CLINICAL CANCER ADVANCES

2011

ASCO’s Annual Report on Progress Against Cancer

American Society of Clinical Oncology
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# CLINICAL CANCER ADVANCES 2011

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A Letter from ASCO’s President

It has been 40 years since U.S. President Richard Nixon signed the National Cancer Act of 1971, which many view as the nation’s declaration of the “war on cancer.” The bill has led to major investments in cancer research and significant increases in cancer survival. Today, two-thirds of patients survive at least five years after being diagnosed with cancer, compared to just half of all diagnosed patients in 1975.

The research advances detailed in this year’s Clinical Cancer Advances report demonstrate that improvements in cancer screening, treatment and prevention are saving and improving lives. But while much progress has been made, cancer remains one of the world’s most serious health problems. In the United States, the disease is expected to become the nation’s leading cause of death in the years ahead, as our population ages.

I believe we can accelerate the pace of progress, provided that everyone involved in cancer care works together to achieve this goal. It is this viewpoint that has shaped the theme for my presidential term: Collaborating to Conquer Cancer. In practice, this means that physicians and researchers must learn from every patient’s experience, ensure greater collaboration between members of the patient’s medical team, and involve more patients in the search for cures through clinical trials. Cancer advocates, insurers and government agencies also have important roles to play.

Today, we have an incredible opportunity to improve the quality of cancer care by drawing lessons from the real-world experiences of patients. ASCO is taking the lead in this area, in part through innovative use of health information technology. In addition to our existing quality initiatives, ASCO is working with partners to develop a comprehensive “rapid learning system” for cancer care. When complete, this system will provide physicians with personalized, real-time information on the care of every patient with cancer, while also connecting patients and their entire medical teams. The rapid learning system will form a continuous cycle of learning—securely capturing data from every patient at the point of care, drawing on evidence-based guidelines, and evaluating quality of care against those standards and the outcomes of other patients.

Clinical trials are another area where collaboration is critical. Increasing clinical trial participation will require commitment across the cancer community—from physicians, patients, insurers, hospitals and industry. A 2010 report by the Institute of Medicine (IOM) described challenges to participation in trials by both physicians and patients and provided recommendations for revitalizing clinical trials conducted through the National Cancer Institute’s Clinical Trials Cooperative Group Program. ASCO has pledged its support for the full implementation of these recommendations.

More broadly, ASCO recently outlined a bold vision for translational and clinical cancer research over the next decade, and put forth recommendations to achieve that vision. ASCO’s Blueprint for Transforming Clinical and Translational Research, released in November, calls for a research system that takes full advantage of today’s scientific and technological opportunities, and sets a high-level agenda for policymakers, regulators and advocates.

Cancer research has transformed cancer care over the past 40 years, and this Clinical Cancer Advances report illustrates how far we have come in the past year alone. We now have a tremendous opportunity to utilize today’s knowledge and collaborate across all facets of cancer care to conquer this deadly disease.

Michael P. Link, MD
ASCO President
Executive Summary

SUMMARY OF FINDINGS

Each year, the American Society of Clinical Oncology conducts an independent review of advances in cancer research that have the greatest potential impact on patients’ lives. This year, Clinical Cancer Advances 2011 features 54 significant studies, including 12 that the report’s editors consider major advances.

This year’s Clinical Cancer Advances report also recaps the year’s most important cancer policy developments and ASCO policy initiatives that are likely to influence cancer care over the coming years. These include developments that could help to accelerate the pace of clinical cancer research progress and ensure access to quality cancer care for patients.

1. Screening and Prevention

With cancer, the ultimate goal is to avoid the disease altogether. Smoking cessation efforts, lifestyle changes, and other biomedical interventions have successfully prevented thousands of cancers over the past decades.

At the same time, researchers seek better ways to detect cancers early, when they are most curable. Screening advances are credited with improving survival rates for a range of cancers. Notable advances in cancer screening and prevention of the past year include:

Low-Dose CT Scanning Reduces Lung Cancer Death Rate in People at High Risk

A national screening trial of more than 50,000 current- and former-heavy-smokers found that three annual low-dose computed tomography (CT) scans reduced the risk of dying from lung cancer by 20 percent compared to those who were screened with three annual chest X-rays. This landmark trial was the first to identify a screening regimen for patients at high risk for lung cancer, despite decades of attempts. Guidance on how to apply these findings is expected over the coming year.

Exemestane Reduces Risk of Invasive Breast Cancer in High-Risk, Postmenopausal Women

A phase III trial showed that exemestane (Aromasin®), a member of a family of drugs called aromatase inhibitors, reduced the risk of developing breast cancer compared with placebo in high-risk, postmenopausal women. This is the first conclusive evidence that an aromatase inhibitor reduced the risk of a first breast cancer, making exemestane an option for postmenopausal women who are at high risk for the disease. Two other drugs, tamoxifen and raloxifene, are already approved for this purpose but carry with them concern over side effects that deter many women who could benefit from such treatment.
2. HARD-TO-TREAT CANCERS
While some cancers respond well to treatment, other forms of the disease are more resistant. Melanoma, ovarian cancer and neuroblastoma all fall into this latter group. In many cases, current therapies can induce remissions or stall the disease’s progression for long periods of time, but these cancers still too often persist and grow.

Progress in these in the past year includes:

**BRAF Inhibitor Improves Survival in Advanced Melanoma, Gains FDA Approval**
A phase III trial showed that the drug vemurafenib (Zelboraf®), which targets a common mutation in melanoma in a gene called *BRAF*, improved overall survival in patients with advanced melanoma when compared to standard chemotherapy. About half of patients have tumors that carry this mutation. Vemurafenib—which received FDA approval in August 2011—is a new standard treatment for patients with melanoma and this gene mutation, helping to usher in a personalized approach to treating the disease.

**First-Line Ipilimumab Plus Chemotherapy Improves Survival in Metastatic Melanoma**
A phase III study found that treatment with ipilimumab (Yervoy®)—an immune therapy that activates the immune system’s T cells—combined with the standard chemotherapy drug dacarbazine improved overall survival by 2 months in patients with previously untreated metastatic melanoma, compared to chemotherapy alone. This is the first study showing the benefit in prolonging life of combining chemotherapy and immunotherapy in patients with advanced melanoma.

**Bevacizumab Delays Progression in Recurrent Ovarian Cancers**
Two randomized phase III trials found that bevacizumab (Avastin®)—a monoclonal antibody that inhibits blood vessel growth and development in tumors—together with standard chemotherapy helped women with recurrent ovarian cancer live significantly longer without their disease worsening than those treated with the same chemotherapy alone. In the first trial, called OCEANS, patients treated with bevacizumab lived a median of four months longer without the disease progressing than those who received chemotherapy alone—a 52 percent reduction in the risk of disease progression.
In the second trial, data suggested that adding bevacizumab to standard carboplatin and paclitaxel chemotherapy for treatment of newly diagnosed ovarian cancer helps women live longer than with treatment with chemotherapy alone, particularly for patients with more aggressive forms of the disease. By extending the time patients can live without disease progression—and without further treatment with chemotherapy—these results suggest that increasingly, ovarian cancer may be treated as a longer-term, chronic disease. Researchers await longer-term data from both studies to get a clearer picture of how these regimens improve survival, and which women benefit most.

New High-Dose Chemotherapy Regimen Improves Survival in Children with Hard-to-Treat Neuroblastoma
A phase III trial showed that a new combination of chemotherapy drugs improved survival for children with high-risk metastatic neuroblastoma. After three years, the event-free survival rate for patients treated with an intense dosing of the chemotherapy drugs busulphan-melphalan was 49 percent compared to 33 percent for the three standard chemotherapy drugs, carboplatin, etoposide and melphalan. These findings establish a new standard of care for high-risk neuroblastoma, and together with other recent treatment advances for the disease, are likely to lead to survival gains for patients.

3. REDUCING CANCER RECURRENCE
While many cancers can be treated successfully at first, preventing the disease from returning is often difficult, particularly when diagnosed at advanced stages. When a cancer recurs, it usually is more resistant to therapy, and may not be curable. Several studies this year marked important advances in preventing recurrence of a type of leukemia in children and young adults, a form of gastrointestinal cancer, and breast cancer.

Three Years of Imatinib Therapy Improves Survival for High-Risk GIST
A phase III trial showed that three years of treatment with the targeted kinase inhibitor imatinib (Gleevec®) after surgery in patients with high-risk gastrointestinal stromal tumors (GIST) significantly improved overall and recurrence-free survival compared to one year of treatment. The findings could result in the three-year course of therapy becoming the new standard of care for those patients who are at risk for relapse.

New Chemotherapy Regimen Boosts Event-Free Survival for Children and Young Adults with Acute Lymphoblastic Leukemia
A phase III Children’s Oncology Group trial of nearly 2,500 children and young adults with acute lymphoblastic leukemia (ALL) showed that giving the common chemotherapy drug methotrexate in large, consistent doses—rather than in the gradually increasing doses of the standard regimen—was more effective in preventing relapses and extended survival. These findings set a new standard of care, and pushed cure rates for pediatric patients with acute lymphoblastic leukemia to more than 80 percent. This disease was once considered one of the most deadly pediatric cancers but today is seen as one of the most curable.
Adding Regional Nodal Irradiation Decreases Recurrences in Women with Early Breast Cancer

An analysis of a randomized phase III trial found that adding radiation to the regional lymph nodes reduces the risk of cancer recurrences both near the tumor and in other parts of the body in women with early-stage breast cancer who have one to three cancer-positive lymph nodes (or high-risk node-negative breast cancer). The findings are important because women with breast cancer that has spread to the lymph nodes are typically treated with breast-conserving surgery and surgery to remove many of the lymph nodes under the arm, followed by radiation to the entire breast to reduce the likelihood of recurrence. The usefulness of expanding the traditional radiation field around the breast in this population of patients had previously been unclear.

4. NEW DRUG APPROVALS

In addition to the approval of vemurafenib for melanoma (see earlier summary in this section), new treatment options were approved by the U.S. Food and Drug Administration for lung cancer and prostate cancer.

