Treatment Options for Colorectal Liver Metastases

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Colorectal cancer commonly metastasizes to the liver. Liver metastases are present in 25% of patients at the time the primary tumor is diagnosed and will ultimately occur in up to two-thirds of the patients who develop advanced colorectal cancer. In 50% of patients with metastatic colorectal cancer, the liver is the only site of disease. The overall prognosis for patients with untreated liver metastases is poor, with survival of 4-8 months. Clearly, liver metastases are a frequent and lethal complication of cancer and require effective therapy. Here I would like to review the current treatment options for patients with colorectal liver metastases and also describe three new and potentially more effective treatment methods that are being developed at The University of Texas M. D. Anderson Cancer Center: hepatic resection, intra-arterial chemotherapy, and chemoembolization.

Liver metastases are a frequent and lethal complication of cancer and require effective therapy.

Hepatic Resection
More than 140,000 cases of colorectal cancer are diagnosed each year in the United States, approximately 40,000 of whom will die of hepatic metastases. The only treatment with any potential of cure is hepatic resection. The study that best defined the potential ability of hepatic resection to cure patients with colorectal liver metastases was from the Registry of Hepatic Metastases. This registry contains the records of 859 patients from 24 institutions who have undergone hepatic resection for colorectal liver metastases. In this study, overall 5-year survival was 33%. This result was significant, considering that patients who are not treated for colorectal liver metastases consistently do not survive beyond 3 years.

At the M. D. Anderson Cancer Center, patients are considered for hepatic resection only if they are medically fit to withstand major surgery, if disease is limited to the liver, and if there are fewer than four metastases. If these three criteria are fulfilled, then a more extensive preoperative evaluation is performed, including an intravenous (IV) contrast computed tomographic (CT) scan of the entire abdomen and pelvis with a detailed examination of the mesenteric, para-aortic, portal, and celiac lymphatics. Colonoscopy of the entire colon is performed if the primary colon resection occurred more than 3 months previously. Further x-ray evaluation is performed only for specific complaints. All patients undergo a celiac and superior mesenteric arteriogram to define hepatic arterial anatomy and thus the vascular supply to the tumor. Because approxi-
mately 40% of patients have anomalous hepatic arterial anatomy, this knowledge is important in planning a resection.

In addition, all patients at M. D. Anderson undergo a dynamic CT angiogram. This is a more sensitive test than the IV-contrast CT scan because it can detect small (1-2 cm) lesions and also define the relationship of the metastases to the hepatic veins. The rationale for a CT angiogram is based on the fact that metastases derive the majority (90-95%) of their blood supply from the hepatic artery and a minimal amount from the portal vein. Thus, contrast injection into the portal vein will maximally enhance the normal liver parenchyma, and the metastases will appear as low attenuation defects. If the preoperative evaluation fails to detect extrahepatic disease and the metastases appear to be technically resectable, the patient undergoes an exploratory laparotomy and possibly a hepatic resection.

At surgery, the abdomen is explored in detail. The lymphatics (celiac, portal, para-aortic, and mesenteric), anastomotic site, and peritoneal surfaces are closely examined for metastatic disease. If no disease is discovered, the liver is examined with intraoperative ultrasound. We use a T-shaped probe with a 5- or 7.5-mHz frequency. The three-step examination begins with identification of the hepatic veins and follows their course throughout the liver. The second step traces the portal pedicles (consisting of the portal vein, hepatic artery, and bile duct) throughout the liver. The final step is a careful examination of the hepatic parenchyma, which can determine if additional lesions are present, define tumor/vessel relation, and aid in planning the resection.

Many types of hepatic resections can be performed and are classified as either anatomic or segmental (nonanatomic). The type of resection is determined by the size and anatomic location of the metastases. Large lesions (> 5 cm) that are confined to one anatomic lobe or metastases that are located adjacent to important vascular structures require an anatomic resection. Examples of anatomic resection are a right or left lobectomy and a trisegmentectomy (resection of the entire right lobe and medial segment of the left).

