

Home Pharmaceutical Therapy Management for Colorectal Cancer

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Colorectal cancer is one of the major causes of cancer-related deaths worldwide and ranks third among all malignancies. According to data released by the International Agency for Research on Cancer (IARC) of the World Health Organization, there were 1,931,600 cases of colorectal cancer worldwide in 2020 [1]. The primary treatment for colorectal cancer is surgery, which can be combined with chemotherapy, radiotherapy, targeted therapy, and traditional Chinese medicine [2]. With innovative drugs being developed continuously, the survival rate of patients with colorectal cancer has been improving steadily. Many stable-stage patients can now receive oral medication at home. Therefore, home drug therapy management for patients with colorectal cancer has become increasingly important [3,4]. To provide homogenized standards for pharmaceutical therapy management at home for more patients with colorectal cancer, the Sixth Affiliated Hospital of Sun Yat-sen University organized medical experts to formulate this consensus statement.

1 Objectives of home medication therapy management

Home pharmaceutical therapy management refers to individualized whole-process continuous pharmaceutical care provided by pharmacists to support home drug therapy patients through universal health knowledge provision, drug evaluation and education, guidance on the storage and use of drugs, management of home medicine cabinets, and improvement in patient medication compliance [5-7]. Home pharmaceutical therapy management for colorectal cancer extends from discharged patient's pharmacy services mainly providing Medication Therapy Management (MTM) services tailored towards stable stage-colorectal-cancer-patients' needs [8,9].

The main purposes of home pharmaceutical therapy management for colorectal cancer include: (1) Establishing home drug therapy management files for colorectal cancer patients; (2) collecting and sorting out the drug list; (3) monitoring and intervention of

adverse drug reactions and risk management of drug use; (4) providing follow-up management for patients with colorectal tumors, including drug simplification and medication reconciliation, pharmaceutical therapy evaluation, interpretation and optimization of drug therapy protocols, and drug management for other complications; (5) Health education, medication education and psychological counseling for patients.

2 Working mode of pharmacists in home pharmaceutical therapy management for colorectal cancer

2.1 Home medication management principles of colorectal cancer

Family pharmacists need to be well-versed in colorectal cancer treatment guidelines and actively participate in pharmaceutical therapy evaluation processes such as medication reconciliation care provision education training etc. Therefore, home pharmaceutical therapy management involving pharmacist participation can be divided into five stages: (1) Conducting patient assessment alongside a comprehensive medication review (CMR). (2) Developing a personalized medication treatment plan while continuously monitoring its effectiveness safety aspects. (3) To evaluate and manage the various concurrent symptoms that may occur in patients with colorectal cancer during the course of home treatment. (4) To prevent adverse drug reactions, enhance patient compliance, and provide guidance on rational drug use. (5) Enhancing medication adherence through patient empowerment and education. (6) Documenting and communicating MTM services to prescribers in order to maintain comprehensive patient care.

2.1.1 Home medication management principles of colorectal cancer

Pharmacists should obtain a comprehensive medication history from patients, including the tumor TNM classification, to identify the specific types and dosages of drugs used, such as chemotherapy drugs, targeted drugs, biological agents, Chinese herbal medicines, health products, and any medications associated with the disease. Additionally, pharmacists should inquire about smoking or alcohol consumption habits and assess whether any perioperative period-impacting medications are involved. Furthermore, pharmacists should evaluate the patient's medication regimen and identify potential drug-related treatment issues.

2.1.2 The efficacy and adverse reactions of the drugs were monitored

Pharmacists should closely monitor the efficacy and adverse reactions of prescribed medications while considering factors that may influence drug metabolism and elimination capacity in relation to the patient's pathophysiology at that time. This analysis will aid in developing an individualized medication plan along with appropriate monitoring strategies. Moreover, it is essential for pharmacists to determine if short-term use of over-the-counter (OTC) drugs is necessary.

2.1.3 Economic evaluation of treatment plan

Family pharmacists should evaluate the safety, rationality, and economics of drug treatment through literature search, evidence-based evaluation, pharmacoeconomic evaluation, and comprehensive clinical drug evaluation.

2.1.4 Health education

Family pharmacists should educate patients about colorectal cancer disease management including drug use, nursing care, and dietary precautions. Family pharmacists should empathize with patients through typical cases, strengthen psychological counseling efforts, and cultivate a positive and optimistic attitude towards treatment in patients.

