**Name of Journal:** *World Journal of Gastrointestinal Oncology*

**Manuscript NO:** 86124

**Manuscript Type:** ORIGINAL ARTICLE

***Retrospective Cohort Study***

**Multidisciplinary discussion and management of synchronous colorectal liver metastases: A single center study in China**

Li H *et al*. Synchronous colorectal liver metastases in MDT

Hao Li, Guo-Li Gu, Song-Yan Li, Yang Yan, Shi-Dong Hu, Ze Fu, Xiao-Hui Du

**Hao Li, Ze Fu,** Graduate School, Medical School of Chinese People’s Liberation Army, Beijing 100039, China

**Hao Li, Guo-Li Gu,** Department of General Surgery, Air Force Medical Center, Air Force Medical University, Beijing 100142, China

**Song-Yan Li, Yang Yan, Shi-Dong Hu, Xiao-Hui Du,** Department of General Surgery, Chinese People’s Liberation Army General Hospital, Beijing 100039, China

**Author contributions:** Li H and Du XH were the guarantor of integrity of entire study, and contributed to the study concepts; Li H, Gu GL, Li SY, and Du XH designed the study; Li H, Gu GL, Li SY, and Hu SD involved in the literature research; Li H and Fu Z contributed to the data acquisition; Li H contributed to the statistical analysis/interpretation and manuscript preparation; Li H, Gu GL, Li SY, Hu SD, and Du XH contributed to the manuscript definition of intellectual content; Li H, Gu GL, and Du XH edited the manuscript.

**Supported by** National Natural Science Foundation of China, No. 81871317; and Military Medical Innovation Project, No. 18CXZ025.

**Corresponding author: Xiao-Hui Du, MD, PhD, Chief Doctor, Deputy Director, Professor, Surgeon,** Department of General Surgery, Chinese People’s Liberation Army General Hospital, No. 28 Fuxing Road, Haidian District, Beijing 100039, China. duxiaohui301@sina.com

**Received:** June 30, 2023

**Revised:** July 24, 2023

**Accepted:** August 4, 2023

**Published online:** September 15, 2023

**Abstract**

BACKGROUND

The multidisciplinary team (MDT) has been carried out in many large hospitals now. However, given the costs of time and money and with little strong evidence of MDT effectiveness being reported, critiques of MDTs persist.

AIM

To evaluate the effects of MDTs on patients with synchronous colorectal liver metastases and share our opinion on management of synchronous colorectal liver metastases.

METHODS

In this study we collected clinical data of patients with synchronous colorectal liver metastases from February 2014 to February 2017 in the Chinese People’s Liberation Army General Hospital and subsequently divided them into an MDT+ group and an MDT- group. In total, 93 patients in MDT+ group and 169 patients in MDT- group were included totally.

RESULTS

Statistical increases in the rate of chest computed tomography examination (*P* = 0.001), abdomen magnetic resonance imaging examination (*P* = 0.000), and preoperative image staging (*P* = 0.0000) were observed in patients in MDT+ group. Additionally, the proportion of patients receiving chemotherapy (*P* = 0.019) and curative resection (*P* = 0.042) was also higher in MDT+ group. Multivariable analysis showed that the population of patients assessed by MDT meetings had higher 1-year [hazard ratio (HR) = 0.608, 95% confidence interval (CI): 0.398-0.931, *P* = 0.022] and 5-year (HR = 0.694, 95%CI: 0.515-0.937, *P* = 0.017) overall survival.

CONCLUSION

These results proved that MDT management did bring patients with synchronous colorectal liver metastases more opportunities for comprehensive examination and treatment, resulting in better outcomes.

**Key Words:** Synchronous colorectal liver metastases; Multidisciplinary team; Imaging examination; Treatment strategy; Oncological outcome

**©The** **Author(s) 2023.** Published by Baishideng Publishing Group Inc. All rights reserved.

**Citation**: Li H, Gu GL, Li SY, Yan Y, Hu SD, Fu Z, Du XH. Multidisciplinary discussion and management of synchronous colorectal liver metastases: A single center study in China. *World J Gastrointest Oncol* 2023; 15(9): 1616-1625

**URL**: https://www.wjgnet.com/1948-5204/full/v15/i9/1616.htm

**DOI**: https://dx.doi.org/10.4251/wjgo.v15.i9.1616

**Core Tip:** Synchronous colorectal liver metastases usually predict a poor prognosis. Nevertheless, given the costs of time and money and with little strong evidence of multidisciplinary team (MDT) effectiveness being reported, critiques of MDTs still persist. This study demonstrates that MDT management brings patients more opportunities for aggressive examination and treatment. Retrospective clinical data shows that the population of patients assessed by MDT meetings has higher 1-year and 5-year overall survival.

**INTRODUCTION**

Colorectal cancer is the second most commonly diagnosed cancer, with an estimated 1.78 million cases occurring in 2020[1]. About 50% of patients with colorectal cancer will suffer distant metastases; the liver is the most common site. In particular synchronous liver metastases account for 15%-25% of colorectal liver metastases[2]. Synchronous colorectal liver metastases are usually defined as liver metastases detected at or before primary colorectal cancer. Curative resection is identified as the most effective method for curing synchronous colorectal liver metastases. However, data showed only 5%-15% patients with synchronous liver metastases were curable with resection[3,4], 5-year survival rates of patients with unresectable liver metastases were starkly lower, at less than 5% respectively[5].

The multidisciplinary team (MDT) originated in the United Kingdom in the 1960s and 1970s[6] and is defined as a regularly scheduled discussion of patients, especially those diagnosed with cancer, comprising professionals from different specialties[7]. After years of development, MDTs have been used in most large hospitals and are recommended by most guidelines on cancer therapy[8]. Nevertheless, given the costs of time and money and with little strong evidence of MDT effectiveness being reported, critiques of MDTs persist[9,10].

