

# Neoplasms and the Management of Neoplastic Disease: An Overview

**Bob Caruthers, CST, PhD, AST Professional  
Development Manager**

**A**t the beginning of this decade, the American Cancer Society predicted that more than 1 million new cancer cases will be diagnosed annually. Such statistics confirm that neoplastic disease—the abnormal formation of tissue, such as a tumor—is among the most prevalent and potentially deadly diseases. The American Cancer Society broke down its nearly 1 million cases according to types of cancer and also estimated the number of female and male cancer deaths that will occur annually. Estimates for the eleven most prevalent types of cancer appear in Table 1.<sup>1</sup>

## **DIFFERENCES BETWEEN BENIGN AND MALIGNANT TUMORS**

Microscopic and other factors help physicians differentiate between benign and malignant tumors.<sup>2</sup> An outline of the basic characteristics of each can be found in Table 2.

## **CARCINOGENIC THEORIES**

Carcinogenesis—the origin of cancer—has been explained through two major theories: (1) the multistage theory and (2) the immune surveillance theory.<sup>1</sup>

**Table 1.** Annual Estimates for the Eleven Most Prevalent Types of Cancer

<b>Types of Cancer</b>	<b>Total New Cases</b>	<b>Female Deaths</b>	<b>Male Deaths</b>
Lung	155,000	49,000	93,000
Breast	142,900	43,000	300
Colon	107,000	27,500	26,000
Prostate	103,000	—	28,500
Bladder	47,100	3,300	6,900
Rectum	44,000	3,800	4,000
Corpus, endometrium	34,000	3,000	—
Oral	30,600	2,875	5,775
Leukemias	27,300	8,300	9,800
Pancreas	27,000	12,500	12,500
Skin, melanoma	27,000	3,000	5,200
<b>Totals</b>	<b>744,900</b>	<b>156,275</b>	<b>191,975</b>

**Table 2.** Basic Characteristics of Benign and Malignant Tumors

Characteristic	Benign tumor	Malignant tumor
<b>Microscopic Factors</b>		
Structure and differentiation	Like tissue of origin	Atypical
Nuclear membranes	Like tissue of origin	Often irregular
Endoplasmic reticulum (ER)	Like tissue of origin	Diminished and smooth
Mitochondria	Like tissue of origin	Decreased in number
Cytoplasm	Like tissue of origin	RNA scattered RNA often viewed as free of ER Scattered unknown particles
Golgi apparatus	Like tissue of origin	Either diminished or increased
Cell membrane	Like tissue of origin	Simplified
<b>Other Factors</b>		
Rate of growth	Typically slow	Rapid or very rapid
Method of growth	Expands Often encapsulated	Usually infiltrates Loosely or not encapsulated
Vascularity	Slight	Moderate or increased
Metastasis	Absent	Frequent
Necrosis / Ulceration	Unusual	Common
Recurrence	Rare	Common
Mortality	Very low	Fatal if untreated

**• Multistage Theory**

According to the multistage theory, cancer develops in a two-stage process: In the "initiation stage," carcinogens (also called "initiators") irreversibly change DNA; then, during the "promotion stage," the damaged DNA—known as a "mutation"—causes cells to become malignant. Malignant cells proliferate with the aid of "promoters," substances which, though not malignant themselves, promote the cancerous process. The multistage theory has been applied to

both environmental carcinogens and carcinogenic pathogens.

While environmental carcinogens have not been identified as causal factors in all cancers, chemicals such as benzo[a]pyrene, a substance found in coal tar and cigarette smoke, appear to correlate with the appearance of the disease. Besides tobacco, environmental carcinogenic risk factors have been traced to diet, alcohol, sexual behavior, air pollution, occupation, ultraviolet radiation, ionizing radiation, and

hormones.

Carcinogenic pathogens, also known as oncogenic viruses—cellular parasites that are divided into two major groups based on nucleic acid content—cause DNA mutations similar to those caused by environmental carcinogens. While believed to attack cells both directly and indirectly, the exact process by which an oncogenic virus transforms a normal cell into a malignant cell is unknown. Theory holds that when functioning directly, viral genes inserted into a normal genome result in a DNA mutation. Viral infection may indirectly cause mutations by increasing cell proliferation during the normal healing process; as the cells divide, they naturally become more susceptible to spontaneous mutation.