2.1.5 Communications between doctor and nurse

As a member of the treatment team, pharmacists should develop a list of therapeutic drugs commonly used in the surgical department; individually adjust the process of medication therapy management based on different diseases, types of operations, special populations, and other factors; collaborate with doctors to develop a comprehensive medication therapy plan and post-discharge working pathway. In addition, pharmacists can provide consultation and training to the family doctor team regarding drug safety, drug interactions, adverse drug reactions, and specific population characteristics related to drug use.

2.2 Responsibility of Pharmacists in Home Pharmaceutical Therapy Management for Colorectal Cancer

Home pharmaceutical therapy management (HPM) is an ongoing medication treatment process that emphasizes. The concept of patient-centered diagnosis and treatment after

discharge is a crucial aspect in healthcare. Clinical pharmacists in the HPM team play a pivotal role in formulating clinical drug treatment strategies and implementing rational drug-based pharmaceutical management centered on patients [10]. Home pharmaceutical therapy for colorectal cancer primarily targets patients with stable colorectal cancer who have received a clear diagnosis and are undergoing drug treatment. This includes:

2.2.1 Colorectal cancer patients who are using anti-tumor drugs and have questions about drug use or drug treatment plan;

2.2.2 Colorectal cancer patients with multiple complications;

2.2.3 Colorectal tumor patients exhibiting suspected adverse drug reactions during the course of treatment;

2.2.4 Colorectal cancer patients with one or more chronic diseases, receiving multi-system drugs or multi-specialty treatment;

2.2.5 Colorectal cancer patients experiencing frequent changes in their treatment regimen and displaying poor compliance;

2.2.6 Colorectal cancer patients requiring other pharmaceutical therapies.

The treatment plan for patients with colorectal cancer is usually a 2-week or 3-week treatment cycle. In the first week after drug treatment, an appointment is made with the patient for home pharmaceutical therapy, and then the follow-up time is agreed upon with the patient every 2-3 weeks or when the patient's treatment plan changes or adverse drug reactions occur. It is clear whether the patient understands the correct use method and precautions of the drug being used, and pays attention to the patient's medication compliance and adverse reactions after medication.

2.3 The specific working path of HPM pharmaceutical therapy management

The service content of home pharmaceutical therapy management should focus on the main treatment drugs for colorectal cancer and the drugs related to its complications, to meet the individual needs of patients with colorectal cancer in the course of drug treatment. Targeted evaluation, analysis, and solution of drug use problems that may occur or have already occurred during the course of treatment, such as drug management for colorectal cancer treatment, evaluation of cancer pain patients and

analgesic drug management, adverse drug reaction evaluation, and guidance for patients to master self-management of drug use, etc., to achieve standardization, standardization and homogenization of colorectal cancer home pharmaceutical therapy services.

Family pharmacists should record the data according to the five core elements of drug therapy management, combined with the actual work, including (1) drug therapy review, (2) personal medication records, (3) drug related activity plan, (4) intervene or provide reference opinions, (5) documentation and follow-up. Where a medication schedule adjustment is involved, the final medication schedule shall be confirmed and signed by the family doctor or specialist, and the finished medication list shall be provided to the patient for reference and implementation.

2.4 Starting line for clinical pharmacists in home pharmaceutical medication therapy management

Studies have shown that the services of home pharmacists can reduce the 90-day readmission rate of patients [11]. Comprehensive and specific home pharmaceutical therapy is conducive to drug safety assessment of patients, understanding of survival and disease progression, providing a basis for precise treatment, providing advice, and popular science education for diseases or adverse drug reactions. The reasons for poor efficacy, safety, compliance and execution accuracy of medication therapy should be analyzed. After the evaluation, the drugs are reconciled, and the drug treatment effect, adverse reactions, drug interactions and drug use in special populations are monitored dynamically. It is an important service item in the whole process of home pharmaceutical therapy management for colorectal cancer.

2.4.1 Assess the medication needs of patients at home and establish comprehensive records

Pharmacists providing home pharmaceutical care should conduct detailed inquiries and actively listen to and maintain meticulous records. By conducting inquiries, performing physical examinations, and reviewing patients' medical records, we can gain a thorough understanding of their overall condition, disease status, treatment details, diagnosis and relevant test results, surgical history, allergy history, medication history, etc. We should

inquire about patients' drug usage patterns and compliance levels to identify any errors or issues with medication habits. Additionally, we need to confirm whether there are any new problems related to drug treatment and provide guidance on the correct administration methods. It is also important to gather information about the patient's work situation, eating habits, and lifestyle choices (such as tobacco and alcohol use) to establish a comprehensive file containing all pertinent medication-related information.

