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Review Article

An analysis of the current perspective and review regarding bone metastasis in colorectal adenocarcinoma

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ABSTRACT

In developed regions, colorectal cancer (CRC) is the third most common cause of cancer-related death, with 1.2 million new cases diagnosed annually worldwide. Six percent of all CRC metastases are bone metastases. Remarkably, 70% of patients develop distant metastases during follow-up, and 22% of patients show them at diagnosis. Bone metastases indicate a worsened oncological prognosis, even though they are rare. Six percent of all CRC metastases are bone metastases. Treating CRC that has spread to the bones can be difficult and frequently signals an advanced stage of the disease. Since the bone is frequently the site of metastasis for a variety of primary tumours, including breast, prostate, lung, thyroid, and kidney cancer, managing bone metastases is a crucial component of cancer care. In addition to reducing pain and complications, effective treatment of bone metastases can enhance patients' quality of life.

Keywords: Colorectal adenocarcinoma, Bone metastasis, Management

INTRODUCTION

According to the world health organisation, colorectal cancer (CRC) is the third leading cause of mortality related to cancer in developed countries. A considerable number of patients experience the development of metastases either at the time of diagnosis or during follow-ups, despite the fact that the incidence of the disease in its early stages has increased as a result of screening programs. The primary sites of secondary dissemination for CRC are the lymph nodes, liver, and lungs.[1-3] This is in contrast to the fact that bone tissue is a common site for secondary dissemination in certain other types of cancer, such as breast, prostate, or lung cancer. Metastases from CRC to the bone are extremely uncommon and almost always occur at the same time as tumour involvement in other parts of the body. Certain factors, such as the location of the primary tumour, the age of the patients, the presence of K-raS mutations, and the degree of tumour differentiation, are considered to be risk factors for bone metastases. However, in contrast to metastases that affect the liver and lungs, bone metastases are typically symptomatic. This has the effect of negatively impacting the patient's quality of life and ultimately leading to a more dismal prognosis with a lower survival rate. It is necessary to create a personalised approach to the management of patients.[2,4,5]

REVIEW

On an annual basis, approximately 1.2 million new cases of CRC, which is also referred to as CRC, are diagnosed in a variety of different regions across the globe. Cancer is the third leading cause of death in developed regions, and as a consequence, it is the third leading cause of death overall. In CRC, the percentage of metastases that are found in the bone accounts for 6% of the total number of metastases that are discovered. The presence of distant metastases is discovered in twenty-two percent of patients at the time of diagnosis, and seventy percent of

patients develop these metastases during the period of follow-up examination. In spite of the fact that the incidence rate of bone metastases is relatively low, the presence of bone metastases is indicative of a worsening of the oncological prognosis. In the case of lesions that are well-localized and singular, the possibility of undergoing a metastatic procedure is one of the therapeutic options that can be taken into consideration. On the other hand, the treatment is designed to provide palliative care in the context of the majority of cases. Radiotherapy, systemic chemotherapy (with or without targeted therapy), and the pharmacological application of bisphosphonates are all examples of treatments that fall under this category. Other examples include the use of bisphosphonates.[3,6-8]

It is possible for CRC to spread to other parts of the body, such as the lungs, the peritoneum, and even the bones, although this is a less common occurrence. This is despite the fact that the liver is the organ to which CRC most frequently spreads. Out of the total number of bone metastases, CRC is responsible for six percent of them. This represents a percentage of the total.[9-11] CRC that has spread to the bones is typically an indication that the disease has progressed to a more advanced stage or that it has reached a more advanced stage. This is due to the fact that once the disease has spread to the bones, it can be difficult to achieve a successful treatment.[12,13]

Since bone tissue is an organ that is both rigid and dynamic, it goes through continuous processes of formation and repair throughout the course of a person's lifetime. Bone tissue is an organ that is both rigid and dynamic. The tissue that makes up bones is an organ that is both mobile and immobile. The primary factor that determines both the structure and function of the skeleton is bone remodelling, which is primarily a metabolic process that occurs more frequently in adults. This process is the primary factor that determines the structure of the skeleton. For this reason, it is essential for the cells that are accountable for bone formation (specifically osteoblasts) and bone resorption (specifically osteoclasts) to engage in coordinated activity. This is necessary in order to guarantee that bone tissue continues to preserve its integrity. The possibility that this could be explained by a mechanism of haematogenous dissemination, which involves the localisation of quiescent tumour cells at the fracture level, is something that ought to be taken into consideration is something that should be considered.[14-16]

