried out according to the tumor response evaluation criteria of the World Health Organization (WHO). Complete disappearance of tumor and confirmation of this result in four weeks was considered a complete response (CR); a regression of 50% or above in the target lesion and a maximum progression of 25% in any lesion and confirmation of this result in four weeks was considered a partial response (PR); no change in the target lesion was considered a stable disease (SD); and a progression of 25% or above in the target lesion or determination of a new lesion was considered a progressive disease (PD). The sum of CR and PR was regarded as an objective response rate (ORR).

Patients' pre-metastasectomy evaluations were carried out with thoracic, lower and upper abdominal computed tomography; PET-CT and colonoscopy were performed in the required cases. The lung metastasectomy process was grouped into wedge resection, segmentectomy, and lobectomy. The resection type was classified as R0, R1 or R2 resection.

Survival Analysis

For patients who received follow-up after the metastasectomy operation and who did not have any lesions, the time between operation and recurrence was regarded as disease-free survival (DFS), and the time until death was considered as overall survival (OS).

Statistical Analysis

The Statistical Package for Social Sciences (SPSS), Windows Version 15.0 was used to conduct statistical analysis of the data; the Chi-Square test and Fisher exact test were used for the comparison between the independent group rates of two groups. For DFS and OS analyses, the Kaplan-Meier Method was used, and for the comparison of two survival curves, the Log rank Test was used. Statistical significance was set at $p<0.05$.

Results

Patient Characteristics

Twenty-nine patients who were treated and received follow-up after being diagnosed with metastatic colorectal cancer and who had had a lung metastasectomy were involved in the study. A majority of the patients were female, and in a large portion of the female patients, the primary tumor was located in the colon. The tumor histology was adenocarcinoma in all patients. Six (20.7%) were metastatic at the time of diagnosis, while 23 (79.3%) became metastatic at a later period. Three of the 17 patients with a primary tumor location in the colon were metastatic at the time of diagnosis, and none of the 12 patients with a primary tumor location in the rectum were metastatic at the time of diagnosis. All the patients that were not metastatic at the time of diagnosis had a previous adjuvant history. Twenty-four (82.8%) patients had an isolated lung metastasis, and 5 (17.2%) had both lung and liver metastasis. Lung metastases were located mostly in the left lung's upper lobe and right lung's lower lobe. Wedge resection and R0 resection were the most commonly performed metastasectomy types. Resection was performed on all patients for lung metastasis, while additional liver metastasectomy was performed on 5 (17.2%). Patients' characteristics are shown in detail in Table 1. There were no operation related deaths.

Treatment regimens

Neoadjuvant treatment was given to 18 (62.1%) patients before they had received a lung metastasectomy; on the remaining 11 (37.9%) patients, a lung metastasectomy was performed directly. Adjuvant treatment was performed on all patients after metastasectomy, with the most common treatment being the Folfiri- bevacizumab regimen. The chemotherapy characteristics of patients are shown in detail in Table 2.

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

Table 1. Patient and tumor characteristics

Variable	n (%)
Gender	
Male	16 (55.2%)
Female	13 (44.8%)
Primary Tumor localization	
Colon	17 (58.6%)
Rectum	12 (41.4%)
Location of tumor metastases during lung metastasectomy	
Isolated lung	24 (82.8%)
Lung+liver	5 (17.2%)
Metastasis location	
Left lung's upper lobe	8 (27.5%)
Right lung's lower lobe	6 (20.6%)
Left lung's lower lobe	5 (17.2%)
Right lung's upper lobe	3 (10.2%)
Right lung's upper + left lung's lower lobe	2 (6.8%)
Right lung's upper and lower lobe	2 (6.8%)
Right lung's lower + left lung's upper lobe	1 (3.4%)
Left lung's upper and lower lobe	1 (3.4%)
Right lung's lower + left lung's lower lobe	1 (3.4%)
Operation type	
Solitary Lung metastasectomy	24 (82.8%)
Lung + liver metastasectomy	5 (17.2%)
Type of Lung Metastasectomy	
Wedge resection	24 (82.8%)
Lobectomy	5 (17.2%)
Type of Resection in Lung Metastasectomy	
R0	17 (58.6%)
R1	12 (41.4%)