FDA Approves Crizotinib (Xalkori) for Lung Cancer

The FDA approved a new drug, crizotinib (Xalkori®), in August for patients with advanced non-small cell lung cancer whose tumors harbor a specific type of alteration in the anaplastic lymphoma kinase (ALK) gene. The drug was found to improve survival by 31 percent after two years. The approval of crizotinib is the latest example of a successful personalized medicine approach in treating patients with lung cancer.

Abiraterone Acetate Approved for Patients with Prostate Cancer

In April, the FDA approved the oral agent abiraterone acetate (Zytiga®) in combination with the drug prednisone for patients with metastatic hormone-refractory prostate cancer who have received prior treatment with the chemotherapy drug docetaxel. Abiraterone acetate works by blocking the production of male sex hormones (such as testosterone), which fuel the growth of prostate tumors. Since only one other agent, cabazitaxel (Jevtana®), an intravenous chemotherapy drug, has been shown to prolong survival in patients who no longer respond to treatment with docetaxel, this approval represents a much-needed new option for patients.
Cancers of the blood and lymphatic system include leukemia, lymphoma and multiple myeloma.

This year, several trials of an antibody-drug combination showed tumor shrinkage in the majority of patients with two types of lymphoma. The antibody-drug combination was subsequently approved by the FDA. In addition, study results of another type of drug called a JAK inhibitor showed responses in patients with myelofibrosis, a potentially deadly bone marrow disorder.

Notable Advances
Trials of Antibody-Drug Combination Show Tumor Shrinkage in Lymphomas

Hodgkin lymphoma and anaplastic large-cell lymphoma (ALCL) are the most common tumors that express the protein antigen CD30 on the cell surface. Previous attempts to target the protein with monoclonal antibodies have been disappointing.

New findings from a trio of trials showed that an antibody-drug combination—brentuximab vedotin (Adcetris®)—directed against CD30 increased tumor responses in patients with both cancers who no longer responded to standard therapies. Brentuximab consists of an antibody directed against the CD30 protein that is chemically linked to a chemotherapy drug, monomethyl auristatin E. Monomethyl auristatin E had previously been tried alone but was found to be extremely toxic. The drug combination—termed a “conjugate”—is designed to bind and deliver the chemotherapy directly to cells with the CD30 protein, which is present only on the cancer cell. This approach concentrates chemotherapy on the cancer cells and spares healthy cells.

Based on phase II trial results, the FDA in August 2011 granted accelerated approval for brentuximab vedotin for patients with refractory Hodgkin lymphoma and ALCL. Brentuximab vedotin is the first drug ever approved specifically for ALCL, and the first new drug approved by the FDA for Hodgkin lymphoma in more than 30 years.1

Briefly, the studies found the following:

- In a phase I multicenter trial, researchers tested the effectiveness of brentuximab in 45 patients with relapsed or refractory CD30-positive hematologic cancers, mostly Hodgkin lymphoma and ALCL. Tumors regressed in 36 of 42 evaluable patients (86 percent).2
- In one of two phase II trials, 102 patients with relapsed or refractory Hodgkin lymphoma were treated with brentuximab, with 75 percent of patients having tumors shrink to at least half their original size.3
- In a phase II trial of 58 patients with ALCL, 87 percent of patients had tumors shrink to at least half their original size, with 57 percent showing complete remissions.4

Diarrhea, fatigue, nausea and peripheral neuropathy were among the most common side effects of the drug combination.
JAK Inhibitor Improves Response Rate for Patients with High-Risk Myelofibrosis

Myelofibrosis (MF), a disorder characterized by scar tissue buildup in the bone marrow, is extremely difficult to treat. It causes anemia, a variety of debilitating symptoms such as fatigue, night sweats, weight loss and bone pain, and an enlarged spleen, and leads to acute myeloid leukemia and bone marrow failure in more than a quarter of patients.

While bone marrow transplantation remains the only potential cure, relatively few of these often elderly patients are eligible. Other therapies, including hydroxyurea, anabolic steroids and thalidomide, lessen symptoms but do not lead to cure.

Two randomized phase III trials showed that the Janus kinase (JAK) inhibitor ruxolitinib improved response rates and symptoms of the disease for three forms of MF. The trials—called COMFORT I and COMFORT II—are the first-ever randomized drug trials for MF. Together, these findings promise to change the standard of care for many patients with MF.

While the median overall survival for myelofibrosis can exceed five years, patients with high-risk forms of the disease only live, on average, about two to four years after diagnosis. About half of all patients carry a mutation in the JAK 2 gene, although many more may have an active JAK signaling pathway. Ruxolitinib inhibits both JAK 1 and JAK 2.

The COMFORT II trial compared ruxolitinib to best available therapy in adults with primary myelofibrosis, post-polycythemia vera-myelofibrosis or post-essential thrombocythemia myelofibrosis. In the study, 219 patients with intermediate or high-risk disease were randomly assigned to either ruxolitinib (146) or best available therapy (73), with responses measured in terms of a 35 percent or greater reduction in spleen size. After 48 weeks, researchers found this reduction in spleen size in 28.5 percent of patients receiving the drug compared to 0 percent in those who did not receive it.5

In the COMFORT I trial, treatment with ruxolitinib was compared to placebo in 309 patients with the same three types of MF. After treatment for a median follow-up of 32 weeks, 42 percent of those who received the drug had a 35 percent reduction in spleen size after 24 weeks compared to 1 percent of patients taking placebo. The majority of patients receiving ruxolitinib in both studies saw improvement in fatigue, night sweats, weight loss and bone pain.6

REFERENCES

5. Harrison, CN, et al: Results of a randomized study of the JAK inhibitor ruxolitinib (INC424) versus best available therapy (BAT) in primary myelofibrosis (PMF), post-polycythemia vera-myelofibrosis (PPV-MF) or post-essential thrombocythemia-myelofibrosis (PET-MF). Presented at the 47th Annual Meeting of the American Society of Clinical Oncology; June 2011; Chicago, IL.
There have been profound changes in recent years for women with breast cancer—the most common cancer among women in the United States—as those diagnosed with the disease live longer, healthier lives. New insights into breast cancer development on a molecular level are helping researchers understand and treat the disease as never before.

Important advances this year include a study showing a new potential role for aromatase inhibitors to reduce the risk of developing breast cancer, and a trial demonstrating the benefit of expanding radiation treatment to the lymph nodes after lumpectomy. Two trials showed the value of combining targeted drugs, together with chemotherapy, in women with stage II and stage III HER2-positive breast cancers. Additionally, a randomized trial of a PARP inhibitor proved ineffective in metastatic triple-negative disease, an extremely aggressive form of breast cancer, despite earlier favorable results.

**MAJOR ADVANCES**

**Exemestane Significantly Reduces Risk of Invasive Breast Cancer in High-Risk, Postmenopausal Women**

Although the anti-estrogen drugs tamoxifen and raloxifene are FDA-approved for breast cancer prevention in women at high risk, only 4 percent of the approximately two million women in the United States who could benefit from them actually take either drug because of concerns about the increased risk of developing endometrial cancers and blood clots.

Over the past year, a phase III trial showed that exemestane (Aromasin®)—a member of a family of drugs called aromatase inhibitors—greatly reduces the risk of developing breast cancer in high-risk, postmenopausal women. This is the first evidence that an aromatase inhibitor reduces the risk of a first breast cancer, and now opens the door for exemestane to become an option for postmenopausal women who are at high risk for breast cancer.

Aromatase inhibitors, which work differently than tamoxifen by preventing estrogen synthesis, have been proven superior to tamoxifen in preventing recurrences in postmenopausal, early breast cancer patients. The current study, known as MAP-3 (Mammary Prevention Trial-3), included 4,560 postmenopausal women who were 60 or older and who were considered high risk for breast cancer. After a median follow up of three years, the group receiving exemestane had a 65 percent reduction in invasive cancers. There was also a 60 percent reduction of invasive breast cancer and pre-invasive ductal carcinoma in situ—the earliest form of breast cancer—in the exemestane group, and fewer pre-cancerous conditions were seen.

**Adding Regional Nodal Irradiation Decreases Recurrences in Women with Early Breast Cancer**

Women with breast cancer that has spread to the lymph nodes are typically treated with breast-conserving surgery (also known as lumpectomy) and surgery to remove many of the lymph nodes under the arm, followed by radiation to the entire breast (whole breast irradiation, or WBI) to reduce the likelihood of recurrence. If a woman’s cancer is considered high-risk for recurrence—such as a larger tumor or the fact it has spread to more than three underarm, or axillary, lymph nodes—radiation is frequently administered to the entire region (regional node irradiation, or RNI) as well. The region consists of the lymph node basins under the arm, above the collar bone (supraclavicular), and beneath the sternum (internal mammary). However, for women with one to three cancer-positive nodes, the benefit of adding RNI has been unclear.

A randomized phase III trial showed that in women with early breast cancer...
with one to three positive lymph nodes (or high-risk node-negative breast cancer), additional radiation treatment to the regional lymph nodes reduces cancer recurrences both near the tumor site and in other parts of the body.\(^2\)

The study enrolled 1,832 women, most of whom (85 percent) had one to three positive lymph nodes, and a smaller proportion of women (10 percent) who had high-risk, node-negative breast cancer. All women had been treated with breast-conserving surgery and adjuvant chemotherapy or hormone therapy. The participants were randomly assigned to receive WBI alone or WBI plus RNI.

After five years, 90 percent of women in the RNI group had no recurrences, compared to 84 percent in the WBI group. (Fig. 1.) The RNI group also had a lower rate of recurrence nearer the tumor site (3 percent versus 6 percent), and a lower rate of cancer recurrences in other parts of the body (8 percent at five years compared to 13 percent in the other group). These results should encourage radiation oncologists to discuss with their patients a more extended radiotherapy field to reduce the risk of recurrence.

