



Current Options in the Management of Colorectal Cancer in Developing Countries: Central America Experience

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Abstract

Purpose of Review Evaluate the current options in the management of colorectal cancer (CRC) in developing countries. We emphasize the experience in Central America, highlighting the disparities that persist in these countries as compared with developed countries; these are pronounced in many aspects of the health-care system, including lack of health investment, education, and cancer research in the setting of a global increase in malignant diseases.

Recent Findings Our analysis demonstrates a multifactorial problem with the absence of government initiatives. There is also lack of interest in the medical community in providing screening for potential curable diseases. Currently, colonoscopy is a screening test widely underutilized in industrialized countries. In developing countries, this is much more pronounced.

Summary Central American countries suffer also from lack of current available data to provide an accurate assessment of the status of colorectal cancer. The current report demonstrates the most available evidence in the screening, diagnosis, and treatment of colorectal cancer, with a focus at a county hospital in Guatemala.

Keywords Colorectal cancer · Developing countries · Management · Experience Central America

Introduction

Colon cancer is a common cancer diagnosis and a major cause of cancer mortality, representing 9.2% of cancer deaths, with an estimated 18.1 million new cases in 2018 worldwide [1]. The mortality in 2014 was 4.3 per 100,000 patients in individuals from 20 to 54 years and is expected to increase by 1.0% per year. Given this pattern, there should be more efficient

screening strategies for early detection, with the ability to provide more accurate treatment strategies [2, 3]. However, even in developed countries, screening strategies for colorectal cancer are widely underutilized [4–6].

The incidence and mortality for colon cancer, as with other malignancies, vary across countries and is partially dependent on the human developing index (HDI). In low- and middle-income countries, there is not an established pattern of reporting cancer cases to cancer registries. There is clear underreporting of malignancies in developing countries which is further compounded by the lack of preventative strategies and screening programs [1, 3, 7].

The American Cancer Society regularly provides updates on epidemiological indicators to create strategies to prevent colorectal cancer (CRC); these indicators apply well to developed countries. However, in developing countries especially in Central America, the applicability of strategies developed by the American Cancer Society becomes null when statistical records and databases are lacking [2, 3, 8, 9••]. Currently, providers in Central American countries are left with empirical evidence and experience to provide the best evidence-based care available at sites where resources are limited. The following manuscript will draw inferences from a major

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referral hospital in one of the largest departments in Guatemala (El Peten). However, it should be noted that care may vary widely from hospital to hospital even within the same country. We will describe the current diagnostic and therapeutic modalities and explore possible strategies for improvement.

Although Central America lags behind the Western world, it is making improvement in the treatment of communicable diseases [10]. The gap between communicable diseases and non-communicable related illness is growing, however, not in parallel to developed countries [10]. Population growth, changes in the demographic structure, diet, and lifestyle factors are important parameters in the increasing incidence of cancer, which likely account for the widening gap between communicable and non-communicable diseases in Central America [3, 11–14].

In 2014, the poverty level of the USA was 13.2%; in Guatemala, it was almost 60%. This level of poverty affects every aspect of life in Guatemala, with a particular impact on health care [15, 16]. Private insurance is available but is uncommon in Guatemala. Outside of the capital city (Guatemala City), this is even more pronounced. As a result of the lack of insurance, the vast majority of the Guatemalan population relies heavily on government-subsidized public hospitals [17–18].

Similar to the rest of Central America, public health care is free. According to the Constitution of Guatemala, every citizen has the universal right to health care, but limited resources prevent this right to be implemented effectively [19].

El Peten is the largest department of Guatemala. This department has a growing population, which increased by 32% in 9 years with the most current census (2013) documenting a population of 687,192 [16]. There are currently four major hospitals in Peten, but the Hospital Nacional de San Benito (HSB) is the largest and major referral center for the entire department. HSB is located six miles from the capital city of Flores in San Benito and it is 294 miles by road from Guatemala City [16].