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

Table 2. Chemotherapy characteristics and diagrams of patient	
Neoadjuvant chemotherapy	
Performed	18 (62.1%)
Non-performed	11 (37.9%)
Adjuvant chemotherapy type	
Folfiri+bevacizumab	10 (34.5%)
Folfiri + cetuximab	4 (13.7%)
Folfox6	3 (10.3%)
Folfox4	3 (10.3%)
Folfiri	3 (10.3%)
Folfox + Bevacizumab	2 (6.9%)
Folfox7	1 (3.4%)
Raltitrexed + oxaliplatin	1 (3.4%)

Table 3. Recurrence pattern following metastasectomy	
Recurrence organ	**n (%)**
Isolated lung	12 (41.3%)
Lung + liver	1 (3.4%)
Liver + peritoneum	2 (6.9%)
Lung + brain	4 (13.8%)
Spleen	1 (3.4%)
Rectum	1 (3.4%)
No recurrence	8 (27.6%)

Survival

In the entire patient group, the median OS was 57 months (SD±4 months), and 1, 3, and 5 year survival rates were 96%, 92%, and 49%, respectively (Figure 1). In patients who received follow-up after undergoing the metastasectomy operation and who did not have lesions, the median DFS was 31 months (SD±3 months), and 1, 3, and 5 year DFS rates were 86.3%, 42%, and 1%, respectively (Figure 2). In patients who had received treatment at a prior time under the diagnosis of early stage colorectal cancer and then became metastatic, the median time between diagnosis and metastasis was 23 months. When the survival is evaluated according to the resection type, median OS was determined as 66 months (SD±5 months) in patients who had R0 resection and 47 months (SD±7 months) in patients who had R1 resection (Figure 3). When survival was evaluated according to the type of metastasectomy, the median OS was 58 months (SD±5 months) and 50 months (SD± 2 months) in patients that had wedge resection and lobectomy, respectively (Figure 4). When survival analyses were assessed according to the primary tumor location, the median OS was 45 months for those whose tumor was in the colon and 63 months for those whose tumor was in the rectum (Figure 5). In the patients that received chemotherapy as adjuvant treatment after metastasectomy, there was no significant difference in terms of survival according to CT regimen.

Recurrence pattern after metastasectomy and treatment characteristics

Recurrence occurred in 21 (72.4%) patients after receiving a lung metastasectomy. Metastasis was present in a single organ in 14 of these patients and 7 had metastasis in two organs. Location and distribution of recurrences are shown in Table 3. A lung metastasectomy was repeated in 4 (19%) of the patients who had a recurrence; in 3 (15%) patients, a lung metastasectomy was performed after neoadjuvant chemotherapy; and palliative chemotherapy was performed on 14 (66%) patients. Of the 7 patients who had a second lung metastasectomy as a result of the recurrence, 6 were rectum derived and 1 colon derived.

Conclusions

Colorectal cancers rank second among cancer related deaths. Lung metastasis occurs in 10-20% of colorectal cancers, whereas colorectal cancer metastasis accounts for only 2-4% of the lung metastases (10, 11, 12). The primary treatment for metastatic colorectal cancers is systemic treatment; however, additional metastasectomy treatment contributes to long-term survival in liver and lung metastases (9,13).

In our study, survival time following a lung metastasectomy in patients with a primary tumor location in the rectum was found to be longer than that in patients with a primary tumor location in the colon. In the literature, it is emphasized that survival time is typically

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

shorter for patients with a primary tumor in the rectum, and that this might be the result, to a large extent, of the rectum's lack of peritoneal protection (mean 5-year survival rate for colon and rectum is 35-65% and 30-53%, respectively) (12,14,-18). However, certain publications have suggested that the primary tumor's localization is not very effective in measuring mean survival rate (12). In the analysis performed on our patients, although there was no statistically significant difference between colon cancer and rectum cancer metastases in terms of survival after metastasectomy, the 5-year survival expectancy was 66% and 76%, respectively. The mean survival time was 45 months (SD±6 months) in patients with primary colon cancer and 63 months (SD±4 months) in patients with primary rectum cancer. We believe that the reason behind obtaining completely opposite results from the above mentioned study (14-18) can be attributed to the small number of patients with tumor location in rectum and the fact that most of the primary colon cancer cases were metastatic at the time of diagnosis.