2.4.2. Organize medication records systematically.

Comprehensive documentation of the current medications used by patients is essential. This includes recording the main therapeutic drugs currently prescribed, such as chemotherapy drugs, targeted drugs, and immune-modulating agents; it is important to record other related medications such as analgesics, nutritional therapies, sedatives/sleep aids, Chinese herbal medicine, and any medications included in the patient's home medicine kit. The name, dosage, and frequency of antitumor drugs administered along with their start dates should be documented. The adverse reactions that may occur after taking these medications must also be recorded. Furthermore, the patient's past use of medications including discontinuation reasons should be noted.

2.4.3 Evaluate and recommend an appropriate drug treatment plan.

Based on evidence-based research findings and individual patient characteristics, a comprehensive evaluation was conducted on all drugs currently used, being used, and expected to be used by the patient. This evaluation considered drug treatment indications, effectiveness, safety, and compliance based on evidence-based evidence and the patient's specific situation. For patients with improper drug use, family pharmacists can provide drug reorganization and management services for drug treatment. They can also propose medication-related suggestions and communicate with the patient's specialist or family doctor to determine new drug treatment plans.

3 Evaluate the rationality of the drug treatment plan.

Based on evidence-based research findings and individual patient characteristics, a comprehensive evaluation was conducted on all drugs currently used, being used, and expected to be used by the patient. This evaluation considered drug treatment indications, effectiveness, safety, and compliance based on evidence-based evidence

and the patient's specific situation. Medication management of concomitant diseases, include thrombosis, hypertension, coronary heart disease, and diabetes, involves the use of appropriate tools like Inappropriate Prescription Screening tool (STOPP) and prescription omission tool (START) [12,13]. For patients with improper drug use, family pharmacists can provide medication reconciliation services for drug treatment. The PROMPT criteria can be applied to middle-aged individuals for assessing chronic disease control and analyzing drug treatment intervention plans. This approach helps identify drugs that lack indications or sufficient prognostic benefits or cause side effects. By implementing a multidisciplinary collaborative model in pharmacy management, adverse drug reactions can be reduced and unfavorable outcomes avoided. They can also propose medication-related suggestions and communicate with the patient's specialist or family doctor to determine new drug treatment plans.

3.1 Adaptability: Evaluate the treatment plan of patients according to the Chinese Norms for the Diagnosis and Treatment of Colorectal Cancer (2020 edition) [14], defining the treatment objectives, and determining whether it falls under preoperative, postoperative adjuvant, or palliative treatment. Baseline imaging assessment and relevant gene detection were completed prior to systemic treatment (including KRAS and NRAS gene mutation detection for clinically diagnosed recurrent or metastatic colorectal cancer patients). Additionally, consider screening for Lynch syndrome, prognostic stratification, and guidance for immunotherapy by performing mismatch repair (MMR) protein expression or microsatellite instability (MSI) detection in colorectal cancer patients [15,16]. Review drug therapy rationality by identifying unnecessary treatments or potential need for additional drug therapy.

3.2 Effectiveness: Assess the efficacy of the primary treatment regimen in disease control, including reduction in size of the primary tumor or metastatic lesions observed through imaging examinations, as well as a decrease in colorectal cancer-related markers such as carcinoembryonic antigen (CEA), CA19-9, and CA242. Evaluate alternative options for drug selection (availability of more effective drugs, ineffectiveness of current treatment regimen, unsuitable dosage form or route of administration) and consider the use of single-component drugs instead of combination

therapies. Also assess factors like low dose usage (insufficient dosage or frequency, inadequate duration of treatment) and inappropriate drug utilization (incorrect timing or method of administration).

3.3 Safety: Evaluate the safety profile of the medication by considering potential adverse reactions such as unexpected pharmacological effects at normal doses, allergic reactions, drug interactions, changes in special physiological conditions during therapy initiation or discontinuation periods, repeated administrations with possible cumulative effects on toxicity levels and speed at which dose adjustments are made.

3.4 Compliance: Assess patient compliance by evaluating factors such as dysphagia associated with medication dosage forms used by patients, difficulties encountered while purchasing medications, excessive frequency or quantity intake, need for assistance from others to administer medications, adherence to an economically optimal treatment plan, subjective reasons affecting compliance such as forgetfulness regarding medication intake schedule, misunderstanding instructions provided with medications leading to incorrect usage patterns and self-adjustment in dosages without medical advice. Additionally conduct economic evaluation related to patients' utilization patterns for prescribed medications.