There are three operating rooms at the HNSB which are utilized for general and subspecialty operations as well as gynecological cases. Approximately 250 general surgery operations are performed monthly. It is a major referral hospital in the region and has new computed tomography imaging capabilities, which is restricted for emergencies only as the resources to operate the equipment 24 h a day are not available. As a result of assistance from a United States-based charity organization, HSB has obtained limited laparoscopic capabilities as of 2013. However, most operations are currently performed via by open approach. The most common elective operations currently performed at HSB are open inguinal hernia repairs and open cholecystectomies, with approximately 90 hernia repairs performed per year [15–17, 20, 21]. These operations, while commonly performed using minimally invasive techniques in the USA, are performed open at the HSB.

This review attempts to address the treatment algorithms of the standard of care in developed countries when compared with developing countries with specific focus on a county hospital in Guatemala (HSB). While we explore the current strategies and the lack of resources available, we also provide strategies that might allow a way to bridge the multiple gaps in the current system in Central America, which include (1) data collection, (2) screening, (3) and treatment of colorectal cancer.

Understanding Cancer Incidence and Prevalence in Central America

Hospitals in developed countries rely on statistics submitted to cancer registries, which are part of all private and public hospitals. Cancer registries are limited in Guatemala. There are two studies regarding colorectal cancer in two hospitals in Guatemala, both are retrospective in nature. The first reported 18 patients from 2004 to 2009 in a public hospital, including only patients who underwent a surgical procedure [9••]. The other study reports the 5-year experience of one surgical team, from 2013 to 2018 [22•]. This study reports 119 patients who underwent laparoscopic colorectal surgery.

Data in Central America is limited even in large referral county hospitals, especially in regions outside of capital cities. It is impossible to understand the magnitude of the problem without proper statistics, which are unfortunately lacking in Central America and Guatemala.

Resource Limitations for the Diagnosis and Treatment of Colon Cancer in Central America

While statistics are lacking in Central America, there is no reason to doubt that the incidence of colorectal cancer parallels that of developed nations. Colorectal cancer is one of the most frequently diagnosed malignancies worldwide. World statistics indicate that in the last 5 years there has been an increase of 32% cases of colorectal cancer, which has been more pronounced in the elderly population (50%) [10, 23•, 24].

In Central America, there have been increased rates in cancer-related deaths over the last decade in comparison with high HDI countries. The increase in cancer-related deaths is likely at least partially attributable to an increased incidence of locally advanced and metastatic gastrointestinal and cervical cancer [11, 12]. It is evident that the high incidence of morbidity and mortality for colorectal cancer is the result of poor screening and lack of early detection. This is due to a central health-care system that is subsidized by the government. Patients have poor access to care and there is a lack of

multidisciplinary approaches for the management of colorectal cancers [6]. Diagnostic and treatment modalities which are easily available in developed countries are lacking in Central America, including endoscopic and radiologic modalities, in addition to chemotherapy and radiation treatments [11].

The national comprehensive cancer network (NCCN) guidelines include recommended algorithms for the treatment of abnormal colonoscopy findings [25]. In brief, pedunculated or sessile polyps may be treated by colonoscopy alone if there is no invasive cancer. However, invasive cancer, fragmented specimen, assessable margins, or unfavorable pathology in a polyp mandates colectomy or trans-anal excision depending on the location and size of the polyp [18, 26, 27]. If a cancer is diagnosed, staging is also indicated which includes chest and abdominal computed tomography (CT), possibly with pelvic magnetic resonance imaging (MRI) or endoscopic ultrasound (EUS).