Breast cancer, lung cancer, thyroid cancer, prostate cancer, kidney cancer, and bladder cancer are just some of the solid organ cancers that have the potential to spread to the bone. Other cancers that also have the potential to spread to the bone include prostate cancer, kidney cancer, and bladder cancer. When it comes to these patients, bone is a site of metastatic involvement that occurs quite frequently.[17,18] The pelvis is responsible for 35.3% of all cases, followed by the lumbar spine (25%), the thoracic vertebrae (21.6%), the sacrum (20.6%), and the ribs (14.7%), which indicates the next most common location for the condition and the most common location overall. The ribs are the most common location overall. Among all the locations, the ribs are the most frequently found. When it comes to lung cancer, secondary bone involvement can be found in as many as forty to fifty percent of cases, and when it comes to prostate cancer, it can be found in as many as sixty to seventy percent of cases. Both of these percentages are indicative of the prevalence of prostate cancer. Both of these percentages are representative of the general population that is affected by prostate cancer. Bone, on the other hand, is the location of metastases that originate from gastrointestinal cancers in a percentage of cases that is less than ten percent. Bone is the site of metastases. Since the beginning, this has been observed.[19-21]

There is a correlation between patients who have been diagnosed with rectal cancer and the presence of bone metastases of colorectal origin. This is the case despite the fact that the incidence of these metastases can range anywhere from 0.96 to 11.1% respectively. Haematogenous dissemination is the most common distribution mechanism because it is highly probable that the vascularization of the cancer plays a role in this incidence. This is the reason why haematogenous dissemination is the more common mechanism. According to the findings of the investigation, the incidence is higher in autopsies, with the range falling somewhere between 8.6 and 27%.[22,23] The incidence, on the other hand, has been described as being higher than its previous level. The presence of bone metastases, on the other hand, is typically accompanied by symptoms, in contrast to the lung or liver location of the metastases.[24-26]

This is because the destruction of bone tissue causes local pain symptoms, which in turn leads to irritation of the periosteum and/or nerve injury, both of which have the potential to result in pathological fractures. This is the reason why this is the case. Because of this, bone metastases are diagnosed at an earlier stage in comparison to metastases that are discovered in the lungs or liver. This is because bone metastases are more straightforward to diagnose. There are a number of additional factors that are linked to the development of bone metastases. These factors include the presence of lung metastases, involvement of lymph nodes, and origin from rectal region.[25-27]

In order to effectively treat cancer, it is absolutely necessary to always include the management of bone metastasis as an essential component from the beginning of the treatment process. At no point in time is it acceptable to fail to fulfil this requirement. On the other hand, this is not always circumstances that are present.[27-29] Specifically, this is because the bone is a common site for metastasis for a wide variety of primary tumours, including cancers of the breast, prostate, lung, thyroid, and kidney. This is the reason why this is case.[30,31]

This is the reason why things are the way they are in the current situation. The reason that things are the way that they are is because of this, taking into consideration the circumstances that are currently in place. There is a chance that the bone will be affected by the disease that has spread to other parts of the body. This is a possibility. There is a possibility that patients who receive treatment that is effective for bone metastasis will experience an improvement in their quality of life, as well as a reduction in the amount of pain they experience and the number of complications they have to deal with throughout the course of their treatment. These outcomes are all possible outcomes. Patients who are currently undergoing treatment have the opportunity to have experiences similar to those described here.[31,34]

