Osmangazi Journal of Med, 2025;47(4):623-629
DOI: 10.20515/otd.1657501

Research Article
Araştırma Makalesi

Osmangazi Journal of Medicine
e-ISSN: 2587-1579

Clinical Outcomes of Adjuvant Chemotherapy in Elderly Patients with Resected Stage II and III Colon Cancer: A Real-life Data

Opere Evre II ve III Kolon Kanserli Yaşlı Hastalarda Adjuvan Kemoterapinin Klinik Sonuçları: Gerçek Yaşam Verileri

Mehmet Zahid Kocak, Murat Araz, Mustafa Karaagac, Mustafa Korkmaz, Aykut Demirkiran, Engin Hendem, Melek Karakurt Eryılmaz,Mehmet Artac

Necmettin Erbakan University, Faculty of Medicine, Department of Medical Oncology, Meram, Konya, Türkiye

ORCID ID of the authors
MZK. 0000-0003-3085-7964
MA. 0000-0002-4632-9501
MK. 0000-0003-4533-0620
MK. 0000-0003-0926-6748
AD. 0000-0002-2842-4695
EH. 0000-0001-6970-4733
MKE. 0000-0003-2597-5931
MA. 0000-0003-2335-3354

Correspondence / Sorumlu yazar:
Mehmet Zahid KOÇAK

Necmettin Erbakan University, Faculty of Medicine, Department of Medical Oncology, Meram, Konya, Türkiye

e-mail: mehmetzahidkocak@hotmail.com

Abstract: This study aimed to evaluate the efficacy and tolerability of adjuvant chemotherapy in clinical practice in the elderly patients with resected stage II and III colon cancer. Fifty-three resected stage II and III colon cancer patients respectively evaluated between August 2010 and September 2019 were included. The study population was divided into two group as received adjuvant chemotherapy and non-received group. Clinical features, overall survival (OS) and disease-free survival (DFS) were compared between groups. Cox regression analysis was used to determine independent risk factors for OS. The hazard ratio (HR) for OS in the group given adjuvant chemotherapy, as compared with non-received group, was 0.80 (95% Confidence interval [CI]: 0.66-0.90) (p=0.0025), corresponding to a 20 percent reduction in the risk of mortality. There was no statistically significant difference between the DFS of these groups (HR:1.02, 95% CI: 0.75-1,35) (p=0.96). In multivariate (age, perforation, obstruction, disease stage, adequate lymph node, tumor side) and univariate analysis, age was not an independent predictive marker for OS. Adjuvant chemotherapy was effective and its toxicity manageable for elderly patients both stage II and stage III colon cancer. Adjuvant chemotherapy decisions should be based on a biological age and functional assessment of the patient than chronological age.
Keywords: Colon cancer, adjuvant chemotherapy, toxicity, elderly patients

Özet: Bu çalışma, opere evre II ve III kolon kanserli yaşlı hastalarda adjuvan kemoterapinin klinik pratikteki etkinliğini ve tolere edilebilirliğini değerlendirmeyi amaçladı. Hasta popülasyonu adjuvan kemoterapi alan ve almayan grup olarak iki gruba ayrıldı. Gruplar arasında klinik özellikler, genel sağkalım (OS) ve hastalıksız sağkalım (DFS) karşılaştırıldı. OS için bağımsız risk faktörlerini belirlemek için Cox regresyon analizi kullanıldı. Adjuvan kemoterapi alan grup ile almayan arasında, OS için Hazard oranı (HR) 0.80 (%95 Güven aralığı [CI]: 0.66-0.90) (p=0.0025) tespit edildi. Bu grupların DFS'leri arasında istatistiksel olarak anlamlı bir fark yoktu (HR:1.02, %95 GA: 0.75-1,35) (p=0.96). Çok değişkenli analizde (yaş, perforasyon, obstrüksiyon, hastalık evresi, yeterli lenf nodu, tümör tarafı) ve tek değişkenli analizde yaş, OS için bağımsız bir prediktif belirteç değildi. Adjuvan kemoterapi hem evre II hem de evre III kolon kanserli yaşlı hastalarda etkiliydi ve toksisitesi yönetilebilirdi. Adjuvan kemoterapi kararı, kronolojik yaştan ziyade biyolojik yaşına ve hastanın fonksiyonel değerlendirmesine dayanmalıdır.
Anahtar Kelimeler: Kolon kanseri, adjuvan kemoterapi, toksisite, yaşlı hastalar