Although chemotherapy is suitable in metastatic colon cancers that are unresectable and that show a systemic distribution, median OS time in these non-operable patients is 20-22 months, whereas the 5-year OS expectancy is only 5%. On the other hand, the mean 5-year OS time of colorectal cancer patients who had lung metastasectomy is reported to be 48% (varying between 41%-56%) (12). In our study, the median OS was 57 months (SD±4 months), and the 1, 3, and 5 year OS rates were 96%, 92%, and 49%, respectively, in the entire group. Published literature results are also similar to the results of the study conducted at our health center.

The report on disease free survival (DFS) published by the International Registry of Lung Metastases (IRLM) in 1997 suggested that a period of more than 36 months had a positive effect on prognosis; Pfannschmidt et al, however, reviewed many studies and stated that the DFS interval was effective on prognosis, independent of other factors, in only two of 20 case series (12,14, 17,19,20). Many of the publications with opposing views involve only predictions for lung metastases of colorectal cancers. The mean survival time in patients with <36 months of DFS was reported as 43.3 months, whereas the mean OS in patients with >36 months of DFS was reported as 47.3 months (14). Similar to the studies seen in the literature, in our study, statistically significant data on the effect of median DFS time on mean OS time were not determined.

It has been reported that synchronous lung and liver metastases were found in approximately 5-10% of patients with primary colorectal cancer. Some studies suggest that systemic chemotherapy will provide better results than radical resection in primary colorectal cancers with synchronous lung and liver metastases (21,22), while some researchers indicate that complete resection of pulmonary metastasis and liver metastasis would have almost the same survival outcomes. Therefore, the performance of a complete resection on solitary liver and lung metastases in selected patients could lead to lasting palliation and encouraging results (14). In three other interesting studies found in the literature, the mean 5-year survival rate was reported as 31% in colorectal cancer diagnosed patients who had both a lung and a liver resection (23-25). Five of our patients had liver metastasis. While the mean 5-year OS was not measured in our study (because there were only 5 patients), the mean survival time for colorectal cancer diagnosed patients who had both a lung and a liver resection was 40 months. Moreover, the survival values of our patients were observed to be consistent with other studies, and the multiple metastases partially reduced mean survival time. However, it is difficult to assert more definite claims given that there are only a limited number of patients with primary colorectal cancer and multiple diagnoses..

In many multi-centered studies, the effects on mean survival of colorectal cancer patients who received R0 and R1/R2 metastasectomy resections for lung metastases were compared (12). Even though the results of these studies were not very clear, a significant effect on survival was not found for R0 and R1/R2 resections, but it was concluded that an R0 resection provided a partially better prognosis in comparison to an R1 resection. In our study, the mean OS time was 66 months (SD±5 months) and 47 months (SD±7 months) in patients that had R0 resection (n:17) and R1 resection (n:12), respectively; given these results, our study supports the view in the

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

literature that an R0 resection offers a better prognosis as compared to an R1 resection (12).

In most of the studies found in the literature, a wedge resection or segmentectomy (60-65%) was performed. A lobectomy was preferred in 35-40% of patients, while a pneumonectomy was performed in only 1-2% of patients (12). In a study conducted by Vogelsang et al, a wedge resection was performed on 52 patients and better results were obtained in terms of 5-year life expectancy as compared to an anatomic lung resection performed on 23 patients (5-year survival wedge resection: 39%, anatomic lung resection: 25%) (26). In other large studies conducted, it was found that resection type did not have a prognostic significance on life expectancy (11,24,27-29). In our study, a wedge resection was performed on 24 patients and a lobectomy on 5 patients. Mean OS following the wedge resection and lobectomy surgeries were 58 months (SD±5 months) and 50 months (SD±2 months), respectively. Similar to many of the studies published in the literature, the results of our study support the view that the type of resection does not have a significant effect on prognosis.

Neoadjuvant treatment was given to 18 (62.1%) colorectal cancer patients who had a lung metastasectomy, while the remaining 11 (37.9%) had a direct lung metastasectomy operation; all patients received adjuvant chemotherapy following the operation. As the neoadjuvant chemotherapy and adjuvant chemotherapy types given in studies published in the literature are very different, it is quite difficult to examine the effect of chemotherapy on expected survival time (12). Adjuvant chemotherapy, however, was given after lung resection in 4 different studies, and no effect was reported on the prognosis or the expected survival time (26,27, 29, 30).