Not every patient requires a hepatic lobectomy to completely extirpate the metastatic disease. A proportion of patients can potentially be cured by a limited hepatic resection or segmentectomy. We prefer to perform a segmentectomy, since this procedure significantly reduces blood loss, shortens operating time, lowers morbidity and mortality, and achieves long-term survival. Segmentectomy should be performed only if tumor size is less than 4 cm and if a tumor-free surgical margin greater than 1 cm can be achieved. The anatomic rationale for this procedure is based on the eight functional units that compose the liver, each of which possesses a separate and identifiable portal pedicle and draining hepatic vein. The use of intraoperative ultrasound is mandatory to identify the intrahepatic vascular structures. This procedure can be safely performed in three isolated hepatic segments that will permit resection of bilobar metastases. Resection of bilobar metastases should be considered, since the disease-free survival has been shown to be equivalent to that of patients who undergo resection of the same number of unilobar metastases.

Intra-arterial Chemotherapy

Unfortunately, only 10-15% of patients with colorectal liver metastases have resectable disease. One treatment option for the remaining patients is hepatic arterial chemotherapy. Metastases derive 90-95% of their blood supply from the hepatic artery, and the normal liver derives 75% of the blood supply from the portal vein. The rationale behind this treatment, then, is that intra-arterial chemotherapy will achieve a higher concentration in the tumor than in the normal liver. At M. D. Anderson the majority of patients receive intra-arterial therapy through a surgically implantable pump that continuously infuses drugs and permits the patient to perform normal daily activities while receiving therapy. The pump is placed in a subcutaneous pocket and attached to a catheter that is placed in the hepatic artery. Objective tumor response to floxuridine (FUDR) administration has been shown to be significantly better in patients receiving intra-arterial therapy (42%) than in those receiving IV therapy (10%). The toxicity of intra-arterial therapy is primarily hepatobiliary and manifested initially by elevated liver enzymes. If therapy is continued despite abnormal liver function, permanent hepatocellular drainage can occur (i.e., biliary sclerosis). Although intra-arterial therapy improves response, significant survival benefit has not yet been demonstrated. At M. D. Anderson ongoing protocols are trying to improve efficacy of intra-arterial therapy and achieve prolonged survival. One study is examining the effect of intra-arterial FUDR and folinic acid in the treatment of liver metastases. Potentially, the addition of folinic acid will enhance FUDR’s effectiveness and improve response. In addition,
Early Discharge for Mastectomy Patients Does Not Increase Morbidity

Will cost containment diminish the quality of patient care? To some, these goals are constantly at odds, but Michael J. Edwards, M.D., thinks otherwise. Edwards and four colleagues at The University of Texas M. D. Anderson Cancer Center compared two groups of mastectomy patients: one before a policy of early discharge was implemented, and one after. For the latter, they found that charges were reduced by 39% and length of hospitalization was reduced by 6 days with no increase in morbidity.

Edwards bases his confidence in cost containment on the success of his study. “But the ‘cost-effective’ measures imposed on physicians by insurance carriers may not all be as valid,” said Edwards, a fellow in the Division of Surgery. “It’s important, therefore, that physicians gather hard data to confirm that the care provided is not only cost effective but safe.”

Edwards was the principal investigator in a study (published last fall in the Annals of Surgery, 208:330-336, 1988) that examined one such cost-containment policy: early discharge for mastectomy patients. Edwards and colleagues compared 59 patients who had mastectomies in 1983-84 with 61 patients who had mastectomies in 1986-87. The first group had “standard management”: patients were admitted 24 hours before surgery and were discharged only after surgical drains had been removed. Patients in the second group, however, were admitted on the day of surgery and discharged “early” with drains in place. The 6-day reduction of the length of stay (from 10.5 days in the first group to 4.3 in the second) resulted in an average savings of $1,886 per patient (adjusted for a 12% increase in inflation). But more important, complication rates (seroma, hematoma, wound necrosis, and infection) between the two groups were not statistically different.

Unique Study

Admission on the same day of surgery and early discharge have been increasingly practiced, particularly by hospitals in the northeast and California, Edwards said. Though numerous studies have been published regarding the safety of these policies, this study was unique in that “confounding” variables were kept to a minimum.

“This study is important,” Edwards said, “because it was the first to examine two groups of patients who were operated on by the same surgeon (Frederick C. Ames, M.D., Department of General Surgery). Some studies compared patients operated on by different surgeons using a variety of techniques, whereas others compared different patient populations from a number of hospitals. These variables have to be taken into account when interpreting the data. In our study, all operations were done by the same surgeon, with the same technique, same drains, and same equipment. The only things that changed between the historical control group and the second group were when patients were admitted and when they went home.”