The major hospitals and some private hospitals in Guatemala and Central America attempt to follow the NCCN guidelines for the management of colon and rectal cancer. However, an important aspect of managing an abnormal colonoscopy in developing countries is the limited access to health services and the insufficient equipment in the hospitals. Most regional hospitals lack endoscopic equipment (colonoscopy), and even in the private sector there is no accessible endoscopic ultrasound. National hospitals including the Guatemalan Social Security Institutions (IGSS) and the Cancer Institute (INCAN) do not have magnetic resonance imaging (MRI) equipment. Further, most regional hospitals in Guatemala lack a pathology department. Oncology specialists are not present in most county hospitals, with chemotherapy and radiation being unavailable to the vast majority of patients in Guatemala.

At HSB, computed tomography is available for emergencies, and there are no MRI capabilities. There are no endoscopic capabilities such as colonoscopy or even sigmoidoscopy. There are no surgical or medical oncologists. There is no availability to chemotherapy. Thus, the recommended treatment strategies as recommended by the NCCN guidelines are not applicable to the vast majority of Guatemalans [2, 28]. Referrals to hospitals of Guatemala City in patients with cancer are common, but patient compliance with recommendations, follow-up, and outcomes is currently unclear.

Poor availability of resources is further compounded by the low socioeconomic status and level of education of the population of Central America compared with developed countries. For instance, in a study at the HSB, we found that a major factor associated in patients presenting with an incarcerated hernia was that none of the patients with an emergent operation for a hernia had an education past secondary school [17]. More than half of the patients presenting for the management of an emergent hernia did not have any form of formal education [17].

Thus, applying NCCN guidelines in Central American Countries is limited by:

1. Poor availability of resources
2. Lack of subspecialists in most county hospitals
3. Unavailability of chemoradiotherapeutic interventions
4. Low socioeconomic status of the patient population
5. Poor education of the patient population

Screening for Colon Cancer

The current colon cancer screening guidelines of multiple societies include invasive and non-invasive tests including stool-based tests (guaiac-fecal occult blood test (gFOBT), fecal immunochemical test (FIT), fecal DNA testing (multitarget stool DNA, MT-sDNA, Cologuard®), and newly developed polymerase chain reaction on blood test (Epi procolon®). Other options for cancer screening include radiologic tests (double contrast barium enema, capsule endoscopy, and computed tomographic colonography (CTC)) or invasive tests such as flexible sigmoidoscopy and colonoscopy (gold standard). In developed countries, barium enema is no longer recommended (low sensitivity 48%) and the use of DNA stool testing is still controversial [29, 30].

In Guatemala, the current available awareness and prevention campaigns from private initiative focus primarily on breast cancer. The Cancer Institute (INCAN) in Guatemala has awareness, prevention, and screening campaigns throughout the year for more types of cancer (esophagus, gastric, colorectal, prostate, skin, breast, and cervical among others); however, these services are only available in Guatemala City. INCAN also promotes education campaigns in different parts of the country to improve awareness in rural communities, which is done in combination with leaders in the community. However, the impact that this has on actual screening and detection of individuals with malignancies is unknown. As we have discussed, the resources for diagnosis and treatment is currently insufficient. Similarly, in Guatemala there is no fecal DNA or immunochemical testing available. There is some hope that gFOBT may be more widely utilized in developing countries as it is inexpensive, simple, and has been shown to reduce colon cancer mortality by 18% [29, 30]. While gFOBT is not the gold standard, any form of screening is better than none.

In the USA, some communities report that only 50% of those who are recommended to undergo screening for colorectal cancer actually participate in some form of screening [5]. Low-income and Latino communities are even less likely to undergo colorectal cancer screening than in the USA [6]. Thus, in a country such as Guatemala, where screening strategies are not widely available, with many financial and

educational constraints, the number of patients actually undergoing recommended screening is reduced to nearly zero.

Treatment Strategies for Colorectal Cancer

When a patient is diagnosed with colorectal cancer, the surgical and medical management of each individual patient should be discussed in a tumor board or multidisciplinary conference. Today, institutions around the globe are adopting this multidisciplinary approach that is considered the standard globally [31].