**NOTABLE ADVANCES**

**Targeting HER2 with Drug Combinations More Effective than Single Agents**

While the monoclonal antibody trastuzumab (Herceptin\(^\text{®}\)) is effective in treating many patients with breast cancer tumors that are positive for the human epidermal growth factor receptor 2 (HER2) protein, a significant number of tumors either don’t respond to this drug or become resistant to it. Clinicians have recently begun conducting trials exploring “dual targeting” of HER2, adding one or multiple HER2-targeted breast cancer drugs to trastuzumab in an attempt to improve or extend treatment response. This strategy proved effective in two trials this year, and larger, longer-term trials (ALTTO and Neo-ALTTO) are currently evaluating whether this approach ultimately extends survival when given after surgery.

In one study—the phase II CHER-LOB trial\(^3\)—researchers found that women with stage II or III breast cancer who received chemotherapy prior to surgery responded better to treatment with a combination of trastuzumab and the tyrosine kinase inhibitor lapatinib (Tykerb\(^\text{®}\)) than to treatment with either lapatinib or trastuzumab alone with chemotherapy.

Investigators measured the complete disappearance of invasive tumors in the breast and axillary lymph nodes in the 121 patients who participated in the study. They found a pathological complete response of 28 percent in the trastuzumab-only arm, 32 percent in lapatinib-only arm and 48 percent in the combination arm. (Fig. 2.)

A second study—a randomized phase II trial called Neosphere—showed that a combination of the chemotherapy drug docetaxel and the monoclonal antibodies pertuzumab (Omnitarg\(^\text{®}\)) and trastuzumab is more effective against HER2-positive breast cancer than chemotherapy with either antibody alone.\(^4\)

In the trial, investigators randomly assigned 417 women with either stage II or stage III HER2-positive breast cancer to four arms to test the effectiveness of the two HER2 antibodies with or without the chemotherapy drug docetaxel before surgery. They found that treatment with pertuzumab, trastuzumab and docetaxel resulted in a 46 percent pathological complete response rate compared to 24 percent with pertuzumab/docetaxel, 29 percent with trastuzumab/docetaxel (the standard therapy) and 18 percent with trastuzumab/pertuzumab.

**PARP Inhibitor Trial Shows No Improvement in Survival in Metastatic Triple-Negative Breast Cancer**

PARP inhibitors are a class of drugs that target a key enzyme involved in DNA repair, especially in the repair of tumor cells. While early-stage trials involving PARP inhibitors have shown promise in breast, ovarian and others cancers, no
PARP inhibitors have been approved for cancer therapy as yet.

In an earlier randomized phase II study, the addition of the PARP inhibitor iniparib to the chemotherapy drugs gemcitabine and carboplatin improved response rates, progression-free survival, and overall survival in 123 women with metastatic triple-negative breast cancer, a particularly aggressive and difficult-to-treat cancer in which tumors lack estrogen, progesterone receptors, and do not over express the HER2 protein. Overall survival increased from 8 months with gemcitabine/carboplatin to 12 months with the addition of iniparib.

However, over the past year a larger phase III trial of gemcitabine and carboplatin along with iniparib in triple-negative breast cancer did not support the results seen in the phase II trial. In the phase III study, investigators randomly assigned 519 women with stage IV triple-negative breast cancer to gemcitabine/carboplatin or to gemcitabine/carboplatin/iniparib. The researchers found that the addition of iniparib did not improve survival.5

The contrasting results between the first, smaller randomized phase II trial and the larger randomized phase III trial underscore the need to conduct carefully controlled, adequately powered studies to clarify promising results in a preliminary study. Further research is needed to better understand the potential use of PARP inhibitors in this type of breast cancer, including identifying a biologic subset of breast cancers most likely to benefit.

REFERENCES

A therapeutic plateau seems to have been reached with conventional cytotoxic chemotherapy in breast cancer. Current research efforts have already justifiably shifted toward rational targeting of critical molecular pathways. While many targeted agents do cause off-target (host) toxicity, there has been much progress toward smarter systemic therapies associated with a higher therapeutic index. I personally am excitedly holding my breath awaiting the results of some ongoing large phase III trials in this regard.

—Andrew D. Seidman, MD
Cancers of the central nervous system include those of the brain and spine. This year, a report showed that a gene may serve as a prognostic biomarker in newly diagnosed glioblastoma, while a companion study also provided evidence of the predictive value of four biomarkers for glioblastoma outcome. A third report showed the importance of the lack of a certain gene in glioblastoma development and as a potential drug target, while lastly, scientists identified a host of genetic alterations in a childhood brain cancer that may ultimately guide drug development and therapy.

NOTABLE ADVANCES
Study Shows Genetic Biomarker Predicts Glioblastoma Survival
Glioblastoma is the most common and deadly type of brain tumor. For patients with newly diagnosed glioblastoma, the outlook can be poor. Patients usually survive fewer than six months after diagnosis without treatment; after surgery, tumors often regrow rapidly, and standard treatment with radiation and chemotherapy extend median survival to approximately 18 months.

Still, it has been difficult to predict which patients with glioblastoma will do well with radiation therapy and adjuvant chemotherapy with the drug temozolomide. Some studies have indicated that patients whose glioblastoma carry a "silenced" gene called methyl guanine methyl transferase (MGMT) have better survival, and that intense temozolomide treatment can reduce levels of the MGMT enzyme in the blood and perhaps the tumor. The MGMT enzyme is an important factor in chemotherapy resistance to glioblastoma.

However, a randomized phase III trial led by the Radiation Therapy Oncology Group, a National Cancer Institute-supported clinical trials group, showed that giving intense temozolomide with standard radiation did not help patients with newly diagnosed glioblastoma live longer than with the usual dose.1 While the study did not find survival differences among two treatment groups, the investigators found that MGMT status predicted overall survival, confirming the prognostic value of the MGMT gene. When they analyzed tumor tissue for MGMT, they found that patients whose tumors had silenced MGMT had better overall survival than those whose tumors did not (21 months versus 14). (Fig. 1.)

In a companion study using the tumor samples from the same trial, researchers retrospectively evaluated four biomarkers or groups of biomarkers, showing that they could predict clinical outcome in glioblastoma.2 The authors proposed that the use of these biomarkers could improve the way glioblastomas are categorized by risk, and could help lead to the development of personalized therapies.

Lack of Gene Linked to Poor Glioblastoma Survival
Studies have shown that nearly all glioblastomas, the most common adult brain cancer, have alterations in the epidermal growth factor receptor (EGFR) gene, including over-active EGFR proteins or mutations in the gene itself. Yet, targeting this pathway with drugs has not been effective. A new study showed that the deletion of NFKBIA, a gene that inhibits the EGFR signaling pathway, also affects tumor formation, increases chemotherapy resistance and worsens survival—and may provide another target for treatment.3 The researchers found that patients with either the NFKBIA or EGFR abnormality had significantly shorter survival, despite therapy, compared to patients whose tumors had neither genetic defect.

Researchers had previously found that patients with low NFKBIA expression in their glioblastomas were resistant to treatment with the chemotherapy drug temozolomide. In this study, investigators analyzed 790 tumor samples...
collected from glioblastoma patients between 1989 and 2009, and compared the results with outcomes of 570 current patients with glioblastoma. They found NFKBIA deletions in a high proportion—nearly 25 percent—of the samples. They also confirmed earlier findings about EGFR, identifying alterations in the gene in about one-third of these samples.

Defects in NFKBIA have been found in other cancers, but this is the first study to implicate the deletion of NFKBIA as contributing to glioblastoma. The authors suggest that discovery of the role of NFKBIA deletion in glioblastoma and its effect on survival could potentially improve the ability to predict a patient’s prognosis, and in turn, may play a role in choosing the most effective treatment.

Molecular Characterization of Medulloblastoma Reveals New Mutation Patterns, May Lead to Personalized Therapies

Brain tumors are the leading cause of childhood cancer deaths, and medulloblastoma is the most common malignant brain tumor in children, accounting for as many as 25 percent of pediatric brain tumors. While approximately two-thirds of patients can be effectively treated, the therapies—including radiation therapy—can have long-term effects on learning and cognition.

In a new study, researchers characterized the most common genetic alterations in medulloblastoma, making it the first pediatric solid tumor to be genetically sequenced. Characterizing commonly-affected genes in medulloblastoma and other pediatric cancers may allow for more accurate molecular classification of the disease and better prognosis—in addition to identifying molecular drug targets, and helping lead to more personalized cancer care. This would be especially critical for pediatric brain tumors, where some current therapies, particularly radiation, can be extremely toxic.

The study found mutations in two predominant genes, MLL2 and MLL3, that are likely involved in the cancer’s development. They also found that, overall, medulloblastoma had fewer mutations than other forms of solid tumors. The results of these studies will likely guide development of drugs that target these key genes. Eventually the results may be used to personalize care by using the genetic profile of patients’ tumors to select the most appropriate type and intensity of therapy.

REFERENCES
GASTROINTESTINAL CANCERS

Specialty Editor: Andrew H. Ko, MD

Gastrointestinal cancers include those of the esophagus, stomach, liver, pancreas, biliary tract, colon, rectum and anus. This year, researchers provided new evidence supporting extended use of a key drug for gastrointestinal stromal tumors. In addition, the U.S. Food and Drug Administration approved three new drugs that extend survival for gastrointestinal cancers, including two drugs for locally advanced and metastatic neuroendocrine pancreatic cancer, and one for advanced gastric cancer.

MAJOR ADVANCE

Three Years of Imatinib Therapy Improves Survival for High-Risk GIST

The use of the targeted kinase inhibitor imatinib (Gleevec®) has greatly improved survival in patients with gastrointestinal stromal tumors (GIST). GIST usually begin in the stomach or intestine. Imatinib targets two abnormal proteins involved in the development and growth of GIST.