Edwards said the goal was to discharge the patient by the third or fourth postoperative day. Patients were discharged only if they had begun eating, were ambulatory, had adequate pain control, and had no special nursing requirements. Patients also had to be familiar with proper wound and drain care procedures. “Patient education was very important, and it began in the outpatient clinic at the time surgery was first proposed,” Edwards said. “The patient was taught how to manage the wound and drainage catheters before she was admitted to the hospital and also while recuperating after surgery. By her last day in the hospital, the patient was given complete responsibility for drain care under the supervision of the nursing staff.”

If the patient had underlying chronic disease or needed but lacked a care partner at home, then she remained hospitalized as long as necessary. Consequently, 15 of the 61 patients (25%) treated in 1986-87 required longer hospitalizations for these reasons.

“Clearly this policy does not apply to all patients,” Edwards said. “But at an institution like M. D. Anderson that performs 400 mastectomies a year, hospital charges could potentially be reduced by $750,000. And I think it’s safe to say, based on this experience, that patients prefer being at home. Some patients in this study lived alone and did not need a care partner to assist them, so the type of self-care required is not extensive.”

Since the conclusion of the study, hospitalization for mastectomy patients has been reduced further, to 3.2 days. Because of the success a majority of the physicians in the Department of Surgery have adopted this policy. Moreover, this policy is being extended to patients with other types of operations, such as regional lymphadenectomies.

“Patients having plastic surgery or surgery for extremity sarcomas can also be discharged with catheters in place,” Edwards said.

Physicians Must Be Involved

Though early discharge cannot be applied to all patients, the potential reduction in cost is still significant—continued on page 7
Non-Hodgkin's lymphomas occur in both adults and children. However, the relative incidence of these diseases differs between populations. Based on correlations of prognosis with histologic features, these diseases have been categorized according to the Working Formulation Classification as low, intermediate, and high grade. In children, the high-grade lymphomas predominate, whereas most adults have low- or intermediate-grade disease.

In general, chemotherapy is the undisputed primary treatment for intermediate- and high-grade lymphomas and low-grade disease in the late stages. Though radiotherapy's role has yet to be firmly delineated, it has been used in some studies to consolidate complete or partial remissions achieved with chemotherapy. The gradual improvement in results for patients with non-Hodgkin's lymphomas has been very gratifying. This is particularly true for patients with all stages of intermediate-grade lymphomas, the most common type being diffuse large cell lymphoma.

The high-grade lymphomas, including the undifferentiated (Burkitt's and non-Burkitt's) lymphomas and lymphoblastic lymphomas, usually occur in children, and it is not surprising that the greatest success has been seen in children. In our latest study, the 5-year survival of 36 patients with Murphy stage I undifferentiated lymphomas who were given combination chemotherapy was 100%. However, survival for children with leukemic manifestations of both undifferentiated and lymphoblastic lymphomas was poor.

The initial diagnosis of non-Hodgkin's lymphoma begins with a suspicion that an enlarged lymph node or an extranodal mass may be malignant. In a child with lymphoblastic lymphoma or undifferentiated lymphoma, the doubling time of the disease may be less than 24 hours. Immediate biopsy is mandatory. Once the diagnosis is established, the investigative procedures should be completed and treatment started within 24 hours. In older patients with a diagnosis of a low-grade lymphoma, such as an indolent follicular lymphoma, the time to biopsy and pretreatment evaluation may be somewhat longer.

Patients with diffuse large cell lymphoma and particularly those with disease in the oral pharynx may need prompt attention. Beginning with the follicular lymphomas, we will discuss investigative procedures, approaches to treatment, and results.

Follicular or Nodular Lymphomas

The clinical behavior of the follicular or nodular lymphomas is influenced by both the cell type and the stage, though all are usually associated with an indolent course. In the Working Formulation Classification, small cleaved (formerly known as poorly differentiated lymphocytic) and mixed cell types are called low-grade lymphomas, whereas the large cell lymphomas are considered to be more aggressive and therefore are included among the intermediate-grade lymphomas. Many of the clinical features of these lymphomas are paradoxical. The follicular lymphomas are seldom diagnosed in an early stage, yet even when diagnosed in an advanced stage they tend to run a chronic course. Also, although advanced disease usually responds to a variety of treatments, relapses are almost inevitable. Because of these paradoxes, investigators disagree about initial therapy, its timing, the importance of remission, and the possibilities for cure. Regardless of these controversies, median survival rates ranging from 5 to 9 years for patients with nodular lymphomas have been reported.