The management and treatment of colon cancer is dependent on the type of cancer, location, clinical stage, and performance status of the patient. It is also important to consider the objectives of treatment (curative or palliative). In most developed nations, the patient and their family are at the center of these conversations. In Central American countries, the family plays a much more critical role in the management. Financial constraints also play a major role. In Latin American Countries, oftentimes, the family does not want the treating physicians to communicate the diagnosis of malignancy to the patient as this would place a substantial psychological burden for something the family knows there is no possible cure based on their economics.

NCCN guidelines recommend different resection techniques for colon cancers depending on the location. It is important to note that when the resources are available (in private sectors in Guatemala City), the surgical team treating the patient adheres to the recommendations of the NCCN, NCI, and the Central and Caribbean Consensus on Cancer. However, in more resource-limited areas, it is sometime impossible to follow some of these recommendations. For instance, a right hemicolectomy is recommended for right colon cancers. It is currently clear that the laparoscopic approach is superior to open for this operation [32]. Minimally invasive techniques are currently being employed in large hospitals and the private sector in Guatemala. However, these techniques are less frequently utilized in smaller, public hospitals.

In the context of metastatic colon cancer, with either isolated lung or hepatic metastases, the Central American and Caribbean Consensus on Cancer recommend proceeding with the colon first and then liver or lung metastectomies [33]. In developed countries with all available modalities, the sequence does not appear to be as important [8, 18, 23, 26, 28, 34].

In developed countries, patients with unresectable metastases are typically treated with chemotherapy, with palliative procedures such as stenting or ostomy creation are performed for decompression as necessary. Patients with unresectable metastases should be treated with a colectomy of the primary tumor and chemotherapy if appropriate. Often, diverting ostomy or stenting then chemotherapy are the only options. When peritoneal carcinomatosis is present, cytoreductive surgery may be performed after chemotherapy. In developing countries,

patients with metastatic disease are typically treated with diverting ostomy. The options of further treatment strategies such as stenting or cytoreductive surgery are not available in most areas in Guatemala and certainly not available at HSB [17, 35, 36].

The treatment options for rectal cancer in Guatemala are even more limited than that for colon cancer. While current guidelines recommend trans-anal excision for smaller, low rectal tumors [37], patients in Guatemala and Nicaragua typically receive abdomino-perineal resection with colostomy as there is little experience with trans-anal excision [9, 22]. While this is an acceptable course of treatment, it is an extremely morbid procedure with a low quality of life, postoperatively.

Similar to colon cancer, laparoscopic approaches in the surgical management of rectal cancer is limited in Guatemala [15, 16]. This is not only the result of limited resources, but there is also limited experience and expertise. Some centers have published their experience with robotic surgery for the management of colorectal cancer [19]. But in Guatemala, as we are still attempting to adopt laparoscopy, robotic surgery appears to be very distant in the future [22].

Neoadjuvant and adjuvant therapy is indicated for stage II (T3–4, node-negative disease) or stage III (node-positive disease without distant metastasis) rectal cancer. Total mesorectal excision is indicated following neoadjuvant therapy, with postoperative chemoradiation being typically indicated due to the high risk of recurrence [25, 37–40]. Most Central American countries follow NCCN guidelines for decision-making in cancer management [25, 38–41]. However, the limited resources and lack of sufficiently available centers makes adherence to guidelines challenging in most areas of Guatemala. At the HSB, patients with known rectal cancer are referred to a hospital in Guatemala City. Follow-up and outcomes on these patients are difficult to establish.

Adjuvant treatment of colon cancer is determined postoperatively and is dependent on the pathologic stage and features. It is focused on preventing distant metastases as this disease is characterized by relatively low rates of local recurrence [9, 25, 42, 43]. Treatment strategies in resource-rich centers are similar to recommendations by NCCN, NCI, and the Central American and Caribbean Consensus on Cancer [9, 25, 44, 45]. These treatment strategies are limited in most areas of Guatemala; patients in need of adjuvant therapies are typically referred to centers to Guatemala City. The outcome of these patients following referral is difficult to establish.