Although there is evidence that giving imatinib to patients for one year following surgical removal of their tumor reduces the likelihood of recurrence, whether one year is the most effective length of treatment has been questioned. This year, a phase III trial answered that question, showing that three years of treatment with imatinib after surgery in patients with high-risk GIST significantly improved both overall and recurrence-free survival compared to one year of treatment.1

In the study 400 patients with GIST who were at high risk for recurrence were randomly assigned to either one or three years of imatinib after surgery. After a median follow up time of 54 months, the investigators found that five-year recurrence-free survival was higher in the three-year group (66 percent) compared to patients treated for one year (48 percent). (Fig. 1.) Similarly, the five-year overall survival for the three-year group was higher—92 percent—compared to 82 percent of patients who received adjuvant imatinib for only one year.

NOTABLE ADVANCES

Trastuzumab Approved for Metastatic Gastric Cancer

In late 2010, the FDA approved trastuzumab (Herceptin®), in combination with the chemotherapy drugs cisplatin and either capecitabine or 5-fluorouracil, for the treatment of patients with gastric cancer whose tumors express high levels of the HER2 protein.2 The approval was based on results of a phase III trial called ToGA (Trastuzumab for Gastric Cancer), in which 594 patients with advanced HER2-overexpressing gastric cancers were randomized to receive chemotherapy alone or in combination with trastuzumab.3 Patients treated with trastuzumab and chemotherapy lived longer than patients who received chemotherapy alone (a median of 14 months vs. 11 months). ToGA is the first trial of a therapy for patients with these cancers that resulted in a median survival of more than one year.

Sunitinib, Everolimus Approved for Rare Type of Pancreatic Cancer

The FDA approved two drugs in May 2011 for the treatment of advanced pancreatic neuroendocrine tumors that cannot be surgically removed or that have spread to other parts of the body. Both were shown to more than double the time it took for cancer to progress compared to treatment with a placebo. The approval of these two new drugs increases treatment options for the disease, which previously consisted of only interferon and chemotherapy.

- Everolimus (Afinitor®) targets an important signaling molecule in tumor cells called mTOR. Its approval was based on a clinical trial of 410 patients with metastatic or locally advanced disease who received either everolimus or

### Fact:

Each year, the incidence of pancreatic cancer has been increasing by 0.8% in men and 1% in women since 1998.
placebo. Patients treated with everolimus lived more than twice as long—a median of 11 months without the cancer worsening—compared to a median 5 months in patients who received placebo.\textsuperscript{4}

- Sunitinib (Sutent\textsuperscript{®}) inhibits the vascular endothelial growth factor (VEGF) receptor, which is involved in the development of cancer growth-fueling blood vessels. The drug’s approval was based on data from a randomized study of 171 patients with metastatic or locally advanced pancreatic neuroendocrine tumors who received sunitinib or a placebo. Patients treated with sunitinib lived more than twice as long without their disease progressing (median 11 months) compared to those who received placebo (5 months).\textsuperscript{5}

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**GENITOURINARY CANCERS**

*Specialty Editor: Bruce J. Roth, MD*

Genitourinary cancers include those in the prostate, bladder, kidney, testis, ureter and urethra. Among these, some of the most important developments are occurring in advanced prostate cancer. Researchers continue to find new ways to exploit biological pathways in cancer cells, as well as uncover new drug targets, specifically in the area of hormone-refractory prostate cancer.

This year, the FDA approved a new drug that extends survival by more than four months in patients with advanced hormone-refractory prostate cancer, which until recently has had relatively few treatment options. Additionally, a novel agent targeting pathways involved in the growth and development of cancer showed a high rate of clinical activity in metastatic hormone-refractory prostate cancer, as well as in several other cancers, including liver and ovarian, and melanoma, along with improvements in bone pain and measurable disease. In the third study, a major trial reported important new insights on selecting second-line therapy for patients with metastatic kidney cancer. Finally, a new drug to prevent or delay skeletal-related events in patients with advanced cancer-related bone metastases received FDA approval for treating prostate cancer.

**MAJOR ADVANCE**

**Abiraterone Acetate Approved for Patients with Advanced Hormone-Refractory Prostate Cancer**

In April 2011, the FDA approved abiraterone acetate (Zytiga\textsuperscript{®}), in combination with the drug prednisone, to treat patients with metastatic hormone-refractory prostate cancer who have received prior treatment with docetaxel.\textsuperscript{3} Abiraterone acetate blocks the production of male sex hormones (such as testosterone) called androgens, which fuel the growth of prostate tumors. Prostate cancer is considered hormone-resistant when the drugs, or surgery, used

The approval of these two new drugs increases treatment options for the disease, which previously consisted of only interferon and chemotherapy.
to reduce testosterone production or block its effects no longer work, and the cancer continues to grow. Hormone-refractory (now called castration-resistant) prostate cancer has been extremely difficult to treat. This drug now helps many patients who, until recently, had few options.

The drug’s approval was based on results from a study of 1,195 patients with hormone-refractory prostate cancer in which patients received either abiraterone acetate in combination with prednisone or a placebo with prednisone. Patients who received the abiraterone acetate-prednisone combination had a median overall survival of 15 months compared to 11 months for patients receiving the placebo-prednisone combination. This oral drug was found to have an excellent safety profile. Only one other agent, cabazitaxel (Jevtana®), an intravenous chemotherapy drug with a high rate of side effects, has been shown to prolong survival in patients who no longer respond to docetaxel.

Multi-Targeted Agent Cabozantinib Shows Clinical Activity against Advanced Prostate Cancer, Reverses Bone Metastases and Pain

A phase II trial showed that cabozantinib, which inhibits MET and VEGFR2—protein kinases involved in the development and progression of prostate cancer—reversed or slowed tumor growth in patients with advanced prostate cancer. The trial was designed as a “randomized discontinuation” trial, in which those who had partial responses stayed on the drug for 12 weeks; those with stable disease were randomized to cabozantinib or placebo; and patients with progressive disease were removed from the trial.

Of 168 patients enrolled in the study, 100 were evaluable with progressive, metastatic hormone-refractory prostate cancer. Overall, the disease control rate (partial response and stable disease) at week 12 was 71 percent for patients treated with cabozantinib. Tumor shrinkage occurred in 84 percent of patients; the objective response rate (partial tumor shrinkage and complete disappearance of tumor) at week 12 was 5 percent.

In addition to controlling prostate cancer progression, researchers reported that 56 of 65 patients (86 percent) with bone metastases treated with cabozantinib experienced either partial or complete disappearance of their bone metastases according to bone scans, often with a drop in the blood tests indicative of bone damage and with significant pain relief. (Fig. 1.) Among the 28 patients who required narcotics for severe bone pain at the beginning of the trial, 64 percent reported improved pain and 46 percent either decreased or stopped taking narcotics.

Multi-Targeted Agent Cabozantinib Shows Clinical Activity against Advanced Prostate Cancer, Reverses Bone Metastases and Pain

Early-Stage Trial Shows Novel Multi-Targeted Agent Cabozantinib Has Significant Effect on Melanoma and Several Other Advanced Cancers

A phase II trial showed that treatment with cabozantinib resulted in either tumor shrinkage or slowed tumor growth in patients with various advanced cancers. Cabozantinib targets MET, VEGFR2, RET, and KIT, a group of protein kinases involved in the development and progression of many cancers. The drug was particularly active in advanced prostate, ovarian, and liver cancers, which are historically resistant to available therapies, as well as some types of melanoma, including ocular. The drug also fully or partially suppressed bone metastases in patients with prostate and breast as well as other cancers.

The trial was designed as a “discontinuation” trial, in which all patients received the drug for 12 weeks. Following 12 weeks, those who had responses continued to receive cabozantinib. Patients with stable disease (cancer did not grow or progress) were randomly assigned to continue to receive cabozantinib or placebo; and patients with progressive disease were removed from the trial. This novel type of clinical trial design more quickly evaluates the disease-stabilizing activity of agents like cabozantinib, compared to the traditional...
model of randomly assigning all patients to either the experimental arm or placebo. This study evaluated patients after the initial 12 weeks of treatment with cabozantinib.

Of the 483 patients enrolled with nine different types of cancer, 398 were evaluable. The response rate (percent of patients with measurable tumor shrinkage) was 9 percent (34 of 398). The overall disease control rate was 54 percent (264 out of 483 patients) at week 12. The highest disease control rates (partial response and stable disease) at week 12 (prior to randomization) were 76 percent for liver cancer (22 of 29 patients), 71 percent for prostate cancer (71 of 100 patients), and 58 percent for ovarian cancer (32 of 51 patients). At least 11 of 60 patients remain on study with a 25- to 80-week follow-up at the time the study was reported.

Of the 65 patients with melanoma who were evaluable at 12 weeks, 60 percent showed some tumor shrinkage, with a 47 percent disease control rate at 12 weeks. Such responses were seen in patients with both ocular (eye) and skin melanoma subtypes. For those melanoma patients who experienced a reduction in bone metastases, many also had significant pain relief and improved quality of life. At the time of the analysis, at least 17 percent of patients were still in the study with stable disease after 25 to 80 weeks of follow-up and continuing to receive cabozantinib.

Cabozantinib appears to be the first agent with significant activity in suppressing the activity of prostate and other cancers as seen by bone scans, and in treating ocular melanoma, which represents a small proportion of patients with melanoma. In addition, cabozantinib seems to be active in a range of melanoma subtypes, unlike the targeted drug vemurafenib, which is effective only in patients with melanoma with tumors carrying a mutation in the BRAF gene.

Study Identifies Most Effective Second-Line Targeted Therapy for Advanced Kidney Cancer

Metastatic renal cell carcinoma is extremely difficult to treat, and fewer than 10 percent of patients live more than five years after diagnosis. Though several drugs have been approved by the FDA for metastatic renal cell carcinoma, and physicians understand which agents to use first based on an individual’s risk profile, the most effective sequence for using these agents as second-line therapy and beyond has been debated.