When it is possible to do so, it is recommended that treatments for bone metastases include the administration of systemic chemotherapy in addition to surgical resection. This is considered to be the most effective treatment combination. Every time it makes sense to do so, this is the situation that occurs.[35,36] This is as a result of the fact that bone metastases are a condition that is extremely difficult to treat. The fact that the metastases are situated in the bone is the reason for the development of this condition. This is the circumstance that led to the occurrence of this particular development. In light of the fact that there was no evidence of metastatic disease at any other levels, this procedure was performed on the patient who was the primary focus of the investigation that is currently being conducted. Another reason why this procedure was carried out was because there was also the possibility of performing a resection with free surgical margins. This was one of the reasons why this procedure was carried out. There was also the possibility of performing a resection, which was in addition to the previous possibility. Taking into consideration the fact that this was the situation was an additional justification for carrying out this procedure.[37] A further component of the treatment plan was the administration of radiotherapy, which was done with the purpose of reducing the size of the tumour and alleviating the symptoms that the patient was experiencing at the time. This was done in order to treat the patient. This course of action was taken in order to achieve the objectives that were outlined in the beginning.[32,33,36]

DISCUSSION

This particular kind of systemic treatment regimen has been found to be effective in terms of survival in patients who have metastatic CRC. Furthermore, it has been found to be effective without compromising the quality of life of the patients that they are treating through the application of this particular kind of treatment regimen. According to the findings of the research that has been carried out, this is the conclusion that can be drawn from the available information.[36,38]

Eight percent of patients who have lung metastases and sixteen percent of patients who have liver metastases are able to survive for a period of five years, respectively. Both of these percentages compare to the overall survival rate. There is a comparison between both of these percentages and the overall survival rate. According to the findings of a number of researchers who have arrived at this conclusion, the survival rate for bone metastases over a period of five years has been determined to be 3.4%. This conclusion was arrived at by the researchers after they had completed their process. Additionally, the presence of bone metastasis, along with age, location in the ascending colon, a high degree of differentiation, lymph node involvement, and high pre-operative carcinoembryonic antigen levels, has been described as factors that are considered to be poor prognostic factors in relation to the survival of patients who are undergoing surgery for CRC. These factors have been linked to a lower likelihood of survival. These factors have been associated with a likelihood of survival that is lower than average.[37,39,40]

CONCLUSION

It is the single most important step that can be taken to reduce the number of skeletal-related incidents that manifest themselves, and it is the step that involves recognising and diagnosing the condition as soon as possible. The fact that a sizeable number of cases of bone metastasis in colorectal adenocarcinoma have a positive clinical outcome following treatment with medical bisphosphonates at the time of treatment does not change the fact that this is the case.

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REFERENCES

1. Matías-García B, Mendoza-Moreno F, Díez-Alonso M, Ovejero-Merino E, Vera-Mansilla C, et al. Single metachronous bone metastasis following rectal adenocarcinoma: A case report. Med Int (Lond). 2024;4(1):6.
2. Fornetti J, Welm AL, Stewart SA. Understanding the Bone in Cancer Metastasis. J Bone Miner Res. 2018;33(12):2099-113.
3. Kobayashi Y, Shida D, Boku N, Yasui K, Nakamura Y, Kudose Y, et al. Prognostic factors of bone metastases from colorectal cancer in the era of targeted therapy. Dis Colon Rectum. 2023;66:401-9.