After sequential staging procedures that include lymphangiography, computed tomography, and bone marrow biopsy, approximately 50% of patients have documented evidence of stage IV disease, and 33% have stage III disease. In a research setting, where staging laparotomy is performed for patients with clinical stage I or II upper-torso disease, approximately 60% have positive abdominal findings and thus have stage III disease.

Stages I and II

In general, patients with clinical or laparotomy-determined stage I or II disease live longer than those with more advanced disease. Recently, several large patient series have demonstrated that a fraction of patients with stage I or II follicular lymphomas may be curable after radiotherapy alone or radiotherapy in combination with chemotherapy. In a study at Stanford University, patients who received total lymphoid irradiation had a better freedom-from-relapse rate than patients who received treatment to involved or extended fields. In our experience, patients who received combination chemotherapy and radiotherapy had a better 5-year relapse-free survival (RFS) rate (64%) than those who received involved-field radiotherapy alone (37%). Although laparotomy for staging can better define
patients who would benefit from involved-field radiation alone, future clinical research may demonstrate that more extensive radiotherapy fields or adjuvant chemotherapy regimens that control occult abdominal disease obviate staging laparotomy.

Stage III
Although stages III and IV follicular lymphomas usually respond to initial treatment with chemotherapy, long-term studies have shown that patients with generalized disease have a prolonged risk of relapse. Because relapse has been assumed to be inevitable, the general conclusion has been that patients with advanced stage III disease cannot be cured. In 1981, Cox, who was then at the University of Wisconsin, reported a 61% RFS rate for 29 patients treated with total lymphoid irradiation. The data suggested that the RFS curve had reached a plateau, and thus that some patients may have been cured. Subsequently, Paryani et al. reported potential cures for approximately 40% of patients with follicular small cleaved cell and follicular mixed lymphomas treated with radiotherapy.

More recently, we reported our results for a combined modality program of CHOP-Bleo (cyclophosphamide, doxorubicin [14-hydroxydaunomycin], vincristine [Oncovin], prednisone, and bleomycin) chemotherapy and radiotherapy for patients with stage III disease. This program resulted in a complete remission rate of 81%, regardless of the disease's cell type, and the 5-year survival rate was 75%. The corresponding RFS rate was 52% for all patients and 64% for responders. Only one relapse occurred 4 years after treatment. A plateau in the RFS curve suggested many patients who achieved complete remission were cured. Adverse prognostic factors for this treatment approach included large cell histology, bulky abdominal disease, and above-normal serum lactic dehydrogenase (LDH) levels. The potential for cure mandates early intervention and treatment, when the disease is least extensive.

Stage IV
Chemotherapy is the acknowledged standard treatment for patients with stage IV follicular lymphomas. Little information is available on treatment results for stage IV disease because they are generally combined with those for stage III. Although evidence is lacking that patients with stage IV disease can be cured with current regimens, several studies have demonstrated a significant survival advantage for those who achieve remission. Most of the effective combination chemotherapy regimens for low-grade lymphomas contain cyclophosphamide, vincristine, and prednisone. Doxorubicin, bleomycin, and procarbazine are also common components of combination regimens. Currently, our approach to treating stage IV disease is to administer CHOP-Bleo chemotherapy to achieve a complete remission and subsequently, in an attempt to maintain this remission, administer the biologic response modifier alpha-interferon.

Diffuse Large Cell Lymphomas
Diffuse large cell lymphomas (DLCLs), formerly known as histiocytic lymphomas and before that as reticulum cell sarcomas, are the most frequently occurring histologic types of non-Hodgkin's lymphomas in adults.

Stages I and II
After sequential staging, short of laparotomy, approximately 40% of all patients appear to have clinically localized nodal or extranodal (E) presentations and no evidence of generalized disease. Yet, before the advent of effective combination chemotherapy, most patients who were given involved-field radiotherapy for localized disease died of distant disease within 1 year. This was particularly true for those with stage II or II-E disease—approximately 50% of patients with localized presentations. Results for involved-field radiotherapy have been satisfactory for only those few patients with very limited extranodal stage I or I-E head and neck disease (staged by the American Joint Committee as T1, T2, or TX) and for selected laparotomy-staged patients with favorable localized disease presentations. Thus, initial treatment for most patients with localized presentations of DLCL should be combination chemotherapy. Involved-field radiotherapy should be used to consolidate a good partial or complete remission.