Conclusion

The incidence of colorectal malignancies is largely unknown in Guatemala and other parts of Central America due to the lack of rigorous statistical collection strategies. Screening is almost nonexistent in most areas of Guatemala. Lack of education and financial limitations prevent patients from seeking

adequate care early in the diagnosis and treatment process. Limited resources and lack of training and centralized form of health-care system prevent adherence to current recommendations for the management of colorectal malignancies in Guatemala and in Central America.

Improving the state of current diagnostic and treatment strategies begins with awareness. We are hopeful that this manuscript will begin a sequence of events which brings more light onto this problem. We need better statistics in order to understand the magnitude of the problem. Then, we can focus on how to manage the problem. We are hopeful, that in collaboration with developed nations, we can bring evidence-based care to Guatemala which parallels treatment options in the USA.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as: • Of importance •• Of major importance

- Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;68(6):394–424.
- Siegel RL, Miller KD, Jemal A. Colorectal cancer mortality rates in adults aged 20 to 54 years in the United States, 1970–2014. *JAMA*. 2017;318(6):572–4.
- Bishehsari F, Mahdavinia M, Vacca M, Malekzadeh R, Mariani-Costantini R. Epidemiological transition of colorectal cancer in developing countries: environmental factors, molecular pathways, and opportunities for prevention. *World J Gastroenterol*. 2014;20(20):6055–72.
- Helsing LM, et al. Colorectal cancer screening with faecal immunochemical testing, sigmoidoscopy or colonoscopy: a clinical practice guideline. *BMJ*. 2019;367:l5515.
- Schoen RE, Weissfeld JL, Trauth JM, Ling BS, Hayran M. A population-based, community estimate of total colon examination: the impact on compliance with screening for colorectal cancer. *Am J Gastroenterol*. 2002;97(2):446–51.
- Green AR, Peters-Lewis A, Percac-Lima S, Betancourt JR, Richter JM, Janairo MP, et al. Barriers to screening colonoscopy for low-income Latino and white patients in an urban community health center. *J Gen Intern Med*. 2008;23(6):834–40.
- Flood D, Chary A, Austad K, Coj M, Lopez W, Rohloff P. Patient navigation and access to Cancer Care in Guatemala. *J Glob Oncol*. 2018;4:1–3.
- Sanchez-Barriga JJ. Mortality trends and risk of dying from colorectal cancer in the seven socioeconomic regions of Mexico, 2000–2012. *Rev Gastroenterol Mex*. 2017;82(3):217–25.
- HA, C., *Perfil clínico y manejo médico-quirúrgico de pacientes con diagnóstico de cáncer colorrectal [thesis]*. 2009, Universidad de San Carlos de Guatemala: Guatemala. p. 55. **One of the most specific study in this topic that shows statistic in Guatemala.**
- Corral JE, Arnold LD, Argueta EE, Ganju A, Barnoya J. Clinical preventive services in Guatemala: a cross-sectional survey of internal medicine physicians. *PLoS One*. 2012;7(10):e48640.
- Sierra MS, et al. Cancer patterns and trends in Central and South America. *Cancer Epidemiol*. 2016;44(Suppl 1):S23–42.