Ethics Committee Approval: The study was approved by Necmettin Erbakan University Noninterventional Clinical Research Ethical Committee (Decision no: 2020/2744 Date: 17.07.2020
Informed Consent: The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.
Authorship Contributions: Design and concept: MZK, MA, MK. Writing: MZK, AD, MK, EH. Data collection and formal analysis: MZK, EH, AD, MK, MK. Draft, and final version: MKE, MA, MA
Copyright Transfer Form: Copyright Transfer Formwas signed by all authors.
Conflict of Interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
Financial Disclosure: The authors received no financial support for the research, authorship, and/or publication of this article.

Received : 13.05.2025
Accepted : 26.05.2025
Published :28.05.2025

How to cite/ Atıf için: Kocak MZ, Araz M, Karaagac M, Korkmaz M, Demirkiran A, Hendem E, Karakurt Eryılmaz, M, Artac M, Clinical Outcomes of Adjuvant Chemotherapy in Elderly Patients with Resected Stage II and III Colon Cancer: A Real-life Data, Osmangazi Journal of Medicine, 2025;47(4):623-629

1. Introduction

The benefit of adjuvant chemotherapy in patients with resected colon cancer has been identified in randomized controlled trials (1, 2). However, its effectiveness in elderly patients remains controversial, as the number of older individuals included in these trials has been relatively small. To address this limitation, data from various studies have been pooled to increase the statistical power of evaluating adjuvant therapy in elderly subgroups. Nevertheless, standard treatment practices for these patients have yet to be clearly established (3).

Adjuvant chemotherapy is considered the standard of care for patients with resected stage III colon cancer. Recommended treatment options include fluorouracil (FU) with leucovorin (LV) or capecitabine, in combination with oxaliplatin. FU-based regimens have been shown to significantly improve disease-free survival (DFS) and overall survival (OS) compared to surgery alone (4). However, the number of patients over the age of 70 in the two major studies supporting these regimens was quite limited (5, 6). In contrast, the benefit of adjuvant chemotherapy in elderly patients with stage II resected colon cancer remains highly controversial. Several studies have failed to demonstrate a survival advantage, even in patients presenting with high-risk features (7).

Age at diagnosis is a major factor influencing the likelihood of receiving chemotherapy, and cure rates tend to decline with increasing chronological age. In elderly patients, adjuvant chemotherapy is administered less frequently due to concerns about treatment-related toxicity, and the initiation of chemotherapy is often delayed following surgery (8, 9). As a result, treatment decisions in this population require a careful assessment of the balance between potential risks and expected benefits. These risks include side effects that may negatively impact survival and quality of life. Furthermore, underlying comorbidities, poor performance status, and age-related declines in organ function may increase susceptibility to treatment-related complications, even in the absence of significant comorbidities (10).

In clinical practice, decisions regarding adjuvant chemotherapy in elderly patients are often based on chronological age rather than a comprehensive evaluation of the patient's biological health status (11). Due to limited evidence, treatment approaches for older adults remain poorly defined. In line with the growing perspective that treatment decisions should be guided by biological rather than chronological age (4), we aimed to evaluate the clinical efficacy and tolerability of adjuvant chemotherapy in patients over 65 years of age with resected stage II and III colon cancer.

2. Patients and Methods

2.1. Study Design and Population

This study was conducted retrospectively. A total of 273 patients were identified through a review of the hospital database and patient records between August 2010 and September 2019. Ethical approval was obtained from the local ethics committee (Approval No: 2020/2744).

