Narcotics and Cancer Pain Control

by C. Stratton Hill, Jr., M.D.
Director, Pain Service
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In the past two decades, improved cancer treatment has caused more patients to be cured and brought longer survival to those not cured. Nevertheless, a significant number remain ill, troubled by a wide variety of symptoms as the disease progresses. Pain, nausea and vomiting, anorexia, weakness, insomnia, and failure to thrive are the most important; of this group, pain is probably the outstanding symptom, the one patients dread most. As the tumor grows and spreads, the pain becomes diffuse. Most likely, the pain originates from several sources, and removing the cause is impossible, making systemic analgesics the mainstay of treatment for this type of pain.

At the same time, however, our understanding of pain has grown. We have found the opiate (narcotic) binding sites in the central nervous system and the naturally occurring ligands for these binding sites. We know the mechanisms of spinal cord modulation of pain, and we have a better understanding of neuropathic and deafferentation pains and central pain states. We know that some pains are partially or totally unresponsive to opiates and are developing drugs for binding at specific opiate-binding sites; we hope that these drugs will have fewer of the undesirable side effects of the opiates. In other words, we have learned that there is more to pain treatment than saturating the opiate-binding sites of the central nervous system with opiates.

In spite of progress in both fields, patients with cancer may suffer pain of such severity that they will require narcotic analgesics to control it. Although physicians recognize the effectiveness of narcotics as pain relievers, the medical literature reports increasing numbers of cancer patients whose pain is unrelieved. What, then, is the problem? Are there barriers to the effective use of narcotics? If so, what are they? What can be done to break them down or overcome them? At M. D. Anderson, the Pain Service is available to advise physicians on ways to achieve optimum pain control for their patients.

The Nature of Pain

The first important concept bearing on narcotic use is the physician's idea of what pain is. In our culture, pain is perceived as a symptom that must have a biomedical explanation. If this biomedical model fails, that is, if a patient complains of pain for which no cause can be found, then the pain, we decide, is psychological. To some physicians this means the pain is imaginary, and they are extremely reluctant to give narcotics to patients complaining of such pain. Occasionally, the biomedical model fails in cancer patients with pain. I know of several patients with severe pain who were denied narcotics when their pain was indeed responsive to such drugs. We should make every effort to identify the etiology of a pain and attack the cause if possible, but if detecting the source is beyond the capabilities of the diagnostic instrument, adequate treatment should be given anyway, including the use of narcotics. In most cases, this pain will prove to be of nociceptive origin.

Understanding pain is important also in deciding when not to use narcotics or when to limit their use for pain control. In some patients, pain is not relieved by narcotics because the patients have become tolerant to the dosage prescribed. In such cases, simply increasing the dose of narcotic will solve the problem. Some types of pain, however, are totally or partially unresponsive to narcotics. These pains may be grouped into (1) central pain states, such as post-herpetic neuralgia, phantom limb pain, and causalgia; (2) narcotic unresponsive pain, such as muscle spasm, dysesthesia, “tenesmoid” sensations of the rectum and bladder.
der seen after radiation therapy, reflex sympathetic dystrophy, and bone pain; and (3) pain that is actually physical and mental suffering, a complex experience associated with the negative emotions that almost always accompany chronic pain. The patient’s suffering may have become so overwhelming that he or she describes any experience as “pain.” Narcotics prescribed in this latter circumstance will almost never work and may indeed cause more dysphoria, making the patient worse.

For Chronic Pain, Oral Medication

Chronic pain is best treated with oral medication because it allows the patient more mobility and participation in daily life. Other routes of administration—intramuscular injection, intravenous infusion, rectal suppository, or indwelling reservoirs—should be used only if the oral route is not available, that is, if the patient has problems such as intestinal obstruction or nausea and vomiting secondary to chemotherapy. Yet physicians often perceive the parenteral route as more effective and choose it instead of the oral route because it is actually an increase in the dose given. Physicians either were not taught or have forgotten the “first pass” effect through the liver—biotransformation—when drugs are given by mouth.

Biotransformation inactivates about two-thirds of the oral dose of morphine. To overcome this phenomenon, the oral dose must be three times larger than the parenteral dose. The ultimate dose reaching the opiate-binding sites of the central nervous system, however, will be essentially the same as the parenteral dose. Exactly the same results can be achieved with both oral and parenteral doses of narcotics if one allows for biotransformation. The accompanying table lists oral-to-parenteral ratios for commonly used narcotics that are equianalgesic to 10 mg of morphine given parenterally for severe pain.