- Sierra MS, Forman D. Burden of colorectal cancer in Central and South America. *Cancer Epidemiol*. 2016;44(Suppl 1):S74–81.
- Pedro Rizo-Ríos AG-R, Felipe Sánchez-Cervantes, Pedro Murguía-Martínez, *Trends in cancer mortality in Mexico: 1990–2012*. *Med J Hospital General de Mexico*. 2015;78:85–94.
- Darío Fernando Burbano Luna MAM, García MÁC, Corona TP, Velázquez NNH, Espinoza YME, Urrutia JMG, et al. *Epidemiology of colorectal cancer in patients under 50 years old in the Hospital Juárez of México*. *Endoscopia*. 2016;28:160–5.
- Imran JB, Ochoa-Hernandez A, Herrejon J, Madni TD, Clark AT, Huerta S. Surgical approach to gallbladder disease in rural Guatemala. *J Surg Res*. 2017;218:329–33.
- Imran JB, Ochoa-Hernandez A, Herrejon J, Ortiz C, Mijangos B, Madni T, et al. Barriers to adoption of laparoscopic cholecystectomy in a county hospital in Guatemala. *Surg Endosc*. 2019;33(12):4128–32.
- Ochoa-Hernandez, A., et al., *Emergent groin hernia repair at a County Hospital in Guatemala: patient-related issues vs. health care system limitations*. *Hernia*, 2019.
- Benson AB, Venook AP, al-Hawary MM, Cederquist L, Chen YJ, Ciombor KK, et al. NCCN guidelines insights: colon cancer, version 2.2018. *J Natl Compr Cancer Netw*. 2018;16(4):359–69.
- Wells KO, Peters WR. Minimally invasive surgery for locally advanced rectal Cancer. *Surg Oncol Clin N Am*. 2019;28(2):297–308.
- Imran JB, et al. Barriers to adoption of laparoscopic cholecystectomy in a county hospital in Guatemala. *Surg Endosc*. 2019.
- Argo, M., et al., Current status of local anesthesia for inguinal hernia repair in developing countries and in the United States. *Hernia*, 2019.
- Sergio Waldemar Macario Nimatuj, M., Maxi Alexander Méndez Morán, Jorge San José Gómez, Herman De Mata Quinto, José Ricardo Guzmán Villatoro, *Cirugía Colorrectal Laparoscópica. Experiencia de los últimos 5 años de un solo Equipo Quirúrgico*. *Revista Guatemalteca de Cirugía* 2018. 24. **Demonstrate the lack of experience in minimal invasive approach in this country.**
- HM, C., *Aspectos clínicos, abordaje terapéutico y complicaciones más frecuentes en pacientes con diagnóstico de cáncer colorrectal, atendidos en el hospital escuela Roberto Calderón en el periodo del 1ro enero 2013 al 30 junio 2014*. 2014, Universidad Nacional Autónoma de Nicaragua: Nicaragua. p. 59. **One of the few studies available in Central America about this topic.**
- Tsoi KKF, Hirai HW, Chan FCH, Griffiths S, Sung JY. Predicted increases in incidence of colorectal cancer in developed and developing regions, in association with ageing populations. *Clin Gastroenterol Hepatol*. 2017;15(6):892–900 e4.
- Benson AB, Venook A, Al-Hawary MM, Arain MA, Chen YJ, Ciombor KK, et al. NCCN clinical practice guidelines in oncology (NCCN guidelines) rectal Cancer. *J Natl Compr Cancer Netw*. 2019.
- Matsuda T, Yamashita K, Hasegawa H, Oshikiri T, Hosono M, Higashino N, et al. Recent updates in the surgical treatment of colorectal cancer. *Ann Gastroenterol Surg*. 2018;2(2):129–36.
- Polanco PM, Mokdad AA, Zhu H, Choti MA, Huerta S. Association of adjuvant chemotherapy with overall survival in patients with rectal cancer and pathologic complete response following neoadjuvant chemotherapy and resection. *JAMA Oncol*. 2018;4(7):938–43.