4 Key points of complications monitoring for pharmacists in home pharmaceutical therapy management of colorectal cancer

Patients need to be evaluated for home pharmaceutical therapy management. Drug monitoring includes the assessment of disease-related or cancer pain, nausea and vomiting, nutritional status, venous thromboembolism, and infection prevention and treatment. The major treatment options for malignancy include surgery, radiotherapy, and pharmacotherapy. Various complications of the gastrointestinal tract accompany with the course of disease. Pharmacists should evaluate various concurrent symptoms that may occur in patients with colorectal cancer during home treatment, and manage the disease-related complications such as cancer pain, nutrition, nausea and vomiting, diarrhea, constipation, and insomnia.

4.1 Pain management

Pain is one of the prominent symptoms of patients with middle and advanced cancer, and 70%-80% of patients with cancer pain require analgesic treatment [17]. The pain management ladder mainly consisted of three steps, First Step - mild pain: non-opioid analgesics such as nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen with or without adjuvants; Second Step - moderate pain: weak opioids (hydrocodone, codeine, tramadol) with or without non-opioid analgesics and with or without adjuvants; Third Step - severe and persistent pain: potent opioids (morphine, methadone, fentanyl, oxycodone, buprenorphine, tapentadol, hydromorphone, oxymorphone) with or without non-opioid analgesics, and with or without adjuvants[18], Gabapentin, pregabalin also can be given for analgesia [19]. Family pharmacists should be proficient in the titration conversion between different opioids and pain assessment, and perform pain assessment for patients with colorectal cancer according to the VAS pain scale. Pain is divided into 10 points, 0 is no pain, 1-3 is mild pain, 4-6 is moderate pain, and 7-10 is severe pain. Patients should be urged to strictly implement the three-step management of pain, adhere to taking medicine on time, reduce the outbreak of pain, actively prevent the adverse reactions of pain drugs, pay attention to the education and psychological communication of pain drugs for family members, and improve patient compliance. At the same time, attention should be paid to the etiology, pain education and social psychological support for patients and their families.

4.2 Nutrition management

Malignant tumors are chronic wasting diseases, and poor nutritional status is common in cancer patients, The prevalence of malnutrition in CRC patients ranges from 20 to 37% [20,21], which can cause treatment outcomes to decrease and negatively impact patient prognosis and long-term quality of life [22,23]. NRS 2002 recommends a nutrition plan for patients with a total score ≥ 3 ; for those whose score is temporarily < 3 , nutritional risk screening can be repeated periodically [24,25]. During chemotherapy, protein intake should exceed $1\text{g}/(\text{kg}\cdot\text{d})$ and is recommended to reach $1.5\text{-}2.0\text{g}/(\text{kg}\cdot\text{d})$ in patients with malnutrition or nutritional risk when daily energy intake is less than 60% of the requirement for more than one to two weeks or expected not to be able to eat for seven days or more, or when inadequate intake induces weight loss [26]. To regulate

the body's immune function, improve metabolism, and enhance chemotherapy tolerance among colorectal tumor patients with malnutrition, family pharmacists should use the Nutritional Risk Screening tool (NRS2002) routinely to conduct nutritional risk screening [27-30]. They should calculate patient BMI and formulate individualized nutritional programs accordingly. There are some rules that need attention: (1) enteral nutrition supplementation should be advocated first as long as gastrointestinal function is good and patient tolerates it well; (2) start with small dose, low concentration, low frequency enteral nutrition powder gradually increasing until target calorie supply reached; (3) diabetic patients should choose enteral nutrition preparations specifically designed for them; (4) immunocompromised individuals must select enteral nutrition preparations suitable for tumors.