### Oral Doses of Narcotic Analgesics That Achieve the Same Pain Relief as 10 mg Parenteral Morphine for Severe Pain

<table>
<thead>
<tr>
<th>Drug</th>
<th>Oral Dose</th>
<th>Oral-to-Parenteral Dose Ratio</th>
<th>Parenteral Dose</th>
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<tr>
<td>Morphine</td>
<td>60 mg</td>
<td>6:1</td>
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<tr>
<td>(single dose)</td>
<td>30 mg</td>
<td>3:1</td>
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<tr>
<td>(repeated dose)</td>
<td>7.5 mg</td>
<td>5:1</td>
<td>1.5 mg</td>
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<tr>
<td>Hydromorphone (Dilaudid)</td>
<td>20 mg</td>
<td>2:1</td>
<td>10 mg</td>
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<tr>
<td>Methadone</td>
<td>4 mg</td>
<td>2:1</td>
<td>2 mg</td>
</tr>
<tr>
<td>Levoorphan</td>
<td>300 mg</td>
<td>4:1</td>
<td>75 mg</td>
</tr>
<tr>
<td>Meperidine (Demerol)</td>
<td>200 mg</td>
<td>1.5:1</td>
<td>130 mg</td>
</tr>
<tr>
<td>Codeine</td>
<td>200 mg</td>
<td>1:1</td>
<td>130 mg</td>
</tr>
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</table>

Effects on Respiration Rate

Other pharmacologic barriers to effective narcotic use are related to misconceptions about respiratory depression and the addictive potential of narcotics. In considering respiratory depression, we must separate narcotic-naive patients from the narcotic-tolerant. Pain is a natural antagonist to the action of opiates—the stronger the pain, the more opiate is required to relieve it. This accounts for the lack of ceiling effect for the dose of opiate: an effect is achieved with all significant increases in dosage. A common question about narcotics among lay persons is, “What will I do when the pain gets really bad?” The answer is simple: “Increase the dose.”

Patients who become tolerant to the analgesic effect of narcotics have also grown tolerant to their respiratory depressant effect—as the dose is increased to relieve the pain, the more it takes to depress the respiration. Respiratory depression is rare to nonexistent in patients tolerant to narcotics. By the same token, respiratory depression in the nontolerant patient with severe pain is unlikely as long as the pain is unrelieved. That is why a narcotic-naive patient with intense pain, such as that seen in renal stone colic or sickle-cell crisis, can tolerate an extremely high dose of narcotic. A physician should give whatever dose is required to relieve the pain.
sacrificing everything they value, including reputation and financial, social, and political resources. Addicts give up their enjoyment of family, food, sex, and personal freedom; they even give up life itself to the drug in question—their major activities are procuring and taking drugs.

Fortunately, few people turn over their lives to drugs in this fashion, especially if their introduction to the drug comes through medical channels. It is therefore unlikely that a cancer patient in pain will eventually become a street addict. Unfortunately, many physicians fear such an outcome if patients are exposed to chemicals with potentially euphorogenic qualities for a long enough time. Physicians seem to ignore the facts that patients may have strong moral values they have been committed to all their lives. They may have made significant contributions to the communities in which they live. Cancer patients taking narcotics seldom are euphoric; if they do experience euphoria occasionally, it is unlikely this experience will be so overwhelming that it will cause them to abandon all values previously held.

Prescribing by Custom

Medical school pharmacology courses usually provide adequate and accurate information about the action of narcotics. One problem frequently seen, however, can be attributed either to a physician's memory lapse or to "customary prescribing." Those of us who study pain treatment find that physicians prescribe narcotics according to custom rather than pharmacology. John Morgan, M.D., of the department of pharmacology of the City University of New York Medical School, compared what students were taught about narcotics in his pharmacology courses with how they actually prescribed narcotics for pain relief. When tested on the dosage and duration of action of various narcotics, students passed the examination without difficulty. But when their subsequent hospital performance in actually prescribing narcotics was evaluated several years later, Morgan found that they prescribed according to custom, even though it contradicted what they had been taught about the pharmacology of the drug. The dosage prescribed was less than the recommended amount, and the time between doses was usually longer than the known duration of action of the drug.

It is customary to undertreat all pain, and cancer pain is no exception. Morgan suggested that physicians have developed an "opiophobia" that prevents prescribing opiates in adequate doses. This phobia is like all others—not subject to rational correction. He suggested that educational efforts be directed to the cultural attitudes of our society, since it is unlikely that adequate doses of narcotics will be prescribed for patients until the phobia is dealt with.