Fifty-three patients aged over 65 years at the time of diagnosis were included in the study. Patients were excluded for the following reasons: 150 patients were under 65 years of age, 50 patients were diagnosed with metastatic disease during the postoperative period, and 20 patients had incomplete file records. All included patients underwent radical surgical resection for colon cancer. A portion of the patients had received adjuvant chemotherapy as combination chemotherapy with fluoropyrimidine and oxaliplatin or as a single agent therapy regimen with fluoropyrimidine and some of them had not received chemotherapy. The inclusion criteria were as follows: available complete patient file, colon adenocarcinoma diagnosed by histopathology, stage II and III classified based on the AJCC/UICC TNM classification system, follow-up data, laboratory data and baseline characteristics. Patients under the age of 65 at the time of diagnosis were excluded from the study. The median follow-up period was 41.1 months. Data regarding clinicopathological characteristics, chemotherapy status, gender, age, tumor localization, T category, number of lymph nodes retrieved, chemotherapy-related toxicities (including neutropenia, diarrhea, vomiting, and hematologic toxicity), and laboratory values were collected from electronic medical records and patient files. Overall survival (OS) is defined as time from diagnosis of colon cancer to death from any cause. Disease-free survival (DFS)is defined as time from diagnosis of colon cancer to disease recurrence.

2.2.Statistical analysis

Descriptive data were presented as Mean ±Standard deviation and Median (minimum-maximum). Categorical variables were analyzed using the chi-

square test or fisher's exact test. The distribution of variables was analyzed with the Kolmogorov-Smirnov test. Nonhomogeneus variables were conducted with Mann-Whitney U test and expressed as median (Min–Max). Homogeneus variables were analyzed by independent t-test and expressed as mean ± SD. Kaplan-Meier method was used for survival analysis and log-rank test was performed. Hazard Ratios (HR) and 95% confidence intervals (CI) were found with the use of the Cox regression model. Statistical analyses were conducted by SPSS 15.0 software. A p value lower than 0.05 was considered as statistically significant.

3.Results

Of the 53 patients in our study, 16 (30.2%) were female and 37 (69.8%) were male. Mean age was 70.8±4.7 years. Among the patients included in the study, 24 patients (45%) had an Eastern Cooperative Oncology Group Performance Status (ECOG-PS) of 0-1, while 29 patients (55%) had an ECOG-PS of 2. In terms of comorbidity status, 32 patients (60%) had at least one comorbid condition, whereas 21 patients (40%) had no documented comorbidities. Pathological stage II was 31 (58.5%), and 22 (41.5%) was stage III. The number of patients with T1-T3 was 46 (86.8%), and was 7 (13.2%) with T4 tumor. The number of patients with N0 was 31 (58.5%), and was 22 (41.5%) with N1-2. Adequate lymph node was examined in 77.4% (41 patients). The number of patients with high CEA level (>5 mcg/L) at the time of diagnosis was 5 (9.4%). Adjuvant chemotherapy was received to 40 (75.5%) patients, and was not received to 13 (25.5%) patients. The most common reason for not received adjuvant treatment was the absence of an indication (50%), other reasons were comorbidity (16.6%) and refused treatment (33.2%). Received adjuvant chemotherapy regimens were FU/LV(30%), folfox (40%), and xelox regimen (15%) and capecitabine alone (15%) (Table 1). Treatment was permanently discontinued in 5 (12.5%) patients. Of these patients, 4 were receiving the xelox regimen and 1 was receiving the FU/LV regimen. Oxaliplatin was discontinued due to grade 4 neuropathy in 3 patients, and the treatment was completed with capecitabine alone. The neurological toxicity (60%) was the most common cause of discontinuing adjuvant treatment, the other cause were pulmonary embolism (20%), and refused treatment (20%). Grade 1 anemia (20%) was the most common hematological toxicity. 2 (3.8%) patients had grade 4 neuropathy in the xelox regimen group and 1 (1.9%). Ten patients (35.7%) receiving oxaliplatin had any grade of neuropathy, and 18 (64.3%) had no neuropathy. One patients (8.3%) receiving non-oxaliplatin regimen, had any grade neuropathy, 11 (91.7%) had not neuropathy. There was no statistically different between oxaliplatin and non-oxaliplatin based regimen for any grade neuropathy (p=0.12). One (1.9%) patient had grade 2 diarrhea and 2 patients (3.8%) had grade 1 renal dysfunction. Liver dysfunction was not detected in any patient.