On a positive note, many retrospective and prospective studies have already provided clinical evidence in favor of MDT meetings with regard to diagnosis, tumor staging, treatment strategy, and oncological outcomes of cancer including colorectal cancers[11-13]. However, few reports have shown the impact of MDT meetings on synchronous colorectal liver metastases. In this study, we undertook a retrospective analysis of the impact of MDT meetings on the clinical data of patients with synchronous colorectal liver metastases, and we provide our insights on management of synchronous colorectal liver metastases in an MDT model.

**MATERIALS AND METHODS**

This retrospective study incorporated patients who were diagnosed with synchronous colorectal liver metastases from February 2014 to February 2017 in the Chinese People’s Liberation Army General Hospital. All patients in the MDT group (MDT+) were discussed by the gastrointestinal cancer MDT of the Chinese People’s Liberation Army General Hospital and had thorough records in minutes of the meetings. Patients without discussion at MDT meetings (MDT-) were treated by doctors with equivalent qualifications of the Chinese People’s Liberation Army General Hospital. This study received approval from the ethics commission of the General Hospital of People’s Liberation Army.

***Data collection***

Patients with uncertain diagnoses and medical records were excluded, as were patients suffering from extrahepatic metastases or other severe disease that might affect survival time seriously. These patients were followed up for 66 mo in this study. A total of 169 patients in MDT- group (80 men and 89 women; mean age: 60.15 years) and 93 patients in MDT+ group (53 men and 40 women; mean age: 59.19 years) were ultimately included in this study.

To analyze the impact of MDT on overall survival (OS), we compiled the following items in our data collection according to previous studies[14-17]: (1) Demographic data: Age, gender, body mass index; (2) Cancer characteristics: Site of primary tumor, primary lymph node (LN) involvement, multiple liver metastases, extrahepatic metastases; (3) Baseline examination including imaging data and serum carcinoembryonic antigen (CEA) levels; (4) Detailed data about chemotherapy and surgery; (5) Clinical data of follow-up until patients’ death or the end of the follow-up period (August 2022). Data were mainly collected from the Electronic Medical Record of the Chinese People’s Liberation Army General Hospital, and those unavailable in the Electronic Medical Record were obtained from patients, in the form of copied records, imaging and laboratory data.

***Statistical analysis***

Continuous data are presented as median (range) unless indicated otherwise. Comparisons of differences in continuous variables between the two groups were performed with student’s *t* test. Chi-square test and Fisher’s exact method were carried out for categorical data. In the analysis of event-specific rates, patients were considered to be at risk of the studied event until death or the end of follow-up. Cumulative survival curves were plotted using the Kaplan-Meier method and statistically compared using the log-rank test. Univariate and multivariate survival analysis was performed using the Cox proportional hazards model, with results presented as a hazard ratio (HR) with a 95% confidence interval (CI). Univariate and multivariate logistic analysis was performed using the likelihood ratio test, with results presented as an odds ratio (OR) with a 95%CI. Multivariate analysis included items with univariate analysis results of *P* < 0.20. Statistical significance was set at *P* < 0.05. All analyses were performed using the Statistical Program for Social Sciences 26.0 software (SPSS, Inc., Chicago, IL, United States).

**RESULTS**

***Patient***

A total of 262 patients were included in this study. The clinical characteristics of patients are detailed in Table 1. In MDT+ group, a significant 80.65% of patients (75 out of 93) were diagnosed with liver metastases at more than one site. Interestingly, the proportion of patients in MDT- group was 79.88% (*P* = 0.989). No significant differences in demographic data and cancer characteristics were observed between these two groups.

***Baseline imaging examination and radiological tumor-node-metastasis staging***

The rate of chest computed tomography (CT) examination in patients in MDT+ group was significantly higher than that in MDT- group (100% *vs* 82.84%, *P* = 0.001). This trend was mirrored in the rate of abdomen magnetic resonance imaging (MRI) (100% *vs* 73.96%, *P* = 0.000). As radiological tumor-node-metastasis (TNM) staging was routinely required in our gastrointestinal cancer MDT meeting, all patients in MDT+ group had been diagnosed with TNM staging. However, only 20.12% of patients were evaluated with radiological TNM staging in MDT- group (*P* = 0.000). No significant difference in positron emission tomography-CT (PET-CT) between the two groups was observed (*P* = 0.906). Baseline imaging examination and radiological TNM staging results are represented in Table 2.

***Oncology treatment and surgery***

Of 17 patients in MDT+ group were diagnosed with initial resectable synchronous colorectal liver metastases. 77 patients in the MDT+ group and 116 patients in MDT- group received chemotherapy (82.80% *vs* 68.64%, *P* = 0.0191). Approximately 10% of these chemotherapy patients were successfully converted to be radically resectable after several chemotherapy cycles. At the end of the follow-up period, 30 patients in MDT+ group and 35 patients in MDT- group had undergone curative resection (32.29% *vs* 20.71%, *P* = 0.0415). Statistical differences were not observed in the proportion of initial resectable liver metastases, and successful conversion chemotherapy between the two groups. Oncology treatment and surgery is outlined in Table 3.

***OS***

The 1-year OS rate of all 262 patients was determined to be 54.58%. There was a significant difference between the two groups, with patients in MDT+ group demonstrating statistically higher 1-year OS rates than those in MDT- group (66.67% *vs* 47.93%; *P* = 0.0036, Figure 1). Univariate analysis employing the Cox proportional hazards model, age > 75 years, CEA > 5 ng/mL, primary LN involvement, multiple liver metastases, extrahepatic metastases, curative resection, MDT, and chemotherapy were associated with 1-year OS rates at *P* < 0.20 (Table 4).

Subsequent multivariate analysis illuminated that age > 75 years (HR = 2.276, 95%CI: 1.419-3.649, *P* = 0.001), CEA > 5 ng/mL (HR = 5.139, 95%CI: 3.093-8.539, *P* = 0.000), Primary LN involvement (HR = 1.828, 95%CI: 1.073-3.116, *P* = 0.027), multiple liver metastases (HR = 5.300, 95%CI: 1.627-17.262, *P* = 0.006), and extrahepatic metastases (HR = 6.187, 95%CI: 3.702-10.339, *P* = 0.0001) were high-risk factors. In contrast, MDT (HR = 0.608, 95%CI: 0.398-0.931, *P* = 0.022, Figure 1A) and curative resection (HR = 0.024, 95%CI: 0.003-0.177, *P* = 0.000) emerged as protective factors. During our analyses of 5-year OS rates, we found that despite the complexity of variables, MDT remained an independent protective factor (HR = 0.694, 95%CI: 0.515-0.937, *P* = 0.017, Table 5 and Figure 1B).