Other cultural influences on narcotic use for pain control are the attitudes of the family, friends, and patients themselves towards narcotics. All these groups fear addiction, which they consider synonymous with drug abuse and all its negative connotations. Somehow the notion is abroad that, when a patient is given a drug with mood-altering properties, any degree of euphoria the drug produces will create an overpowering craving for the drug, and the patient's entire value system will be destroyed. That is not true. I have continually observed that patients who take narcotics for pain control simply stop taking the drug when the pain is relieved. Numerous studies support this observation.

Uncertainty About Drug Laws

A final barrier to narcotic use is physician uncertainty about state and federal laws and regulations relating to narcotics and how those laws are enforced. Most physicians are unaware of the contents of these laws and regulations, which often contain ambiguous language that fails to distinguish a drug abuser from someone taking the same drug for legitimate medical needs. Until the laws are changed, this problem will persist.

One result of this uncertainty is a practice called "stacking," in which the physician prescribes an additional narcotic with the same mechanism of action when the pain cannot be controlled by the first drug. For example, when hydromorphone (Dilaudid)—taken in a dose of 8 mg every three hours around the clock—cannot control the pain, the physician adds another narcotic such as morphine rather than increase the hydromorphone dose beyond the "usual" dose range. This practice may proceed to include several other drugs, until the patient is taking numerous drugs at various time intervals and becomes confused about what should be taken and when. Prescribing one drug at adequate doses and with a single, scheduled time interval is preferable, because it is easier for the patient. Fear of attracting the attention of regulatory agencies prevents physicians from pursuing the latter course.

Patients Are Not Street Addicts

Cancer pain control is not likely to improve until these cultural issues are addressed and corrected. Educational efforts must be directed to all segments of society. Both professional and lay persons must be taught that cancer pain can be controlled, in the vast majority of cases, with the means currently available to most physicians. The beneficial nature of the legitimate use of narcotics must be emphasized. There is no doubt that we have a prodigious drug abuse problem with narcotics in this country. Physicians do not want to contribute to this problem, but there is little evidence that they do. Those that do divert drugs from legitimate to illegitimate use—"script doctors"—are continued on page 8
Shared Research Resources Provide Expertise and Cost Savings

Studying colon cancer, a scientist may have isolated a particular marker protein, unique to colon cancer cells, that potentially has diagnostic application. The scientist knows that raising a monoclonal antibody is the first step toward the development of a diagnostic assay but is unfamiliar with the technique. What are his or her alternatives?

Traditionally, researchers depended on commercial biotechnology companies for such specialty procedures, but now, primarily owing to funding by the National Cancer Institute (NCI), M. D. Anderson Cancer Center investigators can take advantage of 15 in-house laboratories equipped to provide essential specialty procedures and services. Collected under the name Shared Research Resources, these laboratories develop monoclonal antibodies, synthesize DNA, and perform genetic signature analysis.

In addition, researchers may also recruit laboratory services in antigen synthesis, gene cloning assays, biosafety, tissue procurement and banking, histopathology, electron microscopy, cytometry, and recombinant DNA. Other shared resources extend veterinary care for research animals or provide specialized animal models for research. Still others offer help with biostatistics and computational resources. These services will be supported through 1992 as a result of a $6.9 million core grant from the NCI.

The complexity of these services varies, but they all have one thing in common: each requires specialized knowledge and specific equipment and materials.

Having these services in-house has several advantages. They are not only convenient but also less expensive than those offered by biotechnology companies. Moreover, the directors of these services, since they routinely use these procedures themselves in their own research, are in effect on-the-spot experts who are readily available for consultation.

Monoclonal Antibodies

A case in point is the Department of Tumor Biology’s Hybridoma Core Facility directed by James C. Chan, Ph.D. The lab has produced more than 5,000 monoclonal antibodies during the past 6 years. “We developed an improved procedure for use in our own research,” Chan said. “As a part of Shared Research Resources, we can offer it to our M. D. Anderson colleagues to further their research as well. Shared Research Resources is a neat concept, and it works.”

Researchers preparing grant applications often consult with Chan, who may provide scientific and technical input even at this stage. “Since developing a monoclonal antibody is a complicated procedure, I can usually strengthen their proposal by providing specific information. If I collaborate on projects, I then write that part of the grant proposal myself. After the grant is awarded, in addition to producing the monoclonal antibody, I might suggest how to maximize its production, purification, and utilization.”