4.3 Nausea and vomiting management

Nausea and vomiting are the most prevalent adverse events following oncologic surgery, with an incidence rate of 30%. The administration of opioids in perioperative analgesia may also escalate the risk of nausea and vomiting in a dose-dependent manner. In patients undergoing colorectal chemotherapy who do not receive antiemetic drugs, up to 70%-80% will develop chemotherapy-induced nausea and vomiting (CINV). This can lead to detrimental consequences such as dehydration, metabolic disorders, diminished self-care ability, nutritional deficiencies, anorexia, reduced physical strength, wound debridement complications, and esophageal mucosa tearing [31-33]. Therefore, the prevention or management of CINV holds paramount importance. Clinically employed treatments include 5-HT₃ receptor antagonists, NK1 receptor antagonists, corticosteroids, anti-dopamine agents, antihistamines, and anticholinergics [34]. The metabolism of 5-HT₃ receptor antagonists is associated with CYP2D6 in vivo [35], while aripiprazole acts as both a substrate and moderate inhibitor of CYP3A4 and inducer of CYP2C9[36]. Metoclopramide-induced extrapyramidal reactions are linked to plasma drug concentration in vivo, and its plasma exposure is also influenced by CYP2D6 gene polymorphism [37]. The selection of antiemetic drugs should be based on the emetogenic risk level associated with the chemotherapy regimen as well as previous experiences with antiemetics while fully considering patient-related risk

factors. Chemotherapy-induced vomiting risks can be categorized into four grades: high, moderate, low, and minimal. Family pharmacists should evaluate patients' susceptibility to vomiting and guide drug usage according to their respective grade levels. Apart from chemotherapy-related factors, patient-related risk factors encompass being female, younger than 50 years old, a history of prior CINV, motion sickness, vomiting during pregnancy, anxiety, and no or low alcohol consumption in daily life.

4.4 Diarrhea and constipation

Patients undergoing home-based oral chemotherapy, such as capecitabine, regorafenib, furoquinetinib, or long-term use of anti-tumor drugs like irinotecan hydrochloride, etoposide, fluorouracil, cyclophosphamide, cytarabine and other periodic chemotherapy regimens may experience diarrhea. Conversely, opioid analgesics and vinblastine anti-tumor preparations are more likely to cause constipation. The primary objective in managing diarrhea and constipation is to regulate bowel movements to occur 1-2 times a day. Pharmacists should gather information on the patient's bowel habits, diet patterns, activity levels etc., in order to devise appropriate treatment plans:

- (1) Adjust the frequency and dosage of antidiarrheal medications based on individual circumstances: for patients with mild diarrhea, oral rehydration salts can be supplemented along with intestinal probiotics. In cases of moderate diarrhea, montmorillonite powder (3g, three times a day) can be added to the rehydration salts and probiotics regimen. The initial dose should be 6g. For acute severe diarrhea, loperamide hydrochloride capsules (4mg, once daily) can be administered in addition to rehydration salts and probiotic conditioning; however, the total daily dose should not exceed 6 capsules. Modification: This sentence has been revised to enhance its academic tone while maintaining its original meaning.
- (2) Advise patients to maintain anal hygiene after defecation in order to prevent infection. Modification: This sentence remains unchanged.
- (3) If patients complain of anal pain, it is recommended that they wash their anus thoroughly and apply an oily ointment around the area to prevent direct contact between feces and skin. Modification: This sentence remains unchanged.
- (4) Depending on the severity of chemotherapy-induced constipation, assist patients in adjusting laxative dosages and frequencies. Commonly used medications include wheat

fiber granules, lactulose oral liquid, polyethylene glycol 4000 powder etc. Additionally, abdominal hot compress using Chinese medicine Wuscornus can aid in bowel movement. If a patient does not have a bowel movement for more than 3 days despite these measures being taken into account promptly investigate the possibility of intestinal obstruction and seek medical attention accordingly. Modification: This sentence has been modified by incorporating more formal language suitable for an academic context. (5) Encourage patients to establish regular daily bowel habits by consuming foods rich in fiber and water [38,39], as well as creating a balanced meal plan. Modification: This sentence remains unchanged.

4.5 Insomnia

The psychological and physiological changes experienced by cancer patients are substantial. Depending on the tumor type and treatment stage, the prevalence of sleep disorders in cancer patients is 20%-59%, which is approximately three times higher than that of the general population [40,41]. Long-term pain and continuous treatment can lead to depression, anxiety, insomnia, and other psychological stress reactions among patients. It is crucial for family pharmacists to engage in thorough communication with both patients and their families, understand the current sleep patterns and psychological well-being of patients, and provide personalized recommendations based on individual circumstances: (1) For patients seeking non-pharmacological interventions rooted in scientific knowledge, options such as exercise therapy, massage therapy, foot baths or music therapy should be considered alongside emphasizing the importance and necessity of medication; (2) Patients may also benefit from traditional heart-soothing herbal therapies like Zao Ren Anshen capsules or Suanzao Ren pills for nourishing blood while promoting tranquility; Yangxin Anshen formulations like Tianwang Buxin Dan or Zhongzhen Anshen formulas such as Cinar Anshen pills could also be explored. Modern proprietary Chinese medicine treatments like Wuling capsule may offer additional alternatives; (3) Pharmacotherapy should be employed when necessary to aid sleep quality while enhancing patient understanding regarding sleeping pill effects and proper usage. Short-acting benzodiazepines including lorazepam or oxazepam can be considered along with long-acting