**DISCUSSION**

In MDT+ group, a significant majority of patients underwent a chest CT examination (100% *vs* 82.84%, *P* = 0.001). A SEER-based study including 46027 colorectal cancer patients found that about 20% of patients with colorectal liver metastasis were diagnosed with lung metastases simultaneously[16]. Furthermore, resection of liver and lung metastases brings better oncological outcomes than resection of liver metastases only[18]. Thus, the high frequency of chest CT examinations observed in the MDT+ group aligns with the need for comprehensive diagnostics in the management of patients with synchronous colorectal liver cancer. Moreover, the rate of abdomen MRI examination was significantly higher in MDT+ group compared to the MDT- group (*P* = 0.000), indicating a greater focus on identifying patients with questionable or curatively resectable liver metastases[19,20]. Most cancer therapy guidelines and clinical research underscore the importance of TNM staging in informing treatment strategies, reinforcing the value of accurate preoperative radiological TNM staging in treatment planning and monitoring clinical efficacy. Moreover, researchers have also proved that preoperative tumor staging increased cancer-specific endpoints[21]. Therefore, the increased likelihood of comprehensive baseline examination in patients under the MDT model can significantly contribute to more effective cancer treatment planning. For patients with synchronous liver metastases, PET-CT examination was frequently selected as the diagnostic modality of choice[22]. Notably, a substantial 80% of patients in the MDT+ group received chemotherapy (*P* = 0.019). A study from Phelip *et al*[23] indicated that a multidisciplinary meeting was the only factor independently associated with administration of chemotherapy.

Within the MDT+ group, patients were categorized into two subgroups: Those initially deemed resectable and those considered potentially resectable. Despite ongoing controversies surrounding the use of neo-adjuvant therapy for patients with initially resectable synchronous liver metastases[24-28], several benefits of neo-adjuvant therapy can be identified. Firstly, neo-adjuvant chemotherapy provides a “window period” that allows for the observation of any new unresectable liver metastases, thereby preventing unnecessary operations[29]. Secondly, neo-adjuvant therapy can potentially increase the chances of R0 surgery and the volume of residual liver post-surgery[30,31]. Thirdly, combining neo-adjuvant chemotherapy with adjuvant chemotherapy may enhance the outcomes of patients undergoing curative surgery[32,33]. Given these benefits, we often advocate for neo-adjuvant therapy, especially for patients with large liver metastases and large number of liver metastases or suspicious LN metastases. However, the status of the primary tumor lesion, patient willingness, chemotherapy toxicity and risk of disease progression should still be considered[26].

Successful conversion is an important goal for potentially resectable patients, while the symptoms and tumor burden usually influence the treatment strategy for unresectable patients. Large clinical trials have reported that the rates of successful conversion of unresectable liver metastases were about 4%-15%[34,35]. We observed a similar proportion (17.11% in MDT+ group and 9.46% in MDT- group) in our study. Research showed that the resection margin width of liver metastases was independently associated with OS rates[36]. However, complete radiological response only contributed 15%-70% of complete pathological response, and even among patients with a complete pathological response, long-term remission occurred in only 20%-50% of those treated with systemic therapy[37]. For patients who convert to be curatively resectable, we advocate for immediate curative resection, given the hepatotoxicity and potential for decreased chemosensitivity associated with prolonged chemotherapy. As the macroscopic disease disappears on preoperative imaging, an excision extension according to the baseline imaging data is recommended.

Despite the significantly higher 5-year OS rates of resectable colorectal liver metastasis (37%-49%) in contrast to unresectable liver metastases(2%-4%)[5,38,39], only about 10% of patients in our study were diagnosed as initially resectable. Given these stark contrasts, the pursuit of resectability remains crucial. We typically discourage palliative excision of liver metastases, yet for patients who lose the opportunity for curative resection due to primary tumor complications, we do advocate for the R0 resection of liver metastases[40]. Over 90% of patients underwent simultaneous combined laparoscopic resection in MDT+ group. Simultaneous liver and colorectal resections for metastatic colorectal cancer are associated with similar long-term cancer outcomes compared with staged procedures[41,42]. Considering factors such as operation duration, blood loss, hospital stay, and morbidity[43,44], patients can benefit much more from simultaneous operations. While long-term outcomes like overall survival, progression-free survival, and local recurrence after excision radio frequency ablation (RFA) remain contentious[45,46], we usually prefer excision unless specialists in our MDT meeting agree that excision is a great risk or complete ablation of liver metastases with RFA is possible. In our MDT, intraoperative RFA was performed by doctors from the department of intraoperative ultrasound. And only 5 of 30 patients in MDT+ group received RFA.

In the last part of this study, after adjusting for variables like age, primary LN involvement, multiple liver metastases, extrahepatic metastases, and curative resection, we discovered that MDT meetings were a protective factor for 1-year OS (HR = 0.608, 95%CI: 0.398-0.931, *P* = 0.022, Table 4) and 5-year OS (HR = 0.694, 95%CI: 0.515-0.937, *P* = 0.017, Table 5). Patients may achieve this *via* the improvement of patients’ treatment compliance, accurate radiological TNM staging, and an increased proportion of curative resection and systemic therapy in the MDT model.

**CONCLUSION**

The successful operation of a MDT necessitates fixed members, consistent meeting time, and location, an academic secretary with a medical background, and chat software enabling constant communication among team members. An MDT can help mitigate incomplete decisions made by individual doctors. Nonetheless, further evidence is still needed to confirm these benefits and assess the clinical benefits in light of the time and financial costs.