4. Ma CX, Guan X, Wei R, Wang S, Quan JC, Zhao ZX, et al. The distinction of clinicopathological characteristics, treatment strategy and outcome in colorectal cancer patients with synchronous vs. metachronous bone metastasis. Front Oncol. 2020;10:974.
5. Zhenghong, Zihua Z, Guoweijian, Zhangning, Caiyunyun, Yingjiangshan, et al. Retrospective study of predictors of bone metastasis in colorectal cancer patients. J Bone Oncol. 2017;9:25-8.
6. Suresh Babu MC, Garg S, Lakshmaiah KC, Babu KG, Kumar RV, Loknatha D, et al. Colorectal cancer presenting as bone metastasis. J Cancer Res Ther. 2017;13:80-3.
7. Liu Z, Xu Y, Xu G, Baklaushev VP, Chekhonin VP, Peltzer K, et al. Nomogram for predicting overall survival in colorectal cancer with distant metastasis. BMC Gastroenterol. 2021;21(1):103.
8. Yin S, Zhai X, Li Y, Zeng R, Zhang D, Sun X, et al. Bone Metastasis Mediates Poor Prognosis in Early-Onset Gastric Cancer: Insights Into Immune Suppression, Coagulopathy, and Inflammation. Cancer Med. 2025;14(5):e70737.
9. Tang Z, Zhou G, Xu Y, Zhang Y. Survival analysis and prediction of early-onset colorectal cancer patients post-chemotherapy: an analysis based on the SEER database. Int J Colorectal Dis. 2025;40(1):74.
10. Nozue M, Oshiro Y, Kurata M, Seino K, Koike N, Kawamoto T, et al. Treatment and prognosis in colorectal cancer patients with bone metastasis. Oncol Rep. 2002;9(1):109-12.
11. Chen Q, Li K, Rhodin KE, Deng Y, Lidsky ME, Luo S, et al. Development and internal validation of individualized prediction models of overall survival and 6-month mortality among patients with synchronous early-onset colorectal liver metastases. HPB (Oxford). 2024;26(11):1349-63.
12. Gao Y, De S, Brazil DP. The Role of GREMLIN1, a Bone Morphogenetic Protein Antagonist, in Cancer Stem Cell Regulation. Cells. 2025;14(8):578.
13. Nakamura S, Fukui T, Suzuki S, Takeda H, Watanabe K, Yoshioka T. Long-term survival after a favorable response to anti-EGFR antibody plus chemotherapy to treat bone marrow metastasis: a case report of *KRAS*-wildtype rectal cancer. Onco Targets Ther. 2017;10:1143-7.
14. Popescu I, Dudău AM, Dima S, Herlea V, Croitoru VM, Dinu IM, et al. Multimodal Treatment of Metastatic Rectal Cancer in a Young Patient: Case Report and Literature Review. Medicina (Kaunas). 2024;60(5):696.
15. Zeeneldin A, Al-Dhaibani N, Saleh YM, Ismail AM, Alzibair Z, Moona MS, et al. Anorectal Cancer with Bone Marrow and Leptomeningeal Metastases. Case Rep Oncol Med. 2018;2018:9246139.
16. Lazzaroni M, Angelini F, Guglielmi R, Novizio R, Iadevaia A, Andreadi A, et al. Severe Hypercalcemia Following Pembrolizumab Therapy: A Case Report and A Literature Review. Endocr Metab Immune Disord Drug Targets. 2025.
17. Yin S, Zhai X, Li Y, Zeng R, Zhang D, Sun X, et al. Bone Metastasis Mediates Poor Prognosis in Early-Onset Gastric Cancer: Insights Into Immune Suppression, Coagulopathy, and Inflammation. Cancer Med. 2025;14(5):e70737.
18. Xiaobin C, Zhaojun X, Tao L, Tianzeng D, Xuemei H, Fan Z, et al. Analysis of Related Risk Factors and Prognostic Factors of Gastric Cancer with Bone Metastasis: A SEER-Based Study. J Immunol Res. 2022;2022:3251051.
19. Tang Z, Zhou G, Xu Y, Zhang Y. Survival analysis and prediction of early-onset colorectal cancer patients post-chemotherapy: an analysis based on the SEER database. Int J Colorectal Dis. 2025;40(1):74.
20. Siegel RL, Wagle NS, Cercek A, Smith RA, Jemal A. Colorectal cancer statistics, 2023. CA. 2023;73(3):233-54.
21. 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.
22. Patel SG, Karlitz JJ, Yen T, Lieu CH, Boland CR. The rising tide of early-onset colorectal cancer: a comprehensive review of epidemiology, clinical features, biology, risk factors, prevention, and early detection. Lancet Gastroenterol Hepatol. 2022;7(3):262-74.
23. Dwyer AJ, Murphy CC, Boland CR, Garcia R, Hampel H, Limburg P, et al. A summary of the fight colorectal cancer working meeting: exploring risk factors and etiology of sporadic early-age onset colorectal cancer. Gastroenterol. 2019;157(2):280-8.
24. Stoffel EM, Murphy CC. Epidemiology and mechanisms of the increasing incidence of colon and rectal cancers in young adults. Gastroenterology. 2020;158(2):341-53.
25. Chang DT, Pai RK, Rybicki LA, Dimaio MA, Limaye M, Jayachandran P, et al. Clinicopathologic and molecular features of sporadic early-onset colorectal adenocarcinoma: an adenocarcinoma with frequent signet ring cell differentiation, rectal and sigmoid involvement, and adverse morphologic features. Mod Pathol. 2012;25(8):1128-39.
26. Willauer AN, Liu Y, Pereira AAL, Lam M, Morris JS, Raghav KPS, et al. Clinical and molecular characterization of early-onset colorectal cancer. Cancer. 2019;125(12):2002-10.
27. Song M, Hu FB, Spiegelman D, Chan AT, Wu K, Ogino S, et al. Long-term status and change of body fat distribution, and risk of colorectal cancer: a prospective cohort study. Int J Epidemiol. 2016;45(3):871-83.
28. Liang PS, Chen TY, Giovannucci E. Cigarette smoking and colorectal cancer incidence and mortality: systematic review and meta-analysis. Int J Cancer. 2009;124(10):2406-15.
29. Chan GHJ, Chee CE. Making sense of adjuvant chemotherapy in colorectal cancer. J Gastrointestinal Oncol. 2019;10(6):1183-92.