benzodiazepines such as Clonazepam, Alprazolam or Estazolam. commonly used imidazopyridine hypnotic drugs include Zolpidem tartrate which acts rapidly but has a short duration of action; (4) In cases where insomnia stems from pain-related issues, timely adjustment of analgesic plans should occur to improve patient compliance with medications, thereby enhancing the quality of life [42].

4.6 Evaluation of concomitant diseases

Medication management of concomitant diseases, such as thrombosis, hypertension, coronary heart disease, and diabetes, involves the use of appropriate tools like Inappropriate Prescription Screening tool (STOPP) and prescription omission tool (START). The PROMPT criteria can be applied to middle-aged individuals for assessing chronic disease control and analyzing drug treatment intervention plans. This approach helps identify drugs that lack indications or sufficient prognostic benefits or cause side effects. By implementing a multidisciplinary collaborative model in pharmacy management, adverse drug reactions can be reduced and unfavorable outcomes avoided.

5 Key points of medication monitoring for adverse effects in home pharmaceutical therapy management of colorectal

In terms of drug treatment, traditional chemotherapy not only kills tumor cells but also causes damage to normal cells, resulting in severe adverse reactions. Common adverse drug reactions associated with colorectal cancer treatment drugs include myelosuppression (primarily decreased white blood cells, neutrophils, and platelets), gastrointestinal reactions (such as loss of appetite, nausea, vomiting, gastrointestinal bleeding, abdominal pain, and diarrhea), neurotoxic reactions (including sensory disturbances or abnormalities in the extremities and painful cramps or cold sensitivity), skin symptoms (such as numbness, tingling sensation, painlessness or pain, skin swelling or erythema, peeling dandruff blisters or severe pain), oral mucositis liver function impairment renal function impairment and immune treatment-related adverse reactions. It is advisable to provide guidance on preventing or mitigating these adverse reactions that may occur in patients undergoing different drug treatment regimens by promptly discontinuing medication in case of serious adverse drug reactions.

5.1. Single-drug chemotherapy

The commonly used drug therapies for colorectal cancer include single-drug chemotherapy regimens such as fluorouracil drugs trifluridine, rhatitrexide, capecitabine. Monitoring indicators should focus on the following potential adverse drug reactions; if a patient cannot tolerate, they should seek medical attention promptly and adjust the treatment plan accordingly:

5.1.1 Nausea vomiting poor appetite and other side effects can be alleviated with anti-emetic drugs for mild to moderate cases; however severe cases that do not respond to medication require immediate medical intervention. If medication (capecitabine regorafenib) is missed due to vomiting it is unnecessary to take it on the same day; and it can be taken according to the original treatment plan on the following day.

5.1.2 Cardiotoxicity such as chest tightness chest pain breathlessness lower limb edema etc.

5.1.3 Mental abnormalities caused by hyperammoniasis such as insanity disorientation coma ataxia etc.

5.1.4 Nerve end toxicity, such as hand-foot syndrome, such as tingling, swelling, pain, erythema accompanied by tenderness, desquamated limbs edema, peripheral neuropathy, decreased sensation, taste difference, etc.

5.1.5 Oral mucositis, mild and moderate oral mucositis can be gargled with concentrated tinidazole or gallic acid gargle, and supplemented with vitamins, when drugs cannot alleviate the oral mucositis, or affect eating, it's necessary to seek medical attention in time.

5.1.6 Diarrhea can be treated with drugs according to the severity of diarrhea (see disease complications - diarrhea and constipation). When the patients with severe diarrhea that cannot be alleviated by drugs should seek medical attention in time.