**ARTICLE HIGHLIGHTS**

***Research background***

Multidisciplinary teams (MDTs) have been implemented in numerous large hospitals; however, critiques persist due to the high costs and limited strong evidence of their effectiveness.

***Research motivation***

The motivation behind this article is to provide further evidence on the application of MDTs in the field of colorectal liver metastasis. By conducting this research, we aim to contribute to the existing knowledge base and enhance the understanding of how MDTs can effectively improve patient outcomes in this specific context.

***Research objectives***

The objective of this study is to evaluate the effects of MDTs on patients with synchronous colorectal liver metastases and provide insights and recommendations on the management of synchronous colorectal liver metastases.

***Research methods***

This retrospective study investigated the influence of MDT involvement on clinical data of patients with synchronous colorectal liver metastases at the Chinese People’s Liberation Army General Hospital.

***Research results***

The analysis revealed significant statistical increases in the rates of chest computed tomography examination (*P* = 0.001), abdomen magnetic resonance imaging examination (*P* = 0.000), and preoperative image staging (*P* = 0.0000) among patients in the MDT+ group. Furthermore, a higher proportion of patients in the MDT+ group received chemotherapy (*P* = 0.019) and underwent curative resection (*P* = 0.042). Multivariable analysis demonstrated that patients assessed through MDT meetings had higher 1-year overall survival [hazard ratio (HR) = 0.608, 95% confidence interval (CI): 0.398-0.931, *P* = 0.022] and 5-year overall survival (HR = 0.694, 95%CI: 0.515-0.937, *P* = 0.017).

***Research conclusions***

The findings of this study provide evidence that MDT management offers patients with synchronous colorectal liver metastases increased access to comprehensive examinations and treatments, ultimately leading to improved outcomes.

***Research perspectives***

This study conducted from the perspective of surgeons through a retrospective analysis of clinical records, observed that MDT management offers increased opportunities for comprehensive examinations and treatments in patients with synchronous colorectal liver metastases, consequently leading to improved treatment outcomes. This further validates the benefits of MDT management.

**REFERENCES**

1 **Sung H**, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin* 2021; **71**: 209-249 [PMID: 33538338 DOI: 10.3322/caac.21660]

2 **McMillan DC**, McArdle CS. Epidemiology of colorectal liver metastases. *Surg Oncol* 2007; **16**: 3-5 [PMID: 17493802 DOI: 10.1016/j.suronc.2007.04.008]

3 **Manfredi S**, Lepage C, Hatem C, Coatmeur O, Faivre J, Bouvier AM. Epidemiology and management of liver metastases from colorectal cancer. *Ann Surg* 2006; **244**: 254-259 [PMID: 16858188 DOI: 10.1097/01.sla.0000217629.94941.cf]

4 **Giannis D**, Sideris G, Kakos CD, Katsaros I, Ziogas IA. The role of liver transplantation for colorectal liver metastases: A systematic review and pooled analysis. *Transplant Rev (Orlando)* 2020; **34**: 100570 [PMID: 33002670 DOI: 10.1016/j.trre.2020.100570]

5 **Stewart CL**, Warner S, Ito K, Raoof M, Wu GX, Kessler J, Kim JY, Fong Y. Cytoreduction for colorectal metastases: liver, lung, peritoneum, lymph nodes, bone, brain. When does it palliate, prolong survival, and potentially cure? *Curr Probl Surg* 2018; **55**: 330-379 [PMID: 30526930 DOI: 10.1067/j.cpsurg.2018.08.004]

6 **Grass C**, Umansky R. Problems in promoting the growth of multi-disciplinary diagnostic and counseling clinics for mentally retarded children in nonmetropolitan areas. *Am J Public Health* 1971; **61**: 698-710 [PMID: 5139748 DOI: 10.2105/ajph.61.4.698]

7 **Kurpad R**, Kim W, Rathmell WK, Godley P, Whang Y, Fielding J, Smith L, Pettiford A, Schultz H, Nielsen M, Wallen EM, Pruthi RS. A multidisciplinary approach to the management of urologic malignancies: does it influence diagnostic and treatment decisions? *Urol Oncol* 2011; **29**: 378-382 [PMID: 19576797 DOI: 10.1016/j.urolonc.2009.04.008]

8 **Taylor C**, Munro AJ, Glynne-Jones R, Griffith C, Trevatt P, Richards M, Ramirez AJ. Multidisciplinary team working in cancer: what is the evidence? *BMJ* 2010; **340**: c951 [PMID: 20332315 DOI: 10.1136/bmj.c951]

9 **Thornton S**. Time to review utility of multidisciplinary team meetings. *BMJ* 2015; **351**: h5295 [PMID: 26446102 DOI: 10.1136/bmj.h5295]

10 **Chinai N**, Bintcliffe F, Armstrong EM, Teape J, Jones BM, Hosie KB. Does every patient need to be discussed at a multidisciplinary team meeting? *Clin Radiol* 2013; **68**: 780-784 [PMID: 23623261 DOI: 10.1016/j.crad.2013.02.011]

11 **Pillay B**, Wootten AC, Crowe H, Corcoran N, Tran B, Bowden P, Crowe J, Costello AJ. The impact of multidisciplinary team meetings on patient assessment, management and outcomes in oncology settings: A systematic review of the literature. *Cancer Treat Rev* 2016; **42**: 56-72 [PMID: 26643552 DOI: 10.1016/j.ctrv.2015.11.007]

12 **MacDermid E**, Hooton G, MacDonald M, McKay G, Grose D, Mohammed N, Porteous C. Improving patient survival with the colorectal cancer multi-disciplinary team. *Colorectal Dis* 2009; **11**: 291-295 [PMID: 18477019 DOI: 10.1111/j.1463-1318.2008.01580.x]

13 **Ye YJ**, Shen ZL, Sun XT, Wang ZF, Shen DH, Liu HJ, Zhang WL, Chen YL, Zhou J, Poston GJ, Wang S. Impact of multidisciplinary team working on the management of colorectal cancer. *Chin Med J (Engl)* 2012; **125**: 172-177 [PMID: 22340540]