30. Biller LH, Schrag D. Diagnosis and treatment of metastatic colorectal cancer: a review. JAMA. 2021;325(7):669-85.
31. Spaander MCW, Zauber AG, Syngal S, Blaser MJ, Sung JJ, You YN, et al. Young-onset colorectal cancer. Nat Rev Dis Primers. 2023;9(1):21.
32. Kolarich A, George TJ Jr, Hughes SJ, Delitto D, Allegra CJ, Hall WA, et al. Rectal cancer patients younger than 50 years lack a survival benefit from NCCN guideline-directed treatment for stage II and III disease. Cancer 2018;124(17):3510-9.
33. Eng C, Jácome AA, Agarwal R, Hayat MH, Byndloss MX, Holowatyj AN, et al. A comprehensive framework for early-onset colorectal cancer research. Lancet Oncol. 2022;23(3):e116-28.
34. Ganesh K, Stadler ZK, Cercek A, Mendelsohn RB, Shia J, Segal NH, et al. Immunotherapy in colorectal cancer: rationale, challenges and potential. Nat Rev Gastroenterol Hepatol. 2019;16(6):361-75.
35. Castro-Espin C, Agudo A. The role of diet in prognosis among cancer survivors: a systematic review and meta-analysis of dietary patterns and diet interventions. Nutrients. 2022;14(2):348.
36. Okamoto K, Ozawa T, Nozawa H, Sasaki K, Murono K, Emoto S, et al. Prognosis of early-onset vs. late-onset stage II/III colorectal cancer patients with adjuvant chemotherapy: a multicenter propensity score matched study. Int J Clin Oncol. 2024;29(11):1721-9.
37. Coughlin SS. Social determinants of colorectal cancer risk, stage, and survival: a systematic review. Int J Colorectal Dis. 2020;35(6):985-95.
38. Vuik FER, Nieuwenburg SAV, Nagtegaal ID, Kuipers EJ, Spaander MCW. Clinicopathological characteristics of early onset colorectal cancer. Alimentary Pharmacol Therapeut. 2021;54(11-12):1463-71.
39. Catalano V, Bergamo F, Cremolini C, Vincenzi B, Negri F, Giordani P, et al. Optimizing the use of first-line chemotherapy in metastatic colorectal cancer patients with mucinous histology. A multicenter, retrospective, combined analysis on 897 patients. Ann Oncol. 2018;29:v97.
40. Fernández-Ponce C, Geribaldi-Doldán N, Sánchez-Gomar I, Quiroz RN, Ibarra LA, Escorcia LG, et al. The role of glycosyltransferases in colorectal cancer. Int J Mol Sci. 2021;22(11):5822.
41. Hall C, Clarke L, Pal A, Buchwald P, Eglinton T, Wakeman C, et al. A review of the role of carcinoembryonic antigen in clinical practice. Ann Coloproctol. 2019;35(6):294-305.
42. Zhong M, Wu B. Zhongguo yi xue ke xue yuan xue bao. Acta Academ Medic Sinicae. 2021;43(6):980-5.

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