A total of 7 patients (13.2%) developed recurrence. 5 (9.4%) of them had distant metastasis, 2 (3.8%) of them had local recurrence. All these patients were in receiving chemotherapy group. There was no stastistically different between chemotherapy receiving and non-receiving group for recurrence event (p=0.12) (Table 1). The 5-year DFS was 42.4% (95%Cl: 22.5-55.3), the 5-year OS was 75.2% (95%Cl: 60.7-92.6%) in all patients (Figure 1A, 1B).

The HR for OS in the group given adjuvant chemotherapy, as compared with non-received group, was 0.80 (95% CI: 0.66-0.90) (p=0.0025), corresponding to a 20 percent reduction in the risk of mortality (Figure 2). There was no statistically significant difference between the DFS of the group received adjuvant chemotherapy and non-received chemotherapy (HR: 1.02, 95% CI: 0.75-1,35) (p=0.96). In multivariate (age, perforation, obstruction, disease stage, adequate lymph node, tümör side) and univariate analysis, age was not an independent predictive marker for OS (Table 2).

Table 1. Characteristics and clinical features of the study population

		Study Group
Age (Mean±SD)		70.8±4.7
Gender (n)	Female	16 (30.2%)
	Male	37 (69.8%)
ECOG-PS (n)	0-1	24 (45%)
	2	29 (55%)
Comorbidity (n)	Yes	32 (60%)
	No	21 (40%)

T stage (n)		T1-3	46 (86.8%)	
		T4	7 (13.2%)	
N stage (n)		N0	31 (58.4%)	
		N1-2	22 (41.6%)	
Pathological Stage (n)		Stage 2	31 (58.5%)	
		Stage 3	22 (41.5%)	
Lymph node examined (n)		< 12	12 (22.6%)	
		≥ 12	41 (77.4%)	
Carcinoembryonic antigen (mcg/L) (n)		<5	5 (9.4%)	
		≥ 5	48 (90.6%)	
Adjuvant chemotherapy (n)		Received	40 (75.5%)	
		None	13 (24.5%)	
Chemotherapy regimen (n)		FU/LV	12 (30%)	
		Folfox	16 (40%)	
		Capecitabine	6 (15%)	
		Xelox	6 (15%)	
Recurrence (n)		Local	2 (3.8%)	
		Distant	5 (9.4%)	
		Study Group		
		Recurrence	*Non-recurrence*	*p*
Adjuvant chemotherapy (n)	No	0 (0%)	13 (24.5%)	0.12
	Yes	7 (13.2%)	33 (62.3%)	
Stage (n)	II	3 (5.7%)	28 (52.8%)	0.43
	III	4 (7.5%)	18 (34%)	
		Receiving Oxaliplatin based regimen	*Non-receiving Oxaliplatin based regimen*	*p*
Any grade Neuropathy (n)	No	18 (64.3%)	11 (91.7%)	0.12
	Yes	10 (35.7%)	1 (8.3%)	

Table 2. Multivariate and univariate analysis of overall survival in patient with resected stage II and III colon cancer

	Multivariate analyses			Univariate analyses		
Variable	**HR**	**95% Cl**	**p**	**HR**	**95% Cl**	**p**
Side (Right vs Left)	1.08	0.575-2.033	0.8	0.95	0.524-1.742	0.88
Stage (II vs III)	0.69	0.36-1.31	0.26	0.72	0.385-1.351	0.3
Obstruction (- / +)	0.58	0.184-1.89	0.37	0.749	0.265-2.111	0.58
Perforation (- / +)	3.14	0.379-16.44	0.28	3.904	0.504-30.25	0.19
Age(year)	0.97	0.905-1.051	0.5	0.98	0.924-1.055	0.7
Adequate lymph nodes (- / +)	0.74	0.306-1.801	0.5	1.01	0.495-2.076	0.97