14 **Gobbi PG**, Rossi S, Comelli M, Ravetta V, Rosa LL, Brugnatelli S, Corbella F, Delfanti S, Abumalouh I, Dionigi P. The Prognosis of Patients with Liver Metastases from Colorectal Cancer still Depends on Anatomical Presentation more than on Treatments. *Curr Cancer Drug Targets* 2015; **15**: 511-518 [PMID: 26282549 DOI: 10.2174/1568009615666150508094824]

15 **Schmidt T**, Strowitzki MJ, Reissfelder C, Rahbari NN, Nienhueser H, Bruckner T, Rahäuser C, Keppler U, Schneider M, Büchler MW, Ulrich A. Influence of age on resection of colorectal liver metastases. *J Surg Oncol* 2015; **111**: 729-739 [PMID: 25597497 DOI: 10.1002/jso.23872]

16 **Qiu M**, Hu J, Yang D, Cosgrove DP, Xu R. Pattern of distant metastases in colorectal cancer: a SEER based study. *Oncotarget* 2015; **6**: 38658-38666 [PMID: 26484417 DOI: 10.18632/oncotarget.6130]

17 **Lan YT**, Jiang JK, Chang SC, Yang SH, Lin CC, Lin HH, Wang HS, Chen WS, Lin TC, Lin JK. Improved outcomes of colorectal cancer patients with liver metastases in the era of the multidisciplinary teams. *Int J Colorectal Dis* 2016; **31**: 403-411 [PMID: 26662193 DOI: 10.1007/s00384-015-2459-4]

18 **Andres A**, Mentha G, Adam R, Gerstel E, Skipenko OG, Barroso E, Lopez-Ben S, Hubert C, Majno PE, Toso C. Surgical management of patients with colorectal cancer and simultaneous liver and lung metastases. *Br J Surg* 2015; **102**: 691-699 [PMID: 25789941 DOI: 10.1002/bjs.9783]

19 **Bipat S**, van Leeuwen MS, Ijzermans JN, Comans EF, Planting AS, Bossuyt PM, Greve JW, Stoker J. Evidence-base guideline on management of colorectal liver metastases in the Netherlands. *Neth J Med* 2007; **65**: 5-14 [PMID: 17293634]

20 **Zech CJ**, Korpraphong P, Huppertz A, Denecke T, Kim MJ, Tanomkiat W, Jonas E, Ba-Ssalamah A; VALUE study group. Randomized multicentre trial of gadoxetic acid-enhanced MRI versus conventional MRI or CT in the staging of colorectal cancer liver metastases. *Br J Surg* 2014; **101**: 613-621 [PMID: 24652690 DOI: 10.1002/bjs.9465]

21 **Palmer G**, Martling A, Cedermark B, Holm T. Preoperative tumour staging with multidisciplinary team assessment improves the outcome in locally advanced primary rectal cancer. *Colorectal Dis* 2011; **13**: 1361-1369 [PMID: 20958913 DOI: 10.1111/j.1463-1318.2010.02460.x]

22 **Moulton CA**, Gu CS, Law CH, Tandan VR, Hart R, Quan D, Fairfull Smith RJ, Jalink DW, Husien M, Serrano PE, Hendler AL, Haider MA, Ruo L, Gulenchyn KY, Finch T, Julian JA, Levine MN, Gallinger S. Effect of PET before liver resection on surgical management for colorectal adenocarcinoma metastases: a randomized clinical trial. *JAMA* 2014; **311**: 1863-1869 [PMID: 24825641 DOI: 10.1001/jama.2014.3740]

23 **Phelip JM**, Molinié F, Delafosse P, Launoy G, Trétarre B, Bara S, Buémi A, Velten M, Danzon A, Ganry O, Bouvier AM, Grosclaude P, Faivre J. A population-based study of adjuvant chemotherapy for stage-II and -III colon cancers. *Gastroenterol Clin Biol* 2010; **34**: 144-149 [PMID: 20079591 DOI: 10.1016/j.gcb.2009.08.012]

24 **Adam R**, de Gramont A, Figueras J, Kokudo N, Kunstlinger F, Loyer E, Poston G, Rougier P, Rubbia-Brandt L, Sobrero A, Teh C, Tejpar S, Van Cutsem E, Vauthey JN, Påhlman L; of the EGOSLIM (Expert Group on OncoSurgery management of LIver Metastases) group. Managing synchronous liver metastases from colorectal cancer: a multidisciplinary international consensus. *Cancer Treat Rev* 2015; **41**: 729-741 [PMID: 26417845 DOI: 10.1016/j.ctrv.2015.06.006]

25 **Gruenberger T**, Beets G, Van Laethem JL, Rougier P, Cervantes A, Douillard JY, Figueras J, Gruenberger B, Haller DG, Labianca R, Maleux G, Roth A, Ducreux M, Schmiegel W, Seufferlein T, Van Cutsem E. Treatment sequence of synchronously (liver) metastasized colon cancer. *Dig Liver Dis* 2016; **48**: 1119-1123 [PMID: 27375207 DOI: 10.1016/j.dld.2016.06.009]

26 **Zhu C**, Ren X, Liu D, Zhang C. Oxaliplatin-induced hepatic sinusoidal obstruction syndrome. *Toxicology* 2021; **460**: 152882 [PMID: 34352347 DOI: 10.1016/j.tox.2021.152882]

27 **Tepelenis K**, Pappas-Gogos G, Ntellas P, Tsimogiannis K, Dadouli K, Mauri D, Glantzounis GK. The Role of Preoperative Chemotherapy in the Management of Synchronous Resectable Colorectal Liver Metastases: A Meta-Analysis. *Curr Oncol* 2023; **30**: 4499-4511 [PMID: 37232798 DOI: 10.3390/curroncol30050340]