Producing a monoclonal antibody is a complex and tedious process. First, B lymphocytes that have been immunized to produce antibodies against only one antigen are isolated, Chan explained. These cells are then fused with “immortal” myeloma cells, thus producing a hybridoma. (Cloning of myeloma cells was done about 10 to 15 years ago. If maintained in proper culture conditions, these cells live indefinitely.) The hybridoma now contains both immortality and the information to produce a monoclonal antibody against one antigen. In effect, the hybridoma is a permanent biologic factory that produces one highly specific antibody, the monoclonal.

Monoclonal antibodies can be used to purify immunotherapeutic agents (such as interferon or growth factors) and to detect tumor markers and the sites on viruses that attach to and ultimately destroy cells. When used with radioimaging techniques, monoclonal antibodies can be used to study how cancer cells metastasize. In some studies, monoclonal antibodies have proved to be effective delivery vehicles for cancer drugs, Chan said.

The number of laboratories in the United States that will provide custom-made monoclonal antibodies is limited, according to Chan. Having a hybridoma facility in the institution is an obvious benefit to M. D. Anderson researchers—convenient and two to three times less expensive than commercial laboratories, Chan said. “Moreover, since we make the antibodies, if they were to have any commercial applications, the institution could patent them and retain exclusive rights to them.”

Chan’s laboratory collaborated with the late Benjamin Drewinko, M.D., Ph.D., and his coworker Li-ying Yang, M.S., of the Department of Laboratory Medicine. Yang assisted Drewinko in the development of monoclonal anti-
bodies to detect a tumor marker for colon cancer. "The monoclonal antibodies were central to our research," Yang said, "but we were unfamiliar with the technique. The input and assistance Dr. Chan's laboratory provided were extremely helpful to us. We probably could have had an outside company develop the antibody, but in terms of convenience and cost, it was clearly more efficient to work with Chan."

In addition to monoclonal antibodies, Anderson researchers can obtain other biologic substances from their colleagues. Edwin C. Murphy, Jr., Ph.D., of the Department of Tumor Biology, directs the Macromolecular Synthesis Facility. His lab uses a DNA synthesizer to construct short stretches of DNA called oligonucleotides. "With a DNA synthesizer, you can quickly construct a site-directed mutant, which essentially is a slightly altered form of a DNA sequence that has already been isolated," Murphy said. By manipulating the DNA sequence and studying how these altered sequences affect the function of the gene, investigators can learn more about that gene's role in carcinogenesis.

Moreover, impediments to standard DNA cloning techniques can be overcome by synthesizing DNA. "In our lab, for instance, we had some viral DNA that was extremely difficult to clone," Murphy said. "But we did know some things about its structure, so we combined some pieces of a related viral DNA with a synthetic oligonucleotide and actually made the viral DNA we couldn't clone. If it hadn't been for the DNA synthesizer, we would probably still be wondering how to clone this viral DNA."

Oligonucleotides are readily obtainable from biotechnology companies. However, Murphy charges two to three times less than most biotechnology companies do, and he will assist researchers who are unfamiliar with the technique. "I will sometimes suggest how long the oligonucleotide should be and what part of the gene it should be taken from, but that depends on the expertise of the researchers," Murphy said. "Usually, they simply provide me with a description of a sequence and we make it, but if the oligonucleotide doesn't perform as expected, I'm always available to troubleshoot."

Laurence D. Etkin, Ph.D., of the Department of Molecular Genetics, uses oligonucleotide probes in his research with mRNA. "Oligonucleotides are an integral part of our assay system. Without them, we would have to use a less precise and much more difficult method," Etkin said. "And it's a definite advantage to be able to deal with someone directly instead of a private company over the phone. Murphy's lab bends over backwards to help."

Genetic Signature Analysis

Another service available to Anderson researchers is genetic signature analysis, a process by which a cell line's identity or purity is established by examining its DNA.

Michael J. Siciliano, Ph.D., of the Department of Molecular Genetics, directs the Cell Line Identification Facility. "Cell lines need to be checked routinely," he said. "Labs are run not by gods but by people, and therefore mistakes are sometimes made—a tube may be mislabeled, a cell line cross-contaminated."

Siciliano uses two procedures to identify cell lines: isozyme marker analysis and restriction fragment-length polymorphism (RFLP) analysis.