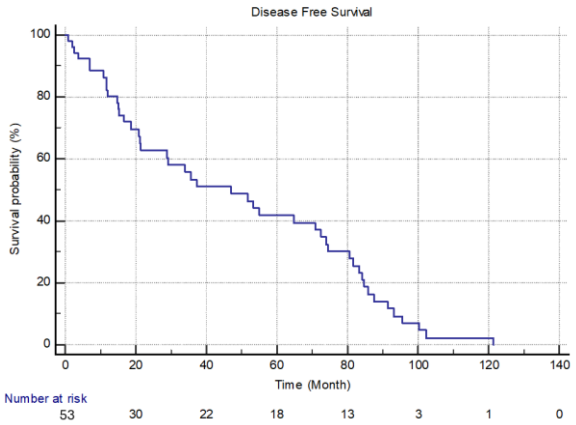

Figure 1A. The 5-year Disease free survival: 42.4 (95% Cl :22.5-55.3)

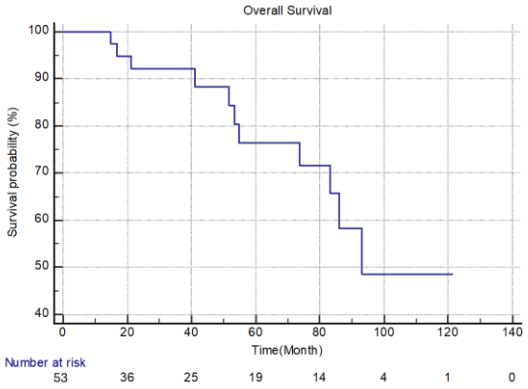

Figure 1B. The 5-year Overall Survival: 75.2% (95Cl: 60.7-92.6)

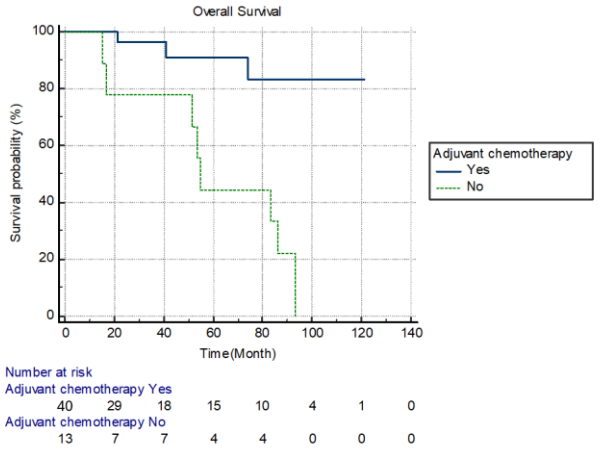

Figure 2. Overall Survival for received and non-received adjuvant chemotherapy [HR: 0.80 (%95 Cl: 0.66 – 0.90) p = 0.0025]

4.Discussion

In this study, we demonstrated that adjuvant chemotherapy provides a significant survival benefit for elderly patients with resected stage II and III colon cancer. Additionally, our findings suggest that chemotherapy-related toxicity in this patient population is manageable, and treatment tolerability is acceptable. Notably, we observed that chronological age alone was not an independent prognostic factor for OS, supporting the increasing recognition in the oncology community that treatment decisions should be guided by biological age and functional status rather than chronological age alone.

The treatment principles for colon cancer in elderly patients are fundamentally similar to those for younger individuals; however, age-related comorbidities, decreased organ reserve, and frailty can increase the risk of adverse events and complicate treatment decisions. Several studies have underscored the importance of individualized treatment approaches for elderly patients, balancing the potential survival benefits of adjuvant chemotherapy against the risks of treatment-related toxicity and impact on quality of life (12, 13). As life expectancy increases globally, the proportion of elderly patients diagnosed with colon cancer is also rising, making this issue increasingly relevant for clinical practice.

The benefits of adjuvant chemotherapy have been clearly proved in stage III colon cancer, where there is a nearly 30 percent reduction in the risk of disease recurrence and a 22 to 32 percent reduction in death compared with surgery alone (1, 13). The MOSAIC trial demonstrated that adding oxaliplatin to FU/LV

significantly improved both DFS and OS in stage III patients (1). However, the ACCENT database meta-analysis confirmed that the addition of oxaliplatin conferred limited benefit in older subgroups, likely due to decreased tolerability and a higher incidence of treatment-related complications in this age group (14). Despite this, real-world data and several retrospective studies have suggested that carefully selected elderly patients can still derive meaningful benefits from adjuvant chemotherapy (15-19). In our study, although a few patients experienced oxaliplatin-related neurotoxicity necessitating treatment discontinuation, overall toxicity was acceptable and did not result in treatment-related mortality.