28 **Bonney GK**, Coldham C, Adam R, Kaiser G, Barroso E, Capussotti L, Laurent C, Verhoef C, Nuzzo G, Elias D, Lapointe R, Hubert C, Lopez-Ben S, Krawczyk M, Mirza DF; LiverMetSurvey International Registry Working Group. Role of neoadjuvant chemotherapy in resectable synchronous colorectal liver metastasis; An international multi-center data analysis using LiverMetSurvey. *J Surg Oncol* 2015; **111**: 716-724 [PMID: 25864987 DOI: 10.1002/jso.23899]

29 **Cleary JM**, Tanabe KT, Lauwers GY, Zhu AX. Hepatic toxicities associated with the use of preoperative systemic therapy in patients with metastatic colorectal adenocarcinoma to the liver. *Oncologist* 2009; **14**: 1095-1105 [PMID: 19880627 DOI: 10.1634/theoncologist.2009-0152]

30 **Tanaka K**, Adam R, Shimada H, Azoulay D, Lévi F, Bismuth H. Role of neoadjuvant chemotherapy in the treatment of multiple colorectal metastases to the liver. *Br J Surg* 2003; **90**: 963-969 [PMID: 12905549 DOI: 10.1002/bjs.4160]

31 **Leonard GD**, Brenner B, Kemeny NE. Neoadjuvant chemotherapy before liver resection for patients with unresectable liver metastases from colorectal carcinoma. *J Clin Oncol* 2005; **23**: 2038-2048 [PMID: 15774795 DOI: 10.1200/JCO.2005.00.349]

32 **Mentha G**, Majno P, Terraz S, Rubbia-Brandt L, Gervaz P, Andres A, Allal AS, Morel P, Roth AD. Treatment strategies for the management of advanced colorectal liver metastases detected synchronously with the primary tumour. *Eur J Surg Oncol* 2007; **33** Suppl 2: S76-S83 [PMID: 18006267 DOI: 10.1016/j.ejso.2007.09.016]

33 **Nordlinger B**, Sorbye H, Glimelius B, Poston GJ, Schlag PM, Rougier P, Bechstein WO, Primrose JN, Walpole ET, Finch-Jones M, Jaeck D, Mirza D, Parks RW, Collette L, Praet M, Bethe U, Van Cutsem E, Scheithauer W, Gruenberger T; EORTC Gastro-Intestinal Tract Cancer Group; Cancer Research UK; Arbeitsgruppe Lebermetastasen und-tumoren in der Chirurgischen Arbeitsgemeinschaft Onkologie (ALM-CAO); Australasian Gastro-Intestinal Trials Group (AGITG); Fédération Francophone de Cancérologie Digestive (FFCD). Perioperative chemotherapy with FOLFOX4 and surgery versus surgery alone for resectable liver metastases from colorectal cancer (EORTC Intergroup trial 40983): a randomised controlled trial. *Lancet* 2008; **371**: 1007-1016 [PMID: 18358928 DOI: 10.1016/S0140-6736(08)60455-9]

34 **Falcone A**, Ricci S, Brunetti I, Pfanner E, Allegrini G, Barbara C, Crinò L, Benedetti G, Evangelista W, Fanchini L, Cortesi E, Picone V, Vitello S, Chiara S, Granetto C, Porcile G, Fioretto L, Orlandini C, Andreuccetti M, Masi G; Gruppo Oncologico Nord Ovest. Phase III trial of infusional fluorouracil, leucovorin, oxaliplatin, and irinotecan (FOLFOXIRI) compared with infusional fluorouracil, leucovorin, and irinotecan (FOLFIRI) as first-line treatment for metastatic colorectal cancer: the Gruppo Oncologico Nord Ovest. *J Clin Oncol* 2007; **25**: 1670-1676 [PMID: 17470860 DOI: 10.1200/JCO.2006.09.0928]

35 **Souglakos J**, Androulakis N, Syrigos K, Polyzos A, Ziras N, Athanasiadis A, Kakolyris S, Tsousis S, Kouroussis Ch, Vamvakas L, Kalykaki A, Samonis G, Mavroudis D, Georgoulias V. FOLFOXIRI (folinic acid, 5-fluorouracil, oxaliplatin and irinotecan) vs FOLFIRI (folinic acid, 5-fluorouracil and irinotecan) as first-line treatment in metastatic colorectal cancer (MCC): a multicentre randomised phase III trial from the Hellenic Oncology Research Group (HORG). *Br J Cancer* 2006; **94**: 798-805 [PMID: 16508637 DOI: 10.1038/sj.bjc.6603011]

36 **Sadot E**, Groot Koerkamp B, Leal JN, Shia J, Gonen M, Allen PJ, DeMatteo RP, Kingham TP, Kemeny N, Blumgart LH, Jarnagin WR, DʼAngelica MI. Resection margin and survival in 2368 patients undergoing hepatic resection for metastatic colorectal cancer: surgical technique or biologic surrogate? *Ann Surg* 2015; **262**: 476-85; discussion 483-5 [PMID: 26258316 DOI: 10.1097/SLA.0000000000001427]

37 **Bischof DA**, Clary BM, Maithel SK, Pawlik TM. Surgical management of disappearing colorectal liver metastases. *Br J Surg* 2013; **100**: 1414-1420 [PMID: 24037559 DOI: 10.1002/bjs.9213]

38 **Valdimarsson VT**, Syk I, Lindell G, Sandström P, Isaksson B, Rizell M, Norén A, Ardnor B, Sturesson C. Outcomes of Simultaneous Resections and Classical Strategy for Synchronous Colorectal Liver Metastases in Sweden: A Nationwide Study with Special Reference to Major Liver Resections. *World J Surg* 2020; **44**: 2409-2417 [PMID: 32185455 DOI: 10.1007/s00268-020-05475-5]

39 **Lordan JT**, Karanjia ND, Quiney N, Fawcett WJ, Worthington TR. A 10-year study of outcome following hepatic resection for colorectal liver metastases - The effect of evaluation in a multidisciplinary team setting. *Eur J Surg Oncol* 2009; **35**: 302-306 [PMID: 18328668 DOI: 10.1016/j.ejso.2008.01.028]