For isozyme analysis, Siciliano's laboratory examines 11 proteins called isozymes. Each of these isozymes is genetically polymorphic, which means that slightly variant forms of the proteins may be produced in cell lines from different sources. The spectrum of variant forms of these isozymes present in a cell provides that cell line's genetic signature.

"We first look at the isozyme marker polymorphisms, and they usually give us a fairly good identification. If we still cannot definitively determine whether the cells under study have the same or independent genetic origins, then we use RFLP analysis," Siciliano said.

In RFLP analysis, DNA is divided into numerous fragments by restriction enzymes that recognize specific locations along the DNA sequence. The resultant fragments are placed on a gel and subjected to an electric field, which causes them to separate into bands according to size. So that the bands can be visualized, the fragments in the bands are hybridized, or fused, to a specific radiolabeled DNA probe. Without mutations, the DNA fragments recognized by the probe would be identical for every individual. The mutations, however, alter sizes of the fragments these enzymes produce. These particular fragments present in each cell line help establish its genetic signature.

RFLP and isozyme marker analyses, according to Siciliano, "aren't difficult to perform, but the technique requires a certain amount of sophistication and special supplies." These services could be obtained elsewhere, but since Siciliano's services are supported entirely by the NCI core grant, researchers are not charged for cell line identification. Moreover, Siciliano provides an in-depth interpretation of the tests.

Louise C. Strong, M.D., of the Department of Experimental Pediatrics, uses the facility approximately once every two weeks. "A major part of our research involves developing tumors in mice from human tumor cells. It's continued on page 8
For Non-small Cell Lung Cancer, Combinations of Surgery, Chemotherapy, and Radiotherapy

Lung cancer is the most lethal human cancer in the United States—the American Cancer Society estimates that 152,000 new cases of lung cancer and 139,000 deaths from the disease will occur in 1988. Despite all efforts, the disease resists long-term cure.

Part of the problem is that lung cancer is extremely difficult to detect early and, in advanced stages, difficult to cure. Symptoms do not appear until the disease is advanced. Because of this, only about one-fourth of all lung cancers are found in an early stage, when the tumor is still localized and has not spread to the hilar, bronchopulmonary, or mediastinal lymph nodes or to other organs. Patients with such limited disease have a fair prognosis with surgery; the five-year survival rate ranges from 33% to 50%.

Although there are four different cell types in lung cancer, the disease is usually divided into two groups, based on the tumor’s behavior and response to treatment—small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). SCLC is a fast-growing tumor that disseminates early; it is not responsive to surgery but is generally responsive to irradiation and chemotherapy. In contrast, NSCLC—which makes up about 70% of all lung cancers—is a slow-growing tumor that responds well to surgery in early stages, but its record of response to irradiation and chemotherapy has so far been modest. In promising pilot studies, researchers have used multiple modes of therapy—surgery, combination chemotherapy, and radiotherapy—for patients with stage II and III NSCLC, in which the regional lymph nodes are involved; but no carefully controlled studies have been done.

In three research programs on NSCLC, physicians at The University of Texas M. D. Anderson Cancer Center are studying the effectiveness of chemotherapy and radiotherapy in addition to surgery for patients who have the disease at stage II or III. Randomized studies that include control groups will allow physicians to interpret the resulting data and determine whether this kind of additional therapy is helpful. As far as the researchers know, each of the treatment plans being studied is equally effective.

The standard approach to NSCLC is surgical removal of the tumor, if possible. "But probably only 20% to 30% of all patients with lung cancer will have operable tumors," said Jack Roth, M.D., chairman of the Department of Thoracic Surgery. "And of those patients with NSCLC, perhaps only 5% or 10% will ever be cured by surgical treatment. Our goal is somehow to reduce these patients' risk of developing metastases, because in the majority of cases patients die of metastatic disease." Roth hopes that systemic therapy, including che-

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<th>Surgery</th>
<th>Postoperative Chemotherapy</th>
<th>Radiotherapy</th>
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<td>Partial or complete resection</td>
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motherapy and biologic response modifiers, will eventually be able to control metastases in sites not accessible to radiation, such as the liver, bone, and adrenal gland.

**Combination Chemotherapy**

Finding effective chemotherapeutic agents is part of the problem. Earlier studies of chemotherapy, with both single agents and combination chemotherapy, have been disappointing, possibly because of ineffective agents, inappropriate dose and schedule, or poor study design, according to Waun K. Hong, M.D., chief of the Section of Thoracic Oncology.