5.2. Combination chemotherapy

Regimens based on fluorouracil, a common chemotherapy regimen for colorectal tumors, include CapeOx (capecitabine + oxaliplatin), FOLFOX (oxaliplatin + fluorouracil + calcium folinate), FOLFIRI (irinotecan + fluorouracil/capecitabine + calcium folinate), and FOLFOXIRI (oxaliplatin + irinotecan + fluorouracil + calcium

folinate). In addition to monitoring the adverse reactions caused by monotherapy, it is important to monitor the following drug toxicities. If patients cannot tolerate them, they should seek timely medical attention and adjust the treatment plan according to their actual condition:

5.2.1 Hematological toxicity including neutropenia, leukopenia, thrombocytopenia, anemia, etc. Neutrophil or leukocyte reduction can be used during or 24-48 hours after chemotherapy to prevent these toxicities. Recombinant human granulocyte stimulating factor or Chinese patent medicines such as Di Yu Sheng Bai tablets are also recommended for prevention. Thrombocytopenia can be managed with recombinant human thrombopoietin or oral medications like Leucogen tablets. Decreased hemoglobin levels or unstable blood counts can be addressed/prevented using Sheng Xue Tiao Yuan granules and Sheng Xue Bao mixture.

5.2.2 Gastrointestinal functional syndrome including dyspepsia, gastrointestinal bleeding, abdominal pain, diarrhea, constipation dehydration, and abdominal paresthesia. Digestive enzymes may help alleviate indigestion. Mild to moderate abdominal pain can be relieved with antispasmodic drugs such as drotaverine hydrochloride or pivillium bromide tablets. Severe pain or bleeding requires immediate medical attention.

5.2.3 Allergic reactions including conjunctivitis, rash, exfoliative dermatitis, rhinitis, pruritus, shortness of breath, and bronchospasm. The mild to moderate allergic reactions can be alleviated with antihistamines. Serious shortness of breath and bronchospasm should be promptly treated while investigating lung function and infection.

5.2.4 The timely treatment of infectious and invasive diseases, including local and fatal systemic infections caused by bacteria, viruses, and fungi, is crucial. This includes addressing oral candida resulting from oral ulcers as well as bacterial or viral infections caused by coughing, sputum production, fever, etc.

5.2.5 Prompt management of cardiovascular system disorders such as hypotension, hypocalcemia, thrombosis, pulmonary embolism, myocardial infarction is essential.

5.3 Targeted drug therapy

Options like cetuximab, bevacizumab, regafenib and fuquinitinib should be considered. When using a combined chemotherapy regimen with targeted therapy drugs in addition to monitoring the serious adverse reactions associated with monotherapy and combined chemotherapy; it is important to also monitor the following toxicities specific to each drug for patients' well-being. If intolerable side effects occur in patients seeking medical attention promptly becomes necessary while adjusting the treatment regimen according to individual circumstances:

5.3.1 Close monitoring of dehydration symptoms along with hypomagnesia-induced headache is required when administering cetuximab.

5.3.2 Bevacizumab necessitates close surveillance for various infections such as cellulitis abscesses sepsis bone marrow suppression hyponatremia heart failure tachycardia proteinuria urinary tract infection muscle and joint pain pelvic pain peripheral sensory neuropathy.

5.3.3 Rigafenib demands close monitoring for infection myelosuppression hyperuricemia bleeding hypertension dysphonia gastroesophageal reflux weight loss among others.

5.3.4 Fuquinitinib requires vigilant observation for hypertension dysphonia sore throat oral mucositis various infections decreased liver function bone marrow suppression.

5.4 Traditional Chinese Medicine (TCM) adverse reactions arising from long-term use of Chinese herbs or Chinese patent medicine treatments like lobelia, white flower snake house, septicum, dandelion require regular assessment of liver and kidney function, jaundice and hemuria.

6 Patient medication risk management

According to the previous evaluation results on rational drug use, in combination with important indicators such as liver and kidney function, as well as circulatory system function, potential adverse reactions and related examination indicators (e.g., blood and urine routine tests, blood drug concentration) should be considered by family pharmacists when managing risks associated with patients' medication use. The management of critical values is a crucial aspect of home pharmaceutical care for cancer patient:

6.1 critical value monitoring

Critical values refer to extremely abnormal test results that pose a life-threatening risk. Family pharmacists should familiarize themselves with specific indicators and their ranges, including but not limited to serum creatinine, fasting blood glucose levels, K⁺, Na⁺, Ca²⁺, blood gas analysis parameters, hemoglobin levels, white blood cell count (WBC), platelet count, and blood coagulation time. Timely identification of critical value indicators can assist in analyzing whether they are related to medications used by the patient. Furthermore, family pharmacists can provide professional pharmaceutical therapy advice and remind patients to seek appropriate treatment measures or medical attention promptly in order to avoid missing the optimal treatment window and causing severe harm or even life-threatening situations.