40 **Hwang M**, Jayakrishnan TT, Green DE, George B, Thomas JP, Groeschl RT, Erickson B, Pappas SG, Gamblin TC, Turaga KK. Systematic review of outcomes of patients undergoing resection for colorectal liver metastases in the setting of extra hepatic disease. *Eur J Cancer* 2014; **50**: 1747-1757 [PMID: 24767470 DOI: 10.1016/j.ejca.2014.03.277]

41 **Lykoudis PM**, O'Reilly D, Nastos K, Fusai G. Systematic review of surgical management of synchronous colorectal liver metastases. *Br J Surg* 2014; **101**: 605-612 [PMID: 24652674 DOI: 10.1002/bjs.9449]

42 **Wang LJ**, Wang HW, Jin KM, Li J, Xing BC. Comparison of sequential, delayed and simultaneous resection strategies for synchronous colorectal liver metastases. *BMC Surg* 2020; **20**: 16 [PMID: 31952490 DOI: 10.1186/s12893-020-0681-7]

43 **Gavriilidis P**, Sutcliffe RP, Hodson J, Marudanayagam R, Isaac J, Azoulay D, Roberts KJ. Simultaneous versus delayed hepatectomy for synchronous colorectal liver metastases: a systematic review and meta-analysis. *HPB (Oxford)* 2018; **20**: 11-19 [PMID: 28888775 DOI: 10.1016/j.hpb.2017.08.008]

44 **Tian ZQ**, Su XF, Lin ZY, Wu MC, Wei LX, He J. Meta-analysis of laparoscopic versus open liver resection for colorectal liver metastases. *Oncotarget* 2016; **7**: 84544-84555 [PMID: 27811369 DOI: 10.18632/oncotarget.13026]

45 **Lee WS**, Yun SH, Chun HK, Lee WY, Kim SJ, Choi SH, Heo JS, Joh JW, Choi D, Kim SH, Rhim H, Lim HK. Clinical outcomes of hepatic resection and radiofrequency ablation in patients with solitary colorectal liver metastasis. *J Clin Gastroenterol* 2008; **42**: 945-949 [PMID: 18438208 DOI: 10.1097/MCG.0b013e318064e752]

46 **Ko S**, Jo H, Yun S, Park E, Kim S, Seo HI. Comparative analysis of radiofrequency ablation and resection for resectable colorectal liver metastases. *World J Gastroenterol* 2014; **20**: 525-531 [PMID: 24574721 DOI: 10.3748/wjg.v20.i2.525]

**Footnotes**

**Institutional review board statement:** This study received approval from the ethics commission of the General Hospital of People’s Liberation Army.

**Informed consent statement:** All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

**Conflict-of-interest statement:** All the authors report no relevant conflicts of interest for this article.

**Data sharing statement:** We are committed to promoting open data access. All research data generated as part of this study will be made available to the scientific community and interested parties, subject to legal, ethical, and privacy considerations.

**STROBE statement:** The authors have read the STROBE Statement-checklist of items, and the manuscript was prepared and revised according to the STROBE Statement-checklist of items.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

**Provenance and peer review:** Unsolicited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Corresponding Author’s Membership in Professional Societies:** Chairman, Colorectal Anal Surgery Professional Committee, Chinese Research Hospital Society; Member of Colorectal Surgery Group, Surgery Society of Chinese Medical Association; Standing member of the General Surgery Committee of the PLA.

**Peer-review started:** June 30, 2023

**First decision:** July 24, 2023

**Article in press:** August 4, 2023

**Specialty type:** Oncology

**Country/Territory of origin:** China

**Peer-review report’s scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): C

Grade D (Fair): 0

Grade E (Poor): 0

**P-Reviewer:** Billeter A, Germany; Tanabe M, Japan **S-Editor:** Wang JJ **L-Editor:** A **P-Editor:** Wang JJ

**Figure Legends**



**Figure 1 Overall** **survival comparison: Multidisciplinary team (+) group *versus* multidisciplinary team (-) group.** A: Multidisciplinary team was a protective factor for 1-year overall survival rates; B: Multidisciplinary team was a protective factor for 5-year overall survival rates. MDT: Multidisciplinary team; HR: Hazard ratio.

**Table 1 Demographic and clinical characteristics of patients**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics** | **MDT+ (*n* = 93)** | **MDT- (*n* = 169)** | ***P* value** |
| Age (yr), mean (min-max) | 59.19 (28.00-89.00) | 60.15 (25.00-92.00) | 0.605 |
| Male/female, *n* | 40/53 | 89/80 | 0.172 |
| BMI (kg/m2), mean (min-max) | 24.83 (17.29-33.82) | 23.62 (16.06-33.5) | 0.221 |
| KPs score ≥ 60 | 89/12 | 150/19 | 0.095 |
| Adenocarcinoma/mucinous adenocarcinoma, *n* | 83/10 | 143/26 | 0.393 |
| Poor differentiation, *n* (%) | 16 (17.20) | 21 (12.43) | 0.380 |
| Primary tumor category ≥ T3, *n* (%) | 67 (72.04) | 135 (79.88) | 0.197 |
| Primary LN involvement, *n* (%) | 60 (64.52) | 118 (69.82) | 0.458 |
| Multiple liver metastases, *n* (%) | 75 (80.65) | 134 (79.29) | 0.920 |

BMI: Body mass index; KPs: Karnofsky performance status; LN: Lymph node; MDT: Multidisciplinary team.

**Table 2 Baseline imaging examination and radiological** **tumor-node-metastasis staging**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **MDT+ (*n* = 93)** | **MDT- (*n* = 169)** | ***P* value** |
| Chest CT, *n* (%) | 93 (100) | 140 (82.84) | 0.001 |
| Abdomen MRI, *n* (%) | 89 (95.70) | 125 (73.96) | 0.000 |
| PET-CT, *n* (%) | 22 (23.66) | 47 (27.81) | 0.906 |
| TNM staging, *n* (%) | 93 (100) | 34 (20.12) | 0.000 |

CT: Computed tomography; MRI: Magnetic resonance imaging; PET: Positron emission tomography; TNM: Tumor-node-metastasis; MDT: Multidisciplinary team.