Our treatment program has consisted of four cycles of CHOP-Bleo, alternated with involved-field radiotherapy, for a maximum dose of 450 mg/m² of doxorubicin. Thereafter, treatment was completed with four cycles of COP (cyclophosphamide, vincristine [Oncovin], and prednisone).

The 10-year survival rate for 147 patients treated on this program was 65%. Multivariate analysis demonstrated that survival was influenced adversely by age, gender, stage,
tumor volume, and above-normal LDH levels. All 24 patients with no adverse factors or, at most, one adverse factor survived up to 5 years, whereas the 5-year survival rate for those with four or more risk factors was 37%. Newer approaches to treatment are needed for patients in the latter category—approximately 25% of patients with localized presentations.

Stages III and IV
Five-year survival rates of patients with stage III and stage IV DLCL given various chemotherapy combinations have ranged between 30% and 50%. Factors that reportedly influence survival rates adversely include high tumor burden, above-normal LDH levels, and poor performance status. Stage of disease was less significant. We have identified three prognostic groups of patients treated with CHOP-Bleo (stage IV) or CHOP-Bleo and radiation (stage III). Those with the best prognosis had a low tumor burden and a normal serum LDH level. Their complete remission rate was 96%, and their 5-year survival rate was 87%. Patients with a poor prognosis had high tumor burdens and above-normal serum LDH levels. Their complete remission rate was only 49%, and their 5-year survival rate was 20%. Patients with an intermediate prognosis had either high tumor burdens or an above-normal LDH level; their complete remission rate was 71%, and the corresponding survival rate was 48%. These findings indicate that new treatment approaches are needed for high-risk patients whose chances for a good response to treatment and for survival are poor.

Lymphoblastic and Burkitt’s or Non-Burkitt’s Lymphomas
Lymphoblastic lymphomas and Burkitt’s and non-Burkitt’s lymphomas, also known as undifferentiated lymphomas or diffuse small noncleaved cell lymphomas (DSNCCls) in the Working Formulation Classification, occur mostly in children. A breakthrough in the treatment for children with these diseases occurred at the Memorial Sloan-Kettering Cancer Center in New York in 1974. Because of the strong tendency for both lymphoblastic lymphoma and DSNCCl to involve the central nervous system, Memorial Sloan-Kettering physicians emphasized both intrathecal and systemic chemotherapy. Their LSA₂-L₂ (second lymphosarcoma, second leukemia) regimen consisted of 10 chemotherapeutic agents (vincristine, prednisone, cyclophosphamide, doxorubicin, methyl­trexate, cytosine arabinoside, bis-nitrosourea, L-asparaginase, thioguanine, and hydroxyurea) and radiotherapy to the initial sites of disease. Subsequently, we found that the LSA₂-L₂ regimen was more effective for children with lymphoblastic lymphoma than for children with DSNCCl. Our current protocol for DSNCCl consists of high-dose cyclophosphamide and high-dose methotrexate with coordinated intrathecal methotrexate.

In addition, the original LSA₂-L₂ protocol has been modified three times for the treatment of lymphoblastic lymphoma and the related acute T cell lymphocytic leukemias. The effect of the latest regimen (T3A) proved to be related to the status of the bone marrow. The 5-year disease-free survival rate for patients with lymphoblastic lymphoma who were not considered to have leukemia was 100%, whereas the corresponding disease-free survival rate for patients with acute T cell lymphocytic leukemia was only 30%.

The status of the bone marrow also influenced the survival of patients with DSNCCl and other B cell lymphomas who were treated with high-dose cyclophosphamide and high-dose methotrexate plus intrathecal methotrexate. For 40 patients who were not considered to have leukemia, the survival was 72%, whereas only one of seven patients with leukemia survived over 5 years. Stage also influenced the survival of patients with DSNCCl who did not have leukemia. Five-year survival according to the Murphy staging system of 36 patients with DSNCCl was 100% for three patients with stage I disease, 71% for eight patients with stage II disease, and 72% for 21 patients with stage III presentations. However, it was only 50% for four patients with stage IV disease.

These results indicate that current treatment programs are effective for lymphoblastic lymphoma and DSNCCl stages I through IV but not for patients with evidence of associated leukemias. Other treatments are required for leukemic presentations of both diseases.