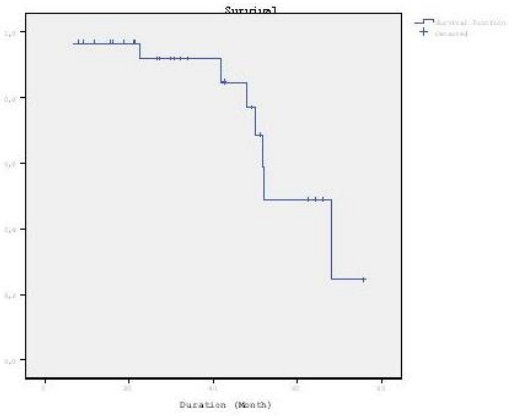


Figure 1

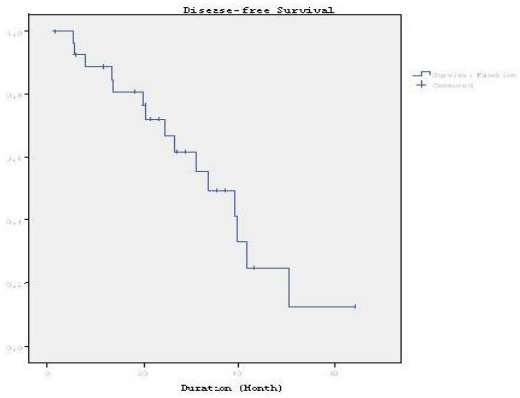


Figure 2

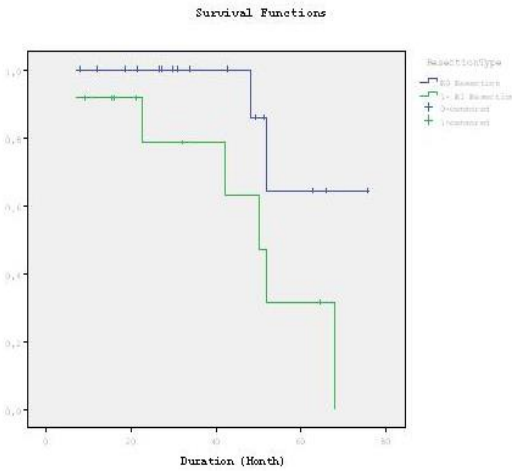


Figure 3

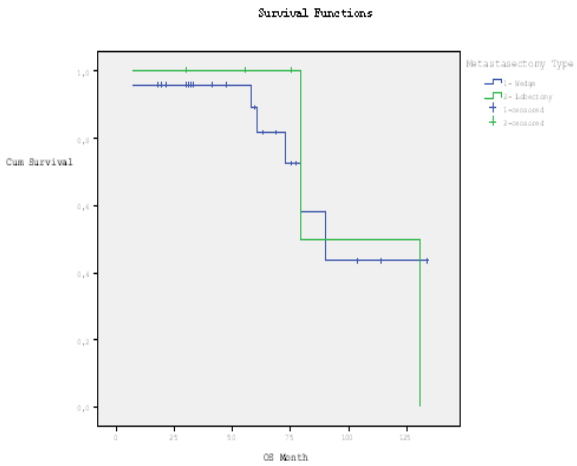


Figure 4

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

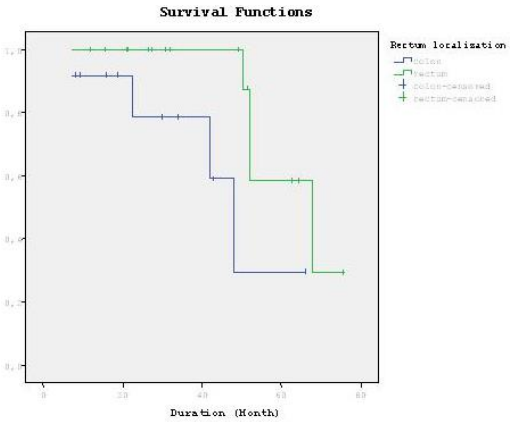


Figure 5

The mean value for isolated lung recurrence of coloreactal cancers with lung metastasis following the lung resection was reported to be 36% (12) in the literature. In our study, recurrence was seen in a total of 21 patients, 12 of which (41%) had isolated lung recurrence, data similar to those seen in the published studies.