6.2 Hierarchical management of adverse reactions

Colorectal cancer patients often have various comorbidities requiring multiple drugs; therefore, adverse drug reactions are common occurrences among them such as infections, elevated aminotransferase levels indicating abnormal liver function, renal impairment affecting kidney function integrity, increased bilirubin levels in the bloodstream along with compromised immunity [43]. Reference may be made to the National Cancer Institute Common Terminology Criteria for Adverse Events (CTCAE) classification system for categorizing common adverse drug reactions associated with anti-tumor therapy drugs. Management strategies for adverse drug reactions should be classified.

7 Preparation of drug list and drug guidance

The patient's adjusted medication regimen should be documented, including the primary treatment plan and the drug control plan for managing disease complications. Any recent adjustments to the medication regimen should also be recorded, specifying the time and specific changes made. The patient's personal medication list should be organized and summarized based on the purpose of each drug, providing information on its name, dosage instructions, guidelines for missed doses, and pharmaceutical therapy recommendations.

8 Medication education and follow-up after discharge

8.1 Discharged patients should receive comprehensive medication education

Follow-up assessments should collect data regarding medication effectiveness, adverse reactions, and adherence to prescribed treatments based on each patient's specific disease type, postoperative category, and key medications used. Drug education for colorectal cancer patients should consider their educational background and comprehension abilities; it must cover indications for use, proper dosage instructions, timing of administration, precautions to take while using medications, potential adverse reactions along with corresponding treatment methods or interventions in case of overdose or missed doses. Additionally important are details about shelf life of drugs as well as lifestyle guidance related to colorectal cancer management. Family pharmacists can create short educational videos about colorectal cancer awareness that guide patients in self-learning processes while enhancing their ability to manage their condition effectively. Individualized follow-up plans/forms tailored according to specific diseases/medications can be developed utilizing mobile applications or other platforms such as pharmaceutical outpatient services or follow-up information systems via telephone/email communication.

8.2 Follow-up tracking

Based on tumor progression status and associated complications' characteristics evaluation, the patient's current drug treatment plan was reassessed, and the economic benefits were estimated in conjunction with the contents of the previous service. Compliance was also evaluated. The follow-up period typically lasts 2-3 weeks but can be extended based on specific circumstances, with a minimum follow-up duration of 1-3 months required for cases involving changes in treatment plans or adverse reactions. Family pharmacists can conduct follow-ups through phone calls, WeChat, Instagram, or other online tools, as well as provide in-home visits. Patients can also visit the pharmacy clinic or proactively report any new developments to the family doctor team via an internet hospital.

9 Family medicine cabinet management

Assistance is provided to patients in organizing their family medicine boxes by assessing whether essential therapeutic drugs are sufficient according to their treatment plans and return visit schedules. The following aspects are managed:

9.1 Drug classification management

Separation of main therapeutic drugs from adjuvant drugs for concurrent diseases; separation of adult and pediatric medications; segregation of internal and external medications; differentiation between first-aid drugs and regular prescription drugs; storage according to instructions' requirements (including temperature, humidity, darkness, closure).

9.2 Expiration drug management

Retention of drug packaging and regular checks on expiration dates; avoidance of excessive stockpiling (generally reserving 1-2 courses for chemotherapy or other major therapeutic drugs); except for chronic patients requiring long-term medication, preparation of 3-5 days' worth of spare medication for other family members; prioritization of near-expiry date medications; regular disposal of expired or spoiled drugs.

9.3 Guidance on safe drug use

All medications should be stored out of reach of children, preferably in a locked cabinet; The use of drugs should always be supervised by healthcare professionals, including doctors and pharmacists; It is crucial to enhance drug safety education for children, emphasizing the distinction between drugs and food to prevent accidental ingestion.

9.4 Drug recovery

Efforts should be made to recover unused or expired stickers related to narcotic drugs and psychotropic substances classified as category; Identification and retrieval of expired or deteriorating medications are essential for ensuring drug safety.

10 Referral communication

Pharmacists involved in home pharmaceutical therapy must maintain close communication and collaboration with colorectal cancer specialists to ensure coordinated patient management [44]. When necessary, timely communication with the primary care physician is required for improving the current treatment plan or

addressing any medication-related issues. In cases where patients with colorectal cancer experience severe adverse drug reactions, serious complications, or critical test results, prompt referral to a hospital for observation and treatment is recommended.

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