A new study—the first phase III trial of a second-line therapy for metastatic disease—showed that axitinib, which inhibits the vascular endothelial growth factor (VEGF) receptor, helped patients with metastatic renal cell cancer live significantly longer without their disease worsening compared to a similar targeted therapy, sorafenib (Nexavar®).5

In the study, 723 patients with clear-cell metastatic renal cell carcinoma who had completed initial therapy were randomly assigning to receive second-line therapy with either axitinib or sorafenib. Researchers found that patients treated with axitinib lived longer without the disease getting worse (median 7 months) than those receiving sorafenib, who lived a median 5 months without disease progression. (Fig. 2.) Of those patients in the axitinib group, 19 percent had some tumor shrinkage compared to only 9 percent for patients who received sorafenib.

Denosumab Approved to Help Prevent Cancer-Related Bone Problems in Patients with Prostate and Other Advanced Cancers

The FDA approved denosumab (Xgeva®) in November 2010 to help prevent skeletal-related events in patients with prostate, breast and others cancers that have metastasized and damaged the bone.6 Skeletal-related events include bone fractures from cancer, spinal cord compression and bone pain requiring radiation.

Denosumab is a monoclonal antibody that targets a protein involved in

Fact:

Five-year survival rates for kidney cancer increased from 51% between 1975-1977 to 68% between 1999-2005.
Gynecologic cancers include cancers of the cervix, uterus, ovaries, fallopian tubes, peritoneum, vagina and vulva. This year brought several advances in ovarian cancer, highlighting new progress in identifying the underlying genetic drivers of the disease and therapies that target them. Researchers reported data on two targeted drugs: bevacizumab—a drug that was designed to interfere with growth of the blood vessels that fuel tumor growth—and olaparib—a drug designed to interfere with DNA repair in cancer cells. Two studies involving these drugs reported data about a relatively new strategy called maintenance therapy—or longer-term drug therapy following standard chemotherapy. Lastly, researchers from the Cancer Genome Atlas project unveiled new clues about the inner workings of ovarian cancer cells, which will guide ongoing research efforts and new drug development.

**Genitourinary Cancers**
cancer.net/prostate
cancer.net/kidney
cancerprogress.net/prostate
cancerprogress.net/kidney

**Fact:**
There are three types of ovarian cancer: epithelial carcinoma, cancer that begins in cells on the outer surface of the ovary; germ cell tumor, cancer that develops in the egg-producing cells of the ovaries; and stromal tumor, cancer that develops in the connective tissue cells that hold the ovaries together and make female hormones.

We have taken the first steps in reaching our goal of individualized medicine for gynecologic malignancies by breaking the diseases (namely ovarian and endometrial cancer) into distinct histologic groups with different genetic and molecular characteristics. Ongoing research to detail these molecular characteristics, from the Cancer Genome atlas and others, will further advance this goal. We are now in a position to begin focused, target directed clinical trials.

—Carol Aghajanian, MD

cancer-related bone destruction, called receptor activator of nuclear factor kappa B (RANK) ligand. It is one of three FDA-approved drugs for skeletal-related events. In men with prostate cancer, the median time to a skeletal-related event was 21 months with denosumab compared to 17 months with zoledronic acid. (Fig. 3.)

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**GENECOLOGIC CANCERS**

**Specialty Editor: Carol Aghajanian, MD**

Gynecologic cancers include cancers of the cervix, uterus, ovaries, fallopian tubes, peritoneum, vagina and vulva. This year brought several advances in ovarian cancer, highlighting new progress in identifying the underlying genetic drivers of the disease and therapies that target them. Researchers reported data on two targeted drugs: bevacizumab—a drug that was designed to interfere with growth of the blood vessels that fuel tumor growth—and olaparib—a drug designed to interfere with DNA repair in cancer cells. Two studies involving these drugs reported data about a relatively new strategy called maintenance therapy—or longer-term drug therapy following standard chemotherapy. Lastly, researchers from the Cancer Genome Atlas project unveiled new clues about the inner workings of ovarian cancer cells, which will guide ongoing research efforts and new drug development.

**MAJOR ADVANCES**

**Bevacizumab Delays Cancer Progression in Recurrent Ovarian, Peritoneal and Fallopian Tube Cancers**

Ovarian cancer is often difficult to treat because it usually is diagnosed in an advanced stage, and despite initial surgery and chemotherapy, most cancers recur and require additional courses of chemotherapy. However, results from a randomized trial showed that women with recurrent ovarian cancer who received a combination of bevacizumab and platinum-based chemotherapy lived significantly longer without their disease worsening than those treated with the standard course of platinum-based chemotherapy alone.1 By extending the time patients can live without disease progression—and without further treatment with chemotherapy—the results suggest that increasingly, ovarian cancer may be treated as a chronic disease. In this case, bevacizumab is used additionally as maintenance therapy, or further treatment given after chemotherapy that is designed to keep the disease in remission.
In the phase III multicenter trial—called OCEANS—484 patients were randomly assigned to receive bevacizumab, an anti-VEGF monoclonal antibody, and chemotherapy (carboplatin and gemcitabine) or a placebo with the same chemotherapy regimen. Bevacizumab or placebo was continued after the completion of chemotherapy until the cancer progressed. After a median follow-up of 24 months, median progression-free survival was 12.4 months for patients in the bevacizumab group compared to 8.4 months for patients treated with chemotherapy alone. (Fig. 1.) In addition, researchers found that 79 percent of women treated with bevacizumab had significant tumor shrinkage, compared to 57 percent of women treated with chemotherapy alone. (Fig. 2.) The tumor shrinkage also lasted longer in the bevacizumab group: 10 months versus 7 months.

The investigators said the next step in this work is to evaluate the role of bevacizumab in combination with chemotherapy for patients in whom chemotherapy has stopped working, and to combine bevacizumab with other emerging therapies such as PARP inhibitors. (Fig. 3.)

**Bevacizumab Extends Progression-Free Survival for Some Patients with Newly Diagnosed Ovarian Cancer**

Interim data from a large, randomized phase III trial suggested that adding bevacizumab to standard carboplatin and paclitaxel chemotherapy for treatment of newly diagnosed ovarian cancer may offer a survival benefit over treatment with chemotherapy alone, particularly for patients with more aggressive disease.2

In the ICON7 study, 1,528 women with newly diagnosed high-risk or advanced epithelial ovarian, primary peritoneal or fallopian tube cancer were randomly assigned to receive either chemotherapy alone, or chemotherapy concurrent with bevacizumab followed by maintenance bevacizumab, for a total duration of 12 months. An interim analysis of overall survival requested by regulatory authorities found that there were fewer deaths in the bevacizumab group than in the standard therapy group (178 versus 200, respectively). This represents a 15 percent overall reduction in risk of death, but was not considered significant.

However, when investigators conducted a further analysis of the results in patients at highest risk, they found a significant benefit in the bevacizumab group. Specifically, among women with stage III ovarian cancer whose tumors were larger than 1 cm after surgery and all stage IV patients, the risk of death was 36 percent lower in the bevacizumab arm (79 deaths versus 109 deaths in the standard therapy group).

**NOTABLE ADVANCES**

**Cancer Genome Atlas Provides Molecular Details, Potential Drug Targets for Ovarian Cancer**

The majority of deaths—approximately 70 percent—in ovarian cancer occur in patients who are diagnosed with advanced high-grade ovarian cancer called serous adenocarcinoma. While surgery and chemotherapy can be effective, most patients experience recurrences. The overall five-year survival is about 31 percent, making the search for new drug targets and improved therapies a priority for cancer researchers.
A major hurdle for research efforts has been the fact that the genes involved in high-grade serous tumors tend to be more complex than many other forms of cancer. But this year, using more powerful genomic technologies, the Cancer Genome Atlas research project shared results from the first comprehensive effort to map the genome of ovarian cancer, pinpointing several common molecular features.\(^3\)

Specifically, researchers analyzed 489 high-grade serous ovarian adenocarcinomas and DNA sequences from 316 of these tumors. They discovered mutations in the \(TP53\) gene—which helps suppress tumors—in nearly all tumors (96 percent), and \(BRCA\) mutations in 22 percent of tumors. In addition, approximately 50 percent of tumors were found to have defects that interfere with DNA repair; drugs targeting this specific molecular feature, called poly ADP ribose polymerase (PARP) inhibitors, are being evaluated in late-stage clinical trials.

These findings reinforce the promise of ongoing research on PARP inhibitors and will inform the development of future drugs, with the ultimate goal of enabling physicians to tailor patient therapy to the specific genetic abnormalities in individual tumors.

**Randomized Study Shows That Maintenance Therapy and PARP Inhibitors Could Play Important Roles in Treatment of Relapsed Ovarian Cancer**

PARP inhibitors are a new class of molecularly targeted agents that inhibit the enzyme poly ADP ribose polymerase (PARP), which is involved in DNA repair. Tumors in up to half of women with high-grade serous ovarian cancer—the most common type of ovarian cancer—may have a DNA repair deficiency that makes them more susceptible to treatment with PARP inhibitors.

A randomized trial showed that maintenance therapy with the PARP inhibitor olaparib significantly improved progression-free survival in ovarian cancer patients with relapsed disease.\(^4\) The multicenter, international study randomly assigned 265 women with relapsed high-grade serous ovarian cancer to either olaparib or placebo, following standard chemotherapy. Researchers found that progression-free survival was significantly longer in the group receiving olaparib than the placebo group, with a median of 8 months versus 5 months. (Fig. 4.)

A number of PARP inhibitors are being tested in phase I and phase II clinical trials either alone or in combination with chemotherapy and radiation. Previous studies have shown that some patients with abnormal \(BRCA\) genes, a feature that raises the risk of developing breast and ovarian cancer, are most likely to benefit from treatment with PARP inhibitors.

Larger trials of PARP inhibitors are underway, and if these results are confirmed, olaparib could become an important treatment for women with advanced or high-risk ovarian cancer. The findings also add to the body of research on maintenance therapies as an additional option to prevent or delay recurrences following standard chemotherapy.

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LUNG CANCERS

Specialty Editor: Jyoti Patel, MD

Lung cancers account for 28 percent of cancer deaths in men and 26 percent in women. While death rates in men have been falling since 1990, they have only recently begun to drop in women, which parallels the more recent increase in smoking cessation among women—though not all lung cancers are caused by smoking.