**The Immune Surveillance Theory**

Proponents of the immune surveillance theory believe that higher organisms' immune systems recognize foreign antigens produced by tumors; however, the antigens in some tumors are allowed to multiply because they are not identified as foreign, which creates circumstances in which malignancy can develop. Theories abound regarding the ability of some antigens to avoid detection.<sup>1</sup>

**CANCER TREATMENTS**

While patients beyond the curative stage receive only palliative therapy, the optimal goal of treatment involves curing the patient of cancer by eliminating the malignant cells. Curative treatment approaches include surgery, radiation therapy, systemic chemotherapy, and combining all three approaches.<sup>1</sup>

Many factors are considered when determining the optimal treatment(s) for a specific situation. Though restricted by tumor location and type, surgical excision

remains the primary curative treatment. Radiation's success depends on detecting small tumors early; tumors in certain anatomical positions are also more likely to respond to radiation.<sup>3</sup> Fast-growing nonsolid tumors are more responsive to chemotherapy than slow-growing solid tumors. The major chemotherapy (antineoplastic) drugs are listed in Table 3.<sup>4</sup>

The primary therapeutic considerations when selecting the appropriate antineoplastic drug include the following:<sup>4</sup>

- Ability to deliver the drug to individual cells
- Differences between cycling and noncycling cells
- Fraction of cells that can be eliminated per dose
- Ability of host immune system in handling remaining neoplastic cells
- Existence of a central hypoxic zone in the tumor

#### CONCLUSION

While our understanding of cancer's biochemical nature increases yearly, cancer continues to present a major health care problem. Ultimate victory, if achievable, will depend on answers

**Table 3.** Common Antineoplastic Drugs<sup>a</sup>

Category	Specific Drug
Alkylating Agents	nitrogen mustards, nitrosoureas, others
Antimetabolites	methotrexate, mercaptopurine, thioguanine, fluorouracil, cytarabine, trimetrexate, 2-deoxycoformycin, hydroxyurea
Antibiotics	daunorubicin, doxorubicin, bleomycin, dactinomycin, mitomycin C, mithramycin
Hormonal Agents	prednisone, tamoxifen
Plant Alkaloids	vincristine, vinblastine, etoposide, teniposide
Other	asparaginase

derived by microbiologists. Until then, surgical intervention will continue to play a significant role in the battle against cancer. ▲

#### REFERENCES

1. McCance KL, Roberts LK. Theories of carcinogenesis. In: McCance KL, Huether SE, eds. *Pathophysiology: The Biologic Basis for Disease in Adults and Children*. St Louis, Mo: The C. V. Mosby Co; 1990.
2. McCance KL, Mooney KH, Roberts LK. Tumor biology. In: McCance KL, Huether SE, eds. *Pathophysiology: The Biologic Basis for Disease in Adults and*

*Children*. St Louis, Mo: C. V. Mosby Co; 1990.

3. Colvin M, Owens AH. Principles of management of neoplastic diseases. In: Harvey AM, Johns RJ, McKusick VA, Owens AH, Ross RS, eds. *The Principles and Practice of Medicine*. 23rd ed. Norwalk, Conn: Appleton and Lange; 1988.
4. Wingard LB, Brody TM, Lerner J, Schwartz A. Individual antineoplastic drugs. In: *Human Pharmacology: Molecular-to-Clinical*. St Louis, Mo: Mosby-Year Book; 1991: chap 43.

.....  
 Education Exchange (cont'd from pg. 28)

How they were affected by the afflictions produced by aging  
 How they tried to overcome these afflictions  
 If they believe they could function normally on a daily basis if they routinely dealt with these challenges

- How some of the problems could be medically and/or surgically corrected

After the essays have been handed in, I use class time to discuss the students' impressions about aging. Students routinely report that the assignment has enhanced their level of compassion for

older individuals, which will increase their patience when working with the elderly in the surgical environment. The box on page 28 contains a sampling of student comments summarizing their reactions to this assignment. ▲