The role of adjuvant chemotherapy in stage II colon cancer remains controversial, particularly in elderly patients. The decision to offer adjuvant treatment in this group is typically based on the presence of high-risk pathological or clinical features, including T4 tumors, poor differentiation, lymphovascular invasion, or inadequate lymph node sampling (20). However, evidence from randomized clinical trials in elderly populations is limited, and no definitive recommendations exist for this subgroup (15). Our study adds to the growing body of literature suggesting that selected elderly patients with stage II disease may benefit from adjuvant chemotherapy, without an unacceptable increase in toxicity. Another important aspect of adjuvant chemotherapy in elderly patients is treatment duration. The IDEA collaboration suggested that for low-risk stage III patients, three months of adjuvant chemotherapy may be as effective as six months when using a capecitabine and oxaliplatin regimen, while high-risk patients may benefit more from six months of treatment (21). In our study, the majority of patients received six months of chemotherapy, and only two patients discontinued earlier due to neurotoxicity, indicating that even extended treatment courses can be feasible in elderly individuals with careful monitoring.

The tolerability of adjuvant chemotherapy in elderly patients has been evaluated in multiple studies. Pooled analyses and systematic reviews have shown that while elderly patients may experience higher rates of certain adverse events, such as neutropenia, diarrhea, and fatigue, these are generally manageable with appropriate supportive care (17-19, 22). The ACCENT study further demonstrated an increased risk of early mortality in elderly patients, particularly those over 70 years of age (23). In contrast, our study did not observe any chemotherapy-related deaths, and most adverse events were manageable, highlighting the importance of patient selection and close monitoring during treatment. Perhaps one of the most significant findings from our study was that chronological age was not an independent predictor of OS. This aligns with the evolving perspective in geriatric oncology that treatment decisions should be based on biological rather than chronological age (4). Comprehensive geriatric assessment (CGA) tools are increasingly being utilized to evaluate factors such as functional status, cognitive function, nutritional status, social support, and comorbidities, providing a more accurate estimation of a patient's ability to tolerate and benefit from chemotherapy. Although we did not formally employ a CGA in this retrospective analysis, future prospective studies incorporating such tools would be valuable in refining treatment strategies for elderly colon cancer patients.

Limitations of our study include its retrospective design, which may introduce selection and information biases, the relatively small sample size, and the imbalance in the chemotherapy regimens administered. Despite these limitations, our results are consistent with existing literature and suggest that adjuvant chemotherapy is both feasible and beneficial for selected elderly patients with resected stage II and III colon cancer.

5. Conclusion

Despite the inclusion of elderly colon cancer patients with a limited sample size, our results are in line with other studies. Adjuvant chemotherapy was effective in elderly patients with both stage II and stage III colon cancer. Biological age is more important than chronological age in adjuvant chemotherapy decision.

REFERENCES

1. André T, Boni C, Navarro M et al. Improved overall survival with oxaliplatin, fluorouracil, and leucovorin as adjuvant treatment in stage II or III colon cancer in the MOSAIC trial. J Clin Oncol. 2009; 27: 3109-3116.
2. Schmoll H-J, Tabernero J, Maroun J et al. Capecitabine plus oxaliplatin compared with fluorouracil/folinic acid as adjuvant therapy for stage III colon cancer: final results of the NO16968 randomized controlled phase III trial. J Clin Oncol. 2015; 33: 3733-3740.
3. Sanoff HK, Carpenter WR, Stürmer T et al. Effect of adjuvant chemotherapy on survival of patients with stage III colon cancer diagnosed after age 75 years. J Clin Oncol. 2012; 30: 2624.