“The other problem may be in relationship to timing. Perhaps if the agents are given first, when the metastatic tumor burden is at its lowest level, they might be more effective,” continued Roth.

One study includes patients whose tumors were completely resected and who had no regional lymph node involvement. Patients are selected to receive either postoperative chemotherapy and chest and brain irradiation or no additional treatment.

In a second study, patients whose tumors were partially resected receive either postoperative chemotherapy and chest and brain irradiation, or postoperative chest irradiation only, to achieve local control.

In the third study, patients with metastasis to mediastinal lymph nodes but no distant metastasis and whose tumors are resectable or potentially resectable receive either pre- or postoperative chemotherapy or immediate surgery and no chemotherapy (see table).

“Using combination chemotherapy as an adjunct treatment is a fairly new approach to treating non-small cell lung cancer,” said Hong. In all three studies, patients on chemotherapy receive six courses of cyclophosphamide, etoposide, and cisplatin. This regimen was chosen because of the extensive experience at M. D. Anderson with these drugs in non-small cell lung cancer, because the drugs are well-tolerated by patients, and because the response rate (42%) in a study of these drugs chaired by Theera Umsawasdi, M.D., is the highest reported.

**Postoperative Radiotherapy**

After completing their chemotherapy, patients undergo five to six and a half weeks of radiotherapy to the chest to prevent local recurrence and brain irradiation to prevent the appearance of brain metastasis, said Nancy Ellerbroek, M.D., a radiotherapist working in the program.

The benefit of postoperative radiotherapy in lung cancer has not yet been proved. “Some studies demonstrated that local control was greatly increased but survival was not,” said Ellerbroek. “I still think that local control is a worthy goal, one worth five weeks of treatment. But I also think it’s exciting to be able to quantitate what benefit this will be to patients, rather than just guessing,” she continued.

Physicians estimate that there are 120,000 new cases of non-small cell lung cancer each year. If these new treatments have even a small effect, the total number of patients affected is potentially very large.

“This institution is unique in its ability to do these studies, with the expertise and the numbers of patients necessary. Because of that, I believe that we have an obligation to conduct well-designed clinical trials,” Roth concluded.

Physicians who desire additional information may write Jack A. Roth, M.D., Department of Thoracic Surgery, Box 109, or Waun K. Hong, M.D., Department of Medical Oncology, Box 80, The University of Texas M. D. Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, Texas 77030, or call (713) 792-6932, Roth; 792-3039, Hong.
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Criminals and should be sought out and prosecuted. Fortunately, this group represents a very small number. Drug abuse should not prevent the physician from prescribing the patient from using narcotics for pain control.

Unfortunately, the current “Just Say No” campaign emphasizes only the negative aspects of drug use. No mention is made of the positive uses of these drugs. As a result of this campaign, it will be even more difficult for physicians to buck the trend and prescribe more narcotics or prescribe them differently for patients to accept narcotic use. Moreover, the physician must fulfill his obligation to relieve pain in spite of it. One negative habit health care professionals must break is the tendency to treat unrelieved cancer pain patients like street addicts when they request better pain relief with narcotics.

Breaking down the other barriers I have discussed here may require multiple small discussion groups at the community level to separate fact from myth about narcotics and their use.

Physicians who desire additional information may write C. Stratton Hill, Jr., M.D., Pain Service, Box 8, The University of Texas M. D. Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, Texas 77030, or call (713) 792-2824.

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important for us to insure that the tumors that develop did so from the tumor cells that were injected,” she said.

“Otherwise, we could waste six months to a year studying a tumor that’s irrelevant to our research. We could send these outside, but, in addition to the expense, there is an increased likelihood of cross-contamination with other cell lines. It’s very helpful to have this service in-house.”

According to Anthony J. Mastromarino, Ph.D., assistant vice president for research, the Shared Research Resources indeed help individual researchers, but the benefits are much broader.

“Access is critical,” he said. “Given the size of the institution, some of these researchers might never meet were it not for the interaction promoted by these facilities. This interlaboratory communication often leads to collaborative efforts. Even when direct collaboration doesn’t result, the informal consultation that goes on usually gives the individual researcher ideas for his own research. As a result, the research at M. D. Anderson is, as a whole, much better for it.”

Physicians who desire additional information may write Anthony J. Mastromarino, Ph.D., Office of the Vice President for Research, Box 101, The University of Texas M. D. Anderson Cancer Center, 1515 Holcombe Boulevard, Houston, Texas 77030, or call (713) 792-3391.