As a result of this study being performed on a limited number of patients with colorectal cancer, metastasectomy approaches on isolated metastases involving the lung generally provided results similar to those seen in the literature. It is quite clear that the multidisciplinary approach in metastatic colorectal tumors, early diagnosis, newly developed and efficient chemotherapeutic agents and effective lung metastasectomies have reached quite significant and promising levels in terms of life expectancy compared to previous years. Complete resections (R0) performed following efficient neoadjuvant treatment, especially in metastases that emerge after a long disease-free survival period, provide significant improvements in the results of patients. Serial follow-up of patients is also very important, and serial metastasectomies performed in the event of recurrences contribute to survival. Therefore, a multidisciplinary approach plays a very important role in the follow-up of patients with colorectal cancer, just as it does in other cancer types.

Conflict of interest: None

References

1.Duran AO, Karaca H, Besiroglu M, Bayoglu IV, Menekse S, Yapici HS, Yazilitas D, Bahceci A, Uysal M, Sevinc A, Hacibekiroglu I, Aksoy A, Tanriverdi O, Arpaci E, Inanc M, Dane F, Ozkan M.. XELOX plus bevacizumab vs. FOLFIRI plus bevacizumab treatment for first-line chemotherapy in metastatic colon cancer: a retrospective study of the Anatolian Society of Medical Oncology. Asian Pac J Cancer Prev 2014;15:10375-9

2.Cokmert S, Ellidokuz H, Demir L, Fuzun M, Astarcioglu I, Aslan D, Yilmaz U, Oztop I. Survival outcomes of liver metastasectomy in colorectal cancer cases: a single-center analysis in Turkey. Asian Pac J Cancer Prev 2014;15: 5195-200

3.Eker B, Ozaslan E, Karaca H, Berk V, Bozkurt O, Inanc M, Duran AO, Ozkan M. Factors affecting prognosis in metastatic colorectal cancer patients. Asian Pac J Cancer Prev 2015;16:3015-21

4. Gunel N, Yamaç D, Akçalı Z, Taneri F, Oguz M. The clinico-pathologic characteristics of colorectal cancer under 50 years of age; experience of an oncology center. Tumori 2001;87:74-7

5.Zhu LM, Zhao YZ, Ju HX, Liu LY, Chen L, Liu BX, Xu Q, Luo C, Ying JE, Yang YS,Zhong HJ.. Efficacy and safety of bevacizumab in Chinese patients with metastatic colorectal cancer. Asian Pac J Cancer Prev 2014;15: 6559-64

6.Van Cutsem E, Nordlinger B, Adam R,Köhne CH, Pozzo C, Poston G, Ychou M,Rougier P; European Colorectal Metastases Treatment Group. Towards a pan-European consensus on the treatment of patients with colorectal liver metastases. Eur J Cancer2006;42:2212-21

7. Fong Y. Surgical therapy of hepatic colorectal metastasis. CA Cancer J Clin 1999;49:231-55

8. Inoue M, Ohta M, Iuchi K, Matsumura A, Ideguchi K, Yasumitsu T, Nakagawa K, Fukuhara K, Maeda H, Takeda S, Minami M, Ohno Y, Matsuda H; Thoracic Surgery Study Group of Osaka University. Benefits of Surgery for Patients With Pulmonary Metastases From Colorectal Carcinoma. Ann Thorac Surg 2004;78:238-44

9. Fong Y, Cohen AM, Fortner JG, Enker WE, Turnbull AD, Coit DG, Marrero AM, Prasad M, Blumgart LH, Brennan MF. Liver resection for colorectal metastases. J Clin Oncol 1997;15:938-46

10. Jemal A, Siegel R, Ward E, Murray T, Xu J, Thun MJ. Cancer statistics, 2007. CA Cancer J Clin 2007;57:43-66

11. Rena O, Casadio C, Viano F, Cristofori R, Ruffini E, Filosso PL, Maggi G. Pulmonary resection for metastases from colorectal cancer: factors influencing prognosis. Twenty-year experience. Europen Journal of Cardio-thoracic Surgery 2002;21:906-12

12.Pfannschmidt J, Dienemann H, Hoffmann H. Surgical Resection of Pulmonary Metastases From Colorectal Cancer: A Systematic Review of Published Series. Ann Thorac Surg 2007;84:324-38