Important new studies in the past year focused on screening to improve early detection of lung cancer, new personalized approaches to treatment that target specific lung cancer mutations and long-term maintenance therapy to improve survival among advanced lung cancer patients.

MAJOR ADVANCES

Large Study Shows Low-Dose CT Scanning Reduces Lung Cancer Death Rate

Lung cancer is usually detected at an advanced stage, when cures with surgery are far more difficult to achieve—highlighting the need for earlier detection strategies. Until now, potential screening approaches have had little impact on reducing the risk of dying from the disease. However, results published this year from a large national screening trial of more than 50,000 current and former heavy smokers found that annual low-dose CT scans reduced the death rate from lung cancer by 20 percent compared to those who were screened with annual chest X-rays.¹

In the study, 53,454 individuals age 55 to 74 at high risk for lung cancer—they smoked the equivalent of a pack of cigarettes a day for 30 years—were randomly assigned to receive three annual screenings with either low-dose CT or single-view chest X-ray and were followed for a median 6.5 years. The study was halted after 8 years when researchers saw a clear benefit with routine CT scanning.

The rate of positive screenings was 24 percent in the low-dose CT group and 7 percent in the chest X-ray group over the three screening rounds. The false-positive rates were high (approximately 95 percent) in both groups, which were likely due to chronic inflammation in the lungs associated with smoking, suggesting a need to carefully select patients for screening.

Overall, there were 1,060 cancers diagnosed in the low-dose CT group compared to 941 in the chest X-ray group, and 356 and 443 deaths from lung cancer, respectively—equating to a 20 percent reduction in lung cancer-related death in the CT-screened population. This is the first randomized trial to find a definitive reduction in lung cancer deaths with screening.

FDA Approves Targeted Drug for Rare Type of Advanced Lung Cancer

The FDA approved a new drug, crizotinib (Xalkori®), in August for patients with advanced non-small-cell lung cancer who harbor a specific type of alteration in the anaplastic lymphoma kinase (ALK) gene.² The approval of crizotinib is one of the latest examples of a successful personalized medicine approach in treating patients with cancer.
When the ALK gene combines with another specific gene, the gene alteration activates the ALK protein, an enzyme that fuels cancer growth and development. While this protein is one of the newest tyrosine kinase inhibitor targets in lung cancer, about 11,000 people in the United States are estimated to be diagnosed with ALK-positive lung cancer each year.

The approval was based on results from two studies. In a phase II study of 136 patients, researchers found 50 percent of patients experienced complete or partial tumor shrinkage. These responses lasted a median of 10 months. In the second study of 119 patients treated with crizotinib, investigators found a 61 percent objective response rate, with these responses lasting a median of 12 months. The phase II studies were based on a phase I trial that showed that more than 90 percent of patients with ALK-positive lung cancer responded—their cancer tumors either became smaller or stopped growing—to crizotinib.

In a follow-up study, researchers found that of those who received crizotinib, 77 percent were still alive after one year, and 64 percent were alive after two years. (Fig. 1.) Among patients who did not receive crizotinib, one-year and two-year overall survival were 73 percent and 33 percent, respectively.3

**NOTABLE ADVANCES**

**New Consortium Improves Treatment Outcome by Matching Tumor Mutations to Drug Selection**

The ability to detect mutations and other genetic alterations that drive the development of lung cancer—and subsequently target them with specific drugs, as is the case for alterations in the epidermal growth factor receptor (EGFR) and the ALK genes—has changed the management of the disease.

This year, in a prospective study, the 14-member Lung Cancer Mutation Consortium (LCMC) has identified at least one of 10 recognized genetic “driver” mutations in tumors in nearly two-thirds of patients with lung adenocarcinomas.4 Investigators suggest that the LCMC program is an important molecular profiling model showing that patients’ tumors may be analyzed for mutations at diagnosis in a systematic way, and such information can be given to physicians to help guide treatment selection and encourage participation in clinical trials.

The LCMC enrolled more than 1,000 patients with advanced (stage IIIB/IV) lung cancers to test lung tumors for 10 driver mutations, including KRAS, EGFR, HER2, BRAF, PIK3CA, AKT1, MEK1, NRAS, and for ALK rearrangements and MET amplifications. (Fig. 2.) Many of these genetic mutations can be targeted by drugs currently approved for lung cancer and other forms of cancer, and some can be targeted by drugs being tested in clinical trials.

Earlier this year, ASCO issued a Provisional Clinical Opinion advocating for routine mutation testing for the EGFR gene in certain patients with advanced lung cancers to help decide the most effective treatment. Physicians in this study used these mutation test results to choose the appropriate drug to match the mutation or gene abnormality. Just as the way drugs such as trastuzumab (Herceptin®) and lapatinib (Tykerb®) target the HER2 protein in breast cancers, crizotinib (Xalkori®) may be used for patients with lung cancer who carry alterations in the ALK gene. Patients with other types of
driver mutations that lack specific drugs are offered participation in trials open at the LCMC institutions that test agents aimed at the particular mutations identified.

As a result of the LCMC program, such “multiplex testing” for many tumor mutations at the same time is now routine at a number of the LCMC sites. While this consortium focuses on patients with advanced lung cancer, some cancer centers already routinely analyze all tumors for mutations. The same tumor mutation identification process can be used for other subtypes of lung cancer and is applicable for other cancers.

Additional Pemetrexed Treatment Extends Survival in Patients with Advanced Lung Cancer

While the combination of the chemotherapy drugs cisplatin and pemetrexed (Alimta) is often effective in bringing patients with advanced non-small-cell lung cancer into remission, it eventually loses its effectiveness.

A phase III, randomized trial showed that longer-term treatment, or maintenance therapy, with pemetrexed reduced the risk of disease progression (known as progression-free survival) in patients with advanced lung cancers who also received pemetrexed as part of their initial chemotherapy regimen, compared to placebo or best supportive care.5

This is the first large trial to demonstrate that using longer-term maintenance therapy with one of the same drugs included in initial treatment (termed “continuation maintenance”) can improve outcomes. The study provides physicians with a new treatment option after first-line therapy with pemetrexed.

In the study, 939 patients were given the standard four courses of first-line treatment with pemetrexed and cisplatin. Of those patients, 539 individuals whose cancer did not worsen during this treatment were randomly assigned to maintenance pemetrexed and best supportive care (359 patients) or placebo and best supportive care (180 patients) until the cancer began to grow again. Best supportive care entails non-anticancer therapy, including treatment for pain and infections, and to stimulate appetite. The investigators found that pemetrexed maintenance resulted in a 38 percent reduction in the risk of disease progression. The median progression-free survival was 4 months for those in the pemetrexed group compared to 3 months in the placebo group. The trial will continue to follow these patients to see if those given pemetrexed maintenance will have improved survival.

REFERENCES

Although lung cancer continues to exert an enormous toll on global health, we have made major advances in the past decade. We know that screening for lung cancer is effective and reduces mortality. Advances in the surgical and radiation management of lung cancer have made potentially curative therapies a reality for more patients. Importantly, we understand that the treatment of lung cancer is no longer monolithic and empiric. As we continue to incorporate molecular markers into treatment decisions, we will see more effective and better tolerated therapies for our patients.

—Jyoti D. Patel, MD
Advanced melanoma is one of the most deadly forms of cancer. Over the past three decades, melanoma incidence has climbed faster than any other cancer type. (Fig. 1.) In recent years, scientists have identified a number of important genetic mutations in melanoma cells that have led to the development of new therapies that target these specific molecular defects. At the same time, new insights into the immune system have helped in the development of novel therapies that mobilize a patient’s immune system to help fight the disease.

This year, researchers reported data on the first-ever molecularly targeted therapy to improve survival for patients with advanced melanoma, which led to the drug’s approval shortly thereafter. A second study reported continued positive results on an immune therapy—findings that will open major new avenues of research on combining this therapy with other effective drugs. Finally, an early-stage study found that combining oral targeted therapies had promising clinical activity against advanced melanoma.

MAJOR ADVANCES

Phase III Results Show BRAF Inhibitor Improves Survival in Advanced Melanoma, Leads to FDA Approval

Results from a trial reported this year showed that the drug vemurafenib (Zelboraf®), which targets a common mutation in melanoma, improved overall survival when compared to dacarbazine in patients with advanced melanoma.1 Vemurafenib—which received FDA approval in August 2011—could become a new standard treatment for patients with melanoma who have the V600E BRAF gene mutation. About half of patients have tumors that carry this mutation, making this drug an important step toward tailoring patient care in melanoma.

A phase III trial compared treatment with vemurafenib to the standard drug dacarbazine in 675 patients with previously untreated, inoperable stage III C or stage IV metastatic melanoma that carries a V600E BRAF gene mutation. The researchers found that 48 percent of patients receiving vemurafenib had tumor shrinkage compared to 5 percent in the dacarbazine group. (Fig. 2.) Vemurafenib reduced the risk of disease progression by 74 percent as compared with dacarbazine. Those who received vemurafenib had an overall survival rate of 84 percent at 6 months compared to 64 percent for those in the dacarbazine group. (Fig. 3.)

The FDA approval of vemurafenib—which was based on these results—is only for patients with late-stage melanoma who have a V600E gene mutation.2

While few patients who received vemurafenib experienced problems with toxicity, about 20 percent developed a low-grade skin cancer, squamous cell carcinoma, which was treatable. The researchers plan to next test vemurafenib in combination with the monoclonal antibody ipilimumab (Yervoy™).

Increasing understanding of the molecular underpinnings of melanoma will lead to new approaches to target melanoma cell growth, invasion and metastasis. At the same time, advances in immunotherapy are leading to longer-term responses and remissions due to the ability to clear drug-resistant disease. Perhaps the optimal therapy will result from a marriage of both approaches.