New Horizons in Understanding and Treating Non-Hodgkin’s Lymphomas
As a result of somatic mutation, genetically unstable tumor cells may rapidly develop resistance. This genetic instability may be a major limitation of cancer chemotherapy for any malignant disease. This hypothesis suggests that the highest probability for such a mutation occurs in tumors such as DSNCCl and lymphoblastic lymphomas that have high numbers of malignant cells. The theory implies that the best possibility for preventing the development of resistant cell lines is to treat the disease with as many effective agents as possible using the highest permissible dosages within the shortest tolerable time periods. A further expansion of this concept is to give consolidation therapy after complete remission or good partial remissions in high-risk patients. In this regard, intensive non-cross-resistant regimens or very high-dose chemotherapy followed by autologous or allogeneic bone marrow transplantation may be effective. The roles of radiotherapy and bone marrow transplantation remain to be defined.

The role of biologic response modifiers in the treatment of lymphomas also needs to be defined. The initial enthusiasm for using bacillus Calmette-Guerin (BCG) or levamisole with combination chemotherapy was not sustained
because of equivocal findings. Currently, anti-idiotypic antibodies designed to take advantage of the presence of certain antigens have not advanced beyond the experimental stage. Moreover, the antibody technique has been applied successfully only in patients with low-grade lymphomas. New agents, which include interferon, tumor necrosis factor, and interleukin-2, are currently under investigation.

Recent molecular biology discoveries and the finding of specific genetic changes in lymphoma (myc translocation in Burkitt's lymphoma) have stimulated the search for similar characteristics in other types of lymphoma. It is conceivable that unraveling the molecular basis for the neoplastic lymphocytic transformation could lead to new diagnostic and treatment concepts for all the lymphomas.

Physicians who desire additional information may consult Hodgkin's Disease and Non-Hodgkin's Lymphoma in Adults and Children (Raven Press, 1988), or write Lillian M. Fuller, M.D., Department of Clinical Radiotherapy, Box 97, The University of Texas M. D. Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, Texas 77030, or call (713) 792-3434.

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Early Discharge continued from page 3

approximately $110 million nationwide. But Edwards is quick to add that hospitals that typically perform fewer mastectomies than does M. D. Anderson may not have the support services necessary to prepare patients for early discharge. "The last thing I want to do," Edwards said, "is admonish the community hospital to discharge patients early when it may not have the resources for outpatient management. To impose this kind of policy without regard to the institution's capability of carrying it out would be unwise."

Edwards' hesitancy in this regard is precisely why he encourages increased physician involvement in cost-containment studies. The quality of patient care will not be maintained if blanket policies are instituted by parties that are unaware of the specific impact. What is needed, Edwards said, is a critical examination of these issues by those who are ultimately responsible for patient care: physicians and surgeons.
another study is examining the impact of pulse intra-arterial chemotherapy (administration of the daily FUDR dose over a 6-hour period). Pulse therapy may reduce the incidence and severity of hepatobiliary toxicity and potentially enable prolongation of intra-arterial therapy. Our goal is to define the drug, dosage, and schedule of administration that most effectively improve survival.

**Chemoembolization**

Chemoembolization is primarily palliative to control symptoms (e.g., pain or hemorrhaging) in patients who have predominant liver metastases and extrahepatic disease or have not responded to intra-arterial therapy. This therapy occludes the hepatic artery and thus depresses tumor blood flow by 90%, significantly reducing the size of the tumor. Hepatic neoplasms are devascularized by either ligation at surgery or percutaneous embolization with particulate material such as polyvinyl alcohol foam (Ivalon) or gelfoam. Arterial occlusion can be more effective when the embolic material is mixed with chemotherapeutic agents before administration. In addition to the direct effect of ischemia, the emboli slow the drug transit time through the vascular bed and increase drug-tumor contact time, enhancing chemotherapeutic effectiveness. The procedure is performed by selectively cannulating the arterial supply to the hepatic tumor and then infusing particulate material until stagnation of blood flow is achieved. At M. D. Anderson this therapy has been used extensively to treat hepatocellular carcinoma, producing an objective tumor response in 40-50% of patients and improving survival. We are currently investigating effectiveness of FUDR chemoembolization for treating colorectal liver metastases.

Though colorectal liver metastases are a frequent and lethal complication of cancer, complete resection of the metastases can provide a 25-35% 5-year survival. To achieve these results, an extensive preoperative evaluation must be performed to properly select patients who can potentially benefit from the procedure. Unfortunately, only 10-15% of patients with liver metastases are eligible for resectional therapy. The remaining patients should be considered for treatment with intra-arterial chemotherapy or chemoembolization. ■

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