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi

13.Kaba E, Toker A. Who Actually Profits from Pulmonary Metastasectomy Operation? Retrospective Analysis of 12 Years. Eurasian J Pulmonol 2014;16:208-9
14.Pfannschmidt J, Muley T, Hoffman H, Dienemann H. Prognostic factors and survival after complete resection of pulmonary metastases from colorectal carcinoma: Experiences in 167 patients. J Thorac Cardiovasc Surg 2003;126:732-9
15.Saito Y, Omiya H, Kohno K, Kobayashi T, Itoi K, Teramachi M, Sasaki M, Suzuki H, Takao H, Nakade M.. Pulmonary metastasectomy for 165 patients with colorectal carcinoma: A prognostic assessment. J Thorac Cardiovasc Surg 2002;124:1007-13
16.Higashiyama M, Kodama K, Higaki N, Takami K, Murata K, Kameyama M, Yokouchi H. Surgery for pulmonary metastases from colorectal cancer: the importance of prethoracotomy serum carcinoembryonic antigen as an indicator of prognosis. Jpn J Thorac Cardiovasc Surg 2003;51:289-96
17.Lee WS, Yun SH, Chun HK, Lee WY, Yun HR, Kim J, Kim K, Shim YM. Pulmonary resection for metastases from colorectal cancer: prognostic factors and survival. Int J Colorectal Dis 2007;22:699-704
18.Iizasa T, Suzuki M, Yoshida S, Motohashi S, Yasufuku K, Iyoda A, Shibuya K, Hiroshima K, Nakatani Y, Fujisawa T. Prediction of prognosis and surgical indications for pulmonary metastasectomy from colorectal cancer. Ann Thorac Surg 2006;82:254-60
19.Yedibela S, Klein P, Feuchter K, Hoffmann M, Meyer T, Papadopoulos T, Göhl J, Hohenberger W. Surgical management of pulmonary metastases from colorectal cancer in 153 patients. Ann Surg Oncol 2006;13:1538-44
20.Rotolo N, De Monte L, Imperatori A, Dominioni L, et al. Pulmonary resections of single metastases from colorectal cancer. Surg Oncol 2007; 16 Suppl 1:141-4
21. Ike H, Shimada H, Ohki S, Togo S, Yamaguchi S, Ichikawa Y. Results of aggressive resection of lung metastases from colorectal carcinoma detected by intensive follow-up. Dis Colon Rectum 2002;45:468-73
22.McCormack PM, Martini N. The changing role of surgery for pulmonary metastases. Ann Thorac Surg 1997;28:139-45
23.DeMatteo RM, Minnard EA, Kemeney N. Surgical resection of both hepatic and pulmonary metastases inpatients with colorectal cancer. Proceedings of ASCO ,1999,abstract 958
24.Headrick JR, Miller DL, Nagorney DM, Allen MS, Deschamps C, Trastek VF,Pairolero PC. Surgical treatment of hepatic and pulmonary metastases from colon cancer. Ann Thorac Surg 2002;71:975-9
25.Kobayashi K, Kawamura M, Ishihara T. Surgical treatment for both pulmonary and hepatic metastases from colorectal cancer. J Thorac Cardiovasc Surg 1999;118:1090-6
26.Vogelsang H, Haas S, Hierholzer C, Berger U, Siewert JR, Präuer H. Factors influencing survival after resection of pulmonary metastases from colorectal cancer. Br J Surg 2004;91:1066-71
27.Kanemitsu Y, Kato T, Hirai T, Yasuki K. Preoperative probability model for predicting overall survival after resection of pulmonary metastases from colorectal cancer. Br J Surg, 2004;91:112-20
28. Melloni G, Doglioni C, Bandiera A, Carretta A, Ciriaco P, Arrigoni G, Zannini P. Prognostic factors and analysis of microsatellite instability in resected pulmonary metastases from colorectal carcinoma. Ann Thorac Surg 2006;81:2008-13
29.Welter S, Jacobs J, Krbek T, Poettgen C, Stamatis G. Prognostic impact of lymph node involvement in pulmonary metastases from colorectal cancer. Eur J Cardiothorac Surg 2007;31:167-72
30.Moore KH, McCaughan BC. Surgical resection for pulmonary metastases from colorectal cancer. ANZ J Surg 2001;71:143-6

Adress for correspondence: Olçun Ümit Ünal, Izmir Bozyaka Eğitim ve Araştırma Hastanesi, Tıbbi Onkoloji Bölümü, İzmir, Türkiye
e-mail: drolcun@hotmail.com
Available at www.actaoncologicaturcica.com
Copyright ©Ankara Onkoloji Hastanesi