4. Gill S, Loprinzi CL, Sargent DJ et al. Pooled analysis of fluorouracil-based adjuvant therapy for stage II and III colon cancer: who benefits and by how much? J Clin Oncol. 2004; 22: 1797-1806.
5. André T, Boni C, Mounedji-Boudiaf L et al. Oxaliplatin, fluorouracil, and leucovorin as adjuvant treatment for colon cancer. N Eng J Med. 2004; 350: 2343-2351.
6. Kuebler JP, Wieand HS, O'Connell MJ et al. Oxaliplatin combined with weekly bolus fluorouracil and leucovorin as surgical adjuvant chemotherapy for stage II and III colon cancer: results from NSABP C-07. J Clin Oncol. 2007; 25: 2198-2204.
7. O'Connor ES, Greenblatt DY, LoConte NK et al. Adjuvant chemotherapy for stage II colon cancer with poor prognostic features. J Clin Oncol. 2011; 29: 3381.
8. Hershman D, Hall MJ, Wang X et al. Timing of adjuvant chemotherapy initiation after surgery for stage III colon cancer. Cancer. 2006; 107: 2581-2588.
9. Dobie SA, Warren JL, Matthews B et al. Survival benefits and trends in use of adjuvant therapy among elderly stage II and III rectal cancer patients in the general population. Cancer. 2008; 112: 789-799.
10. John V, Mashru S, Lichtman SM. Pharmacological factors influencing anticancer drug selection in the elderly. Drugs Aging. 2003;20(10):737-759.
11. Golfinopoulos V, Pentheroudakis G, Pavlidis N. Treatment of colorectal cancer in the elderly: a review of the literature. Cancer Treat Rev. 2006;32(1):1-8.
12. Glimelius B, Osterman E. Adjuvant Chemotherapy in Elderly Colorectal Cancer Patients. Cancers. 2020;12(8):2289.
13. Green SL, Dawe DE, Nugent Z et al. The use of chemotherapy in older patients with stage II and III colon cancer: variation by age and era of diagnosis. J Geriatr Oncol. 2019; 10: 132-137.
14. McCleary NJ, Meyerhardt JA, Green E et al. Impact of age on the efficacy of newer adjuvant therapies in patients with stage II/III colon cancer: findings from the ACCENT database. J Clin Oncol. 2013; 31: 2600..
15. Nitsche U, Stöss C, Friess H. Effect of adjuvant chemotherapy on elderly colorectal cancer patients: lack of evidence. Gastrointes Tumor. 2017; 4: 11-19.
16. Manfredi S, Bouvier A, Lepage C et al. Incidence and patterns of recurrence after resection for cure of colonic cancer in a well defined population. Brit J Surg. 2006; 93: 1115-1122.
17. Sargent DJ, Goldberg RM, Jacobson SD et al. A pooled analysis of adjuvant chemotherapy for resected colon cancer in elderly patients. N Eng J Med. 2001; 345: 1091-1097.
18. Van Erning F, Creemers G, de Hingh I et al. Reduced risk of distant recurrence after adjuvant chemotherapy in elderly stage III colon cancer patients. J Geriatr Oncol. 2013; 4: S42.
19. Asimakopoulou N, Papakonstantinou P, Souglakos J et al. A retrospective analysis regarding the parameters, which influence the administration of adjuvant chemotherapy in for elderly patients (> 70 years) with stage II or III colon cancer in the daily clinical practice. J Geriatr Oncol. 2013; 4: S40-S41.
20. .Renfro LA, Grothey A, Kerr D et al. Survival following early-stage colon cancer: an ACCENT-based comparison of patients versus a matched international general population. Ann Oncol. 2015; 26: 950-958.
21. Grothey A, Sobrero AF, Shields AF et al. Duration of adjuvant chemotherapy for stage III colon cancer. N Eng J Med. 2018; 378: 1177-1188.
22. Hung A, Mullins CD. Relative effectiveness and safety of chemotherapy in elderly and nonelderly patients with stage III colon cancer: a systematic review. Oncologist 2013; 18: 54.
23. Cheung WY, Renfro LA, Kerr D et al. Determinants of early mortality among 37,568 patients with colon cancer who participated in 25 clinical trials from the adjuvant colon cancer endpoints database. J Clin Oncol. 2016; 34: 1182.