—Wolfram E. Samlowski, MD
First-Line Ipilimumab Plus Chemotherapy Improves Overall Survival in Metastatic Melanoma

For years, investigators have tried to harness the body’s immune system to fight melanoma, with relatively little success. However, in 2010, investigators announced results from the first phase III trial showing that ipilimumab, an immune therapy, improved survival in patients with advanced melanoma when used alone. This trial resulted in the FDA approval of ipilimumab in March 2011.3

Ipilimumab is a monoclonal antibody that represents a new class of drugs that allows the immune system’s T cells to seek and destroy melanoma cells. This year, a phase III study found that treatment with ipilimumab, combined with dacarbazine, improved overall survival in patients with metastatic melanoma compared to patients treated with dacarbazine alone.4

In this study, 502 patients with metastatic melanoma were randomized to ipilimumab plus the chemotherapy drug dacarbazine (250) or placebo and dacarbazine (252). The overall survival rate for the combination after one year was 47 percent compared to 36 percent for dacarbazine alone, and 21 percent for the combination versus 12 percent for chemotherapy alone at three years. (Fig. 4.) Investigators also found that the median overall survival was better for those who received the combination: 11 months versus 9 months for those given only dacarbazine.

NOTABLE ADVANCE

Combining Oral Targeted Therapies Shows Early Anti-Tumor Activity for Advanced Melanoma

Normally, a phase I trial—the first step in the clinical drug evaluation process—primarily focuses on the safety and toxicity of an experimental agent; it is rare to see any clear signs of treatment effectiveness. However, a phase I trial this year showed that a combination of two oral targeted therapies—GSK1120212, which is an agent that inhibits the MEK protein, and GSK2118436, a BRAF protein inhibitor—appears to have substantial antitumor activity in patients with advanced melanoma.5 The trial results are important because they show promising synergistic anticancer activity for two therapies that target common genetic abnormalities in advanced melanoma.

The phase I/II trial included 43 patients with advanced melanoma. Of 16 evaluable patients, 13 had partial tumor shrinkage, and three had no further tumor growth, for an overall response rate of 81 percent. This trial suggests that targeting both the BRAF protein (as was done with vemurafenib) and another protein in the same pathway (MEK) may further improve outcomes for patients.

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There are more than 70 types of sarcomas, and more than 50 subtypes of soft tissue sarcomas, which can arise in fat, muscle and nerve tissue. While the treatment with surgery, chemotherapy and radiation are standard for many patients, researchers are beginning to see the results of phase II and phase III trials showing the effectiveness of targeted therapies for soft tissue sarcomas. At the same time, study results are helping investigators unravel the molecular nuances of sarcomas—in turn, enabling the development of better treatment strategies, including prognostic and predictive markers and ways to personalize therapies for individual patients.

This year, significant progress has occurred in the use of drugs that target various biological pathways involved in sarcoma development and progression. A randomized trial found an effective treatment for metastatic soft tissue sarcoma that progressed despite standard therapy, while another study showed that a drug that blocks the activity of a key cell growth-promoting protein improved progression-free survival among various types of advanced soft tissue sarcomas.

**Second-Line Treatment with Antiangiogenic Pazopanib Improves Progression-Free Survival in Metastatic Soft Tissue Sarcoma**

Pazopanib (Votrient™)—which is approved by the FDA for advanced kidney cancer—blocks cancer cell pathways that are associated with tumor growth and blood vessel formation. Preliminary research showed that pazopanib had activity in leiomyosarcoma, synovial sarcoma and types of soft tissue sarcoma. This year, a phase III trial found that pazopanib significantly extended the time it took for these tumors to progress (progression-free survival) in patients whose disease advanced despite previous treatment.1

In the trial—called PALETTE—369 patients with metastatic soft tissue sarcoma were randomly assigned to receive either pazopanib (246 patients) or placebo (123). Researchers followed patients for a median of 15 months. The median progression-free survival was 5 months in patients treated with pazopanib as compared to 2 months for patients given a placebo. (Fig. 1) Overall survival for the pazopanib group was also slightly longer, though the difference was not significant.

Because pazopanib slowed down cancer growth, the results suggest that pazopanib blocks certain biological pathways that help cancer to progress. Future efforts to break down the molecular makeup of these soft tissue sarcoma subtypes may aid physicians in determining which patients are likely to benefit most from pazopanib. The study results are important because pazopanib has shown promising clinical activity as a second-line agent in difficult-to-treat metastatic disease.

**Angiogenesis Agent Brivanib Delays Disease Progression in Advanced Soft Tissue Sarcoma**

An international, phase II randomized discontinuation trial showed that treatment with a single agent—brivanib—significantly improved progression-free survival compared to placebo in patients with advanced soft-tissue sarcoma who had previous chemotherapy.2 Brivanib is a novel agent that blocks two pathways—VEGF (vascular endothelial growth factor) and FGF (fibroblast growth factor)—instead of only one, which most widely used agents target. VEGF and FGF play roles in blood vessel growth and development.

In the study, patients with inoperable soft tissue sarcoma with no other treatment options received brivanib for 12 weeks. The trial was designed as...
a discontinuation trial, in which those who had partial responses stayed on the drug; those with stable disease were randomly assigned to brivanib or placebo; and patients with progressive disease were removed from the trial.

Of 251 patients enrolled, 76 were randomly assigned to continue to receive either brivanib or placebo beyond the original 12 weeks. Researchers found that patients who received brivanib from week 12 lived a median of 3 months without their cancer progressing compared to 1 month with placebo. In those 76 patients, they found a disease control rate (a combination of complete tumor disappearance, partial tumor shrinkage and stable disease) of 30 percent overall. The drug also worked well in leiomyosarcoma, liposarcoma, angiosarcoma and others.

The results provide a new treatment option for a group of patients who historically have been difficult to treat.

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ADVANCED CANCER CARE

Specialty Editor: Jennifer S. Temel, MD

While treatment advances have significantly increased cancer survival rates, every year thousands of patients in the United States face a diagnosis of metastatic cancer. For these patients, the priority is to provide both the most effective treatment for their cancer and palliative and other services to maximize the quality of their life.

Palliative and/or hospice care specializes in helping patients manage pain, side effects and maintain a better quality of life, but research has long shown that many doctors and patients do not take advantage of these options. Earlier this year, ASCO published a statement recommending steps to ensure that all physicians initiate candid discussions about a patient’s illness and prognosis soon after their diagnosis to help patients and their families make informed decisions about treatment options. (See page 42 for more information on ASCO’s statement.)

In addition, several studies this year provided insight on key areas in which advanced cancer care can be improved. One study found that both patients and caregivers benefit from receiving end-of-life care in a hospice compared to a hospital. Additionally, a major report explored the use of hospice care among Medicare recipients, identifying several specific areas for improvement. Finally, a survey showed that patients’ awareness of their terminal illness did not adversely affect their survival, while another study confirmed that hospice patients are less likely to have aggressive end-of-life care than those not in hospice.
Where Patients Die Affects Both the Patients and Their Caregivers

A study of patients with advanced cancer and their caregivers showed that individuals who died in a hospital or intensive care unit (ICU) had a worse quality of life at the end of their lives compared to patients who died at home with hospice services. In addition, their caregivers were more likely to develop grief-related psychiatric illness.

Researchers studied 342 patients with advanced cancer and their caregivers. Patients were followed from the time of study enrollment to death, a median of 5 months. They assessed the patients’ quality of life within two weeks of death. The researchers also evaluated the caregivers’ mental health at the beginning of their participation and six months after the patient’s death.

The investigators found that the type of care patients received near the end of life mattered a great deal to both patients and their caregivers. Patients who died of cancer in an ICU or hospital reported more physical and emotional distress and worse quality of life than those who died at home with hospice. It also found that caregivers of patients who died in ICUs had a five-fold greater risk of developing post-traumatic stress disorder (PTSD) compared with caregivers of patients who died at home with hospice services. Twenty-one percent (4 of 19) of caregivers of patients who died in the ICU or hospital developed PTSD compared to 4 percent (6 of 137) of caregivers of those who died at home with hospice.

The researchers expected to find differences in patients’ quality of life based upon where they died, but were surprised to find such striking differences in caregivers’ mental health during the grieving process. The authors emphasized that efforts aimed at reducing hospitalizations at the end of life or increasing the utilization of hospice services could have a substantial effect on the well-being of both patients and their caregivers.

One-Third of Patients with Poor Prognosis Spend End of Life in Hospital, Many Enter Hospice Late

The Dartmouth Atlas Project issued a report examining the care of Medicare patients over age 65 who were diagnosed with cancer that had a poor prognosis, finding that care at the end of life varied across regions and academic medical centers.

The report shows that many patients with advanced cancer spend significant time at the end of their life in the hospital and do not consistently receive hospice care that is aimed at maximizing the quality of life.

The report’s key findings include the following:

- In many regions and centers across the United States, patients with advanced cancer receive care at the end of life in hospice or some other palliative care setting. However, overall, more than one-third of cancer patients with a poor prognosis spend their last days in the hospital or intensive care unit. Approximately 60 percent of cancer patients were hospitalized at least once during the last months of life.
- In at least 50 academic medical centers, less than half of advanced cancer patients received hospice services during the last month of life. Many patients were enrolled within days of their death, and patients and families appeared to benefit little from such care.

The authors suggest that conversations between health care providers and patients about end-of-life preferences should occur more consistently, and sooner—in some cases within months or even weeks after diagnosis. They also point to research showing that palliative and hospice care may prolong life, even as they improve its quality.
Awareness of Terminal Illness, Entry into Hospice or ICU Does Not Cause Physical, Psychological Harm to Patients

Clinicians are often concerned about discussing a poor prognosis and palliative care/hospice options with patients because they are afraid that it will take away hope for some individuals and affect their survival. However, a survey of terminally ill patients with cancer has shown that patients’ awareness that they are dying and whether they choose to enter either a hospice or intensive care unit do not affect their survival.