**Table 3 Oncology treatment and surgery**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **MDT+ (*n* = 93)** | **MDT- (*n* = 169)** | ***P* value** |
| Initial resectable, *n* (%) | 17(18.285) | 21 (12.43) | 0.270 |
| Successful conversion chemotherapy, *n* (uninitial resectable, *n*) | 13 (761) | 14 (1481) | 0.148 |
| Chemotherapy, *n* (%) | 77 (82.80) | 116 (68.64) | 0.019 |
| Curative resection, *n* (%) | 30 (32.29) | 35 (20.71) | 0.042 |
| Simultaneous resection, *n* (%) | 29 (97.63) | 19 (55.88) | 0.001 |
| RFA, *n* (%) | 5 (16.67) | 15 (44.12) | 0.036 |

1Values in parentheses are numbers of patients with unresectable liver metastases.

RFA: Radiofrequency ablation; MDT: Multidisciplinary team.

**Table 4 Univariate and multivariate analyses of risk factors associated with 1-year overall survival**

|  |  |  |  |
| --- | --- | --- | --- |
|  | ***n* (%)** | **Univariate** | **Multivariate** |
| **HR** | **95%CI** | ***P* value** | **HR** | **95%CI** | ***P* value** |
| Age > 75 | 61 (23.28) | 3.533 | 2.44-5.11 | 0.000 | 2.065 | 1.257-3.393 | 0.004 |
| Sex (male) | 133 (50.76) | 0.845 | 0.590-1.211 | 0.358 |  |  |  |
| BMI > 28 | 46 (17.56) | 0.765 | 0.468-1.250 | 0.285 |  |  |  |
| CEA > 5 ng/mL | 125 (47.71) | 7.296 | 4.674-11.391 | 0.000 | 5.308 | 3.262-8.638 | 0.000 |
| Colon primary | 118 (45.04) | 1.283 | 0.896-1.838 | 0.174 | 1.058 | 0.724-1.544 | 0.772 |
| Mucinous adenocarcinoma | 36 (13.74) | 0.863 | 0.502-1.482 | 0.593 |  |  |  |
| Poor differentiation | 37 (14.12) | 1.282 | 0.793-2.073 | 0.311 |  |  |  |
| Primary tumor category ≥ T3 | 202 (77.10) | 1.284 | 0.820-2.009 | 0.274 |  |  |  |
| Primary LN involvement | 178 (67.94) | 3.336 | 2.061-5.400 | 0.000 | 1.948 | 1.156-3.281 | 0.012 |
| Multiple liver metastases | 210 (80.15) | 13.97 | 4.44-43.97 | 0.000 | 4.747 | 1.470-15.333 | 0.009 |
| MDT | 93 (35.50) | 0.53 | 0.353-0.801 | 0.003 | 0.572 | 0.374-0.874 | 0.010 |
| chemotherapy | 193 (73.66) | 0.239 | 0.166-0.344 | 0.000 | 0.874 | 0.539-1.418 | 0.587 |
| Curative resection | 67 (25.57) | 0.016 | 0.002-0.114 | 0.000 | 0.031 | 0.004-0.227 | 0.001 |

HR: Hazards ratio; CI: Confidence interval; BMI: Body mass index; CEA: Carcinoembryonic antigen; MDT: Multidisciplinary team; LN: Lymph node.

**Table 5 Univariate and multivariate analyses of risk factors associated with 5-year overall survival**

|  |  |  |  |
| --- | --- | --- | --- |
|  | ***n* (%)** | **Univariate** | **Multivariate** |
| **HR** | **95%CI** | ***P* value** | **HR** | **95%CI** | ***P* value** |
| Age > 75 | 61 (23.28) | 3.471 | 2.532-4.758 | 0.000 | 2.040 | 1.322-3.149 | 0.001 |
| Sex (male) | 133 (50.76) | 0.938 | 0.721-1.221 | 0.938 |  |  |  |
| BMI > 28 | 46 (17.56) | 0.951 | 0.679-1.331 | 0.769 |  |  |  |
| CEA > 5 ng/mL | 125 (47.71) | 2.446 | 1.872-3.195 | 0.000 | 2.516 | 1.847-3.428 | 0.000 |
| Colon primary | 118 (45.04) | 1.349 | 1.035-1.757 | 0.027 | 0.828 | 0.622-1.102 | 0.195 |
| Mucinous adenocarcinoma | 36 (13.74) | 0.792 | 0.529-1.184 | 0.256 |  |  |  |
| Poor differentiation | 37 (14.12) | 1.102 | 0.758-1.603 | 0.611 |  |  |  |
| Primary tumor category ≥ T3 | 202 (77.10) | 0.969 | 0.710-1.322 | 0.841 |  |  |  |
| Primary LN involvement | 178 (67.94) | 1.567 | 1.175-2.088 | 0.002 | 1.143 | 0.835-1.566 | 0.404 |
| Multiple liver metastases | 210 (80.15) | 3.852 | 2.592-5.725 | 0.000 | 2.563 | 1.671-3.932 | 0.000 |
| MDT | 93 (35.50) | 0.667 | 0.504-0.884 | 0.005 | 0.709 | 0.527-0.954 | 0.023 |
| Chemotherapy | 193 (73.66) | 0.203 | 0.147-0.281 | 0.000 | 0.591 | 0.388-0.900 | 0.014 |
| Curative resection | 67 (25.57) | 0.091 | 0.058-0.144 | 0.000 | 0.111 | 0.069-0.178 | 0.000 |

HR: Hazards ratio; CI: Confidence interval; BMI: Body mass index; CEA: Carcinoembryonic antigen; MDT: Multidisciplinary team; LN: Lymph node.



Published by **Baishideng Publishing Group Inc**

7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

**Telephone:** +1-925-3991568

**E-mail:** bpgoffice@wjgnet.com

**Help Desk:** https://www.f6publishing.com/helpdesk

https://www.wjgnet.com



**© 2023 Baishideng Publishing Group Inc. All rights reserved.**