- 28 Arnold M, Sierra MS, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global patterns and trends in colorectal cancer incidence and mortality. *Gut*. 2017;66(4):683–91.
- 29 Ginsberg GM, et al. Prevention, screening and treatment of colorectal cancer: a global and regional generalized cost effectiveness analysis. *Cost Eff Resour Alloc*. 2010;8:2.
- 30 Issa IA, Noureddine M. Colorectal cancer screening: an updated review of the available options. *World J Gastroenterol*. 2017;23(28):5086–96.
- 31 Corter AL, Speller B, McBain K, Wright FC, Quan ML, Kennedy E, et al. Evaluating a multidisciplinary cancer conference checklist: practice versus perceptions. *J Multidiscip Healthc*. 2019;12:883–91.
- 32 Varela JE, Asolati M, Huerta S, Anthony T. Outcomes of laparoscopic and open colectomy at academic centers. *Am J Surg*. 2008;196(3):403–6.
- 33•• Lopez RI, et al. *Consensus on management of metastatic colorectal cancer in Central America and the Caribbean: San Jose, Costa Rica, August 2016*. *ESMO Open*. 2018;3(3):e000315 **This document includes the formal expert consensus recommendations in various scenarios in colorectal cancer.**
- 34 Serrano PE, Gu CS, Husien M, Jalink D, Ritter A, Martel G, et al. Risk factors for survival following recurrence after first liver resection for colorectal cancer liver metastases. *J Surg Oncol*. 2019;120(8):1420–6.
- 35 Argo M, Timmerman C, Ochoa-Hernandez A, Ortiz C, Lopez-Huertas V, Huerta S. Current status of local anesthesia for inguinal hernia repair in developing countries and in the United States. *Hernia*. 2019;23(3):621–2.
- 36 Timmerman C, Hernandez AO, Ortiz C, Huertas VL, Lopez R, Huerta S. Current view on the nonoperative management of acute appendicitis in a county hospital in Guatemala. *J Surg Res*. 2019;237:108–9.
- 37 Huerta S, Murray B, Olson C, Patel P, Anthony T. Current evidence-based opinions in the management of adenocarcinoma of the rectum. *Indian J Surg*. 2009;71(6):356–62.
- 38 Sauer R, Becker H, Hohenberger W, Rödel C, Wittekind C, Fietkau R, et al. Preoperative versus postoperative chemoradiotherapy for rectal cancer. *N Engl J Med*. 2004;351(17):1731–40.
- 39 Rahbari NN, Elbers H, Askoxyllakis V, Motschall E, Bork U, Büchler MW, et al. Neoadjuvant radiotherapy for rectal cancer: meta-analysis of randomized controlled trials. *Ann Surg Oncol*. 2013;20(13):4169–82.
- 40 Song JH, Jeong JU, Lee JH, Kim SH, Cho HM, Um JW, et al. Preoperative chemoradiotherapy versus postoperative chemoradiotherapy for stage II-III resectable rectal cancer: a meta-analysis of randomized controlled trials. *Radiat Oncol J*. 2017;35(3):198–207.
- 41 Boland GM, Chang GJ, Haynes AB, Chiang YJ, Chagpar R, Xing Y, et al. Association between adherence to National Comprehensive Cancer Network treatment guidelines and improved survival in patients with colon cancer. *Cancer*. 2013;119(8):1593–601.
- 42 Grothey A, Sobrero AF, Shields AF, Yoshino T, Paul J, Taieb J, et al. Duration of adjuvant chemotherapy for stage III colon cancer. *N Engl J Med*. 2018;378(13):1177–88.
- 43 Twelves C, Wong A, Nowacki MP, Abt M, Burris H 3rd, Carrato A, et al. Capecitabine as adjuvant treatment for stage III colon cancer. *N Engl J Med*. 2005;352(26):2696–704.
- 44 Andre T, et al. Three versus 6 months of oxaliplatin-based adjuvant chemotherapy for patients with stage III colon cancer: disease-free survival results from a randomized, open-label, international duration evaluation of adjuvant (IDEA) France, *Phase III Trial*. *J Clin Oncol*. 2018;36(15):1469–77.
- 45 Bregni G, Rebuzzi SE, Sobrero A. The optimal duration of adjuvant therapy for stage III colon cancer: the European perspective. *Curr Treat Options in Oncol*. 2019;20(1):8.

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