In the Study to Understand Risks, Priority, and Issues at End-of-Life (SUREPRISE), 619 patients were given questionnaires shortly after receiving a terminal cancer diagnosis from their physicians and followed throughout the course of their care. In a follow-up of 483 of these patients, the authors showed that neither patients’ awareness of their terminal illness nor use of palliative care services negatively affected survival. They found that patients who were aware of their terminal illness were more likely to use palliative care (71 percent) and less likely to enter an ICU (50 percent).

The study showed that disclosing patients’ prognoses was not harmful and in fact helped them to make choices regarding their care.

Study Shows Terminal Cancer Patients Not Enrolled in Hospice More Likely to Receive Diagnostic, Testing Procedures at End of Life

A large study of more than 14,000 men with terminal prostate cancer found that those enrolled in hospice care were less likely to have aggressive care at the end of life. Of the more than 28,000 American men who die of prostate cancer annually, only one-third receive hospice care. Investigators examined SEER-Medicare data to measure hospice use and intensity of medical care in 14,521 men 66 years or older who died of prostate cancer between 1992 and 2005. They wanted to characterize hospice use in this patient population and to compare high-intensity care—including diagnostic and testing procedures—in the last six months of life and hospital care between those patients who did and did not enroll in hospice.

Patients who were not enrolled in hospice were more likely to receive diagnostic and testing procedures in the last 6 months of life and more likely to be admitted to the emergency room, hospital or intensive care unit. However, they noted that the proportion of patients using hospice prior to death increased over time, as did the proportion of patients dying within seven days of enrollment.

The authors concluded that the study provides additional evidence that timely discussions regarding goals of care and referral to hospice can help prevent futile care at the end of life that actually lessens quality of life.

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There has been remarkable progress in reducing cancer death rates in the last two decades, thanks to improvements in screening, detection and treatment. However, not all racial and ethnic groups in the United States have benefitted equally. New research in recent years has begun to uncover important differences in biology and cancer susceptibilities among various groups that could play a role in cancer-related disparities. At the same time, researchers continue to pay special attention to the effects of several factors, such as levels of income and education and access to care, that have a substantial effect on cancer outcomes. Progress in better understanding the causes of cancer disparities is needed in order to develop specific interventions aimed at reducing them.

To address some of these issues, ASCO recently published a policy statement, Opportunities in the Patient Protection and Affordable Care Act to Reduce Cancer Care Disparities. In its statement, ASCO advocates for policies—and outlines specific strategies—to ensure access to cancer care for the underserved, including insurance reform, a reduction of economic barriers to quality health care, prevention and wellness and for research in health care disparities.

This year, researchers gained new insights into the effects of socioeconomic and educational differences on disparities in such areas as access to surgical care and palliative care, and their impact on minority and ethnic groups. In a large population-based study, investigators found racial and socioeconomic differences in hospice services among elderly insured patients with lung cancer, while a study of the New York City public hospital system found similar differences in access to ovarian cancer surgery. A special section of a large annual report described the connection between differences in educational levels and survival among various groups. Lastly, a study pointed to differences in survival improvements among blacks and whites with multiple myeloma.

**CANCER DISPARITIES**

*Specialty Editor: Sylvia Adams, MD*

Patients with advanced lung cancer account for approximately 34 percent of all hospice patients with cancer in the United States.

**NOTABLE ADVANCES**

*Hospice Use among Elderly Patients with Lung Cancer Differs by Racial, Socioeconomic Levels*

Hospice care provides compassionate care for individuals in the last phases of cancer. Previous studies have shown greater use of hospice among whites, individuals with higher educational level and those who live in urban areas. But it has not been clear whether there are racial disparities in hospice use among ethnic minorities in urban versus rural areas and within socioeconomic levels.

Researchers examined hospice use in the last six months of life between 1991 and 2005 among 117,894 patients age 66 and older with advanced non-small-cell lung cancer, based on information from the Surveillance, Epidemiology, and End Results (SEER)-Medicare database. Patients with advanced lung cancer account for approximately 34 percent of all hospice patients with cancer in the United States.

The investigators found that in urban areas and overall, patients with lung cancer who were black were 21 percent less likely to receive hospice services within the last six months of life compared to white patients, Asian/Pacific Islanders were 58 percent less likely and Hispanic 19 percent less likely. In rural areas, blacks were 21 percent less likely to receive hospice services than whites.

Overall, patients in the poorest socioeconomic levels were less likely to receive hospice care. When stratified by socioeconomic levels, blacks and Asians/Pacific Islanders obtained less hospice services compared to whites in each of the four socioeconomic level quarters. Within the lowest socioeconomic group, Asian/Pacific Islanders were the least likely to receive services (70 percent less compared with whites within the poorest group). These find-
ings point to the need to identify barriers, enhance support and improve patient education for these populations about the benefits of hospice. This study is one of the first to examine cancer care of Asian/Pacific Islanders and suggests that this population is not sharing in the benefits of hospice care that have been made broadly available with the advent of the hospice care movement that began nearly 40 years ago in Great Britain.

Ovarian Cancer Care Differs between Public and Private Hospitals

For women with ovarian cancer, in which approximately 75 percent of patients have advanced disease at diagnosis, appropriate surgical staging—including the removal of the ovaries, fallopian tubes, uterus, and examination of various tissues in the abdominal cavity—is critical to determining how far the disease has spread and prognosis. In addition, comprehensive surgery to remove as much of the cancer as possible is closely linked to improved survival.

While studies have shown that patients who receive their care from a gynecologic oncologist are more likely to undergo adequate surgery and have a higher survival than those who are treated by a gynecologist or general surgeon, only 40 percent of women with ovarian cancer are treated by gynecologic oncologists. Other studies have also found better outcomes for women treated by surgeons who are considered “high-volume,” meaning they more frequently perform ovarian cancer surgery. In addition, further studies have shown African Americans and Hispanics are less likely to receive standard ovarian cancer surgery.

In one of the first studies to describe the surgical management of ovarian cancer patients in a large urban hospital system, investigators compared the care provided in the New York City public hospital system to private hospitals in New York City between 2001 and 2006. The public hospital system provides care for patients without regard to insurance status, and largely serves minority patients and recent immigrants.

Hospitals were stratified according to the availability of gynecologic oncologists, and surgeons were stratified by subspecialty training and volume of ovarian cancer cases. Researchers found that patients treated in public hospitals were less likely to have their surgery performed by a gynecologic cancer surgeon than in private hospitals (57 percent versus 74 percent), and less likely to be operated on by a high-volume surgeon (21 percent versus 47 percent).

Because only 5 percent of ovarian cancer surgeries were conducted in public hospitals, these findings suggest that patients may benefit from being referred to hospitals that have the highest volume of ovarian cancer cases, or have high-volume surgeons who practice at both public and private hospitals.

The physician who conducted this research was a recipient of the Young Investigator Award given by ASCO’s Conquer Cancer Foundation.

New Insight into Link between Cancer Death Rates and Education Level

While overall cancer death rates have fallen by 22 percent for men and 14 percent for women between 1990 and 2007, death rates for individuals with lower socioeconomic status (defined by education, occupation and other factors) showed little or no decrease, according to the American Cancer Society’s annual Cancer Facts and Figures 2011 Special Section: Cancer Disparities and Premature Deaths.

Many consider an individual’s education level as a marker of socioeconomic status, and this report indicates that the gap in death rates between those with high and low education levels during that 17-year period progressively grew. In both black and white men aged 25 to 64, the cancer death rate was twice as high in the least educated compared with the most educated in 1993. By 2007, there was nearly a three-fold difference. The largest educational differences overall were seen in lung cancer, where the death rate for men was five times higher for the least educated than for the most educated.
Many of the disparities in cancer outcomes among racial and ethnic minorities, the report authors suggest, reflect low education levels and income, recent immigrant status and lack of health insurance—which in turn are linked to access and use of health care services. Educational levels are associated with certain behaviors that increase cancer risk, such as smoking and obesity, as well as lower rates of screening for colorectal and breast cancers.

To measure the impact of educational level on cancer disparities, the authors calculated potential cancer deaths that could have been prevented. In 2007, about 24,500 African Americans age 25 to 64 died of cancer. If death rates were adjusted to the rates observed for the most educated African Americans, more than 10,000 potential deaths (40 percent) would have been avoided. In contrast, if all African Americans were to have the same death rates as their white counterparts with the same level of education, only about 5,000 potential deaths (20 percent) would be avoided. The authors contend that reducing socioeconomic disparities among African Americans could potentially prevent twice as many deaths as eliminating racial differences. Targeted intervention programs emphasizing health promotion as well as early detection are urgently needed to reduce cancer disparities.

Study Finds Key Racial Differences in Multiple Myeloma Survival Over Three Decades

Multiple myeloma is the most common blood cancer among blacks in the U.S. but there is little data on racial disparities in incidence and survival. In the first large-scale, population-based study to assess differences in incidence and survival in multiple myeloma among blacks and whites in the United States spanning three decades, investigators found that the incidence of multiple myeloma was twice as high in blacks than it was in whites, but that blacks had a higher disease-specific survival than whites.5

Using information from the National Cancer Institute’s Surveillance, Epidemiology and End Results (SEER) database, researchers analyzed data from 5,798 black and 28,939 white patients diagnosed with multiple myeloma between 1973 and 2005, and followed the data through 2006. They found that blacks have a younger age of onset (mean age at diagnosis was 66 years) than whites (70 years). Despite the greater disease-specific and relative survival in blacks over the entire study period, improvements in relative survival were small. Relative survival measures the reduced survival associated with a diagnosis of myeloma compared with the expected survival of the general age-matched population. However, for white patients, there were significant improvements in five-year relative survival over the study period, including periods before and after 1994 and 1999 (when important treatments such as stem cell transplantation and the drug thalidomide were introduced).

The fact that blacks tended to develop multiple myeloma at a younger age and had better survival compared with whites may suggest a different disease biology and susceptibility. However, lower improvements in relative survival over the study period raise the possibility of disparities in access and/or responsiveness to newer therapies.

REFERENCES

The field of developmental therapeutics focuses on translating discoveries in the laboratory into drugs that improve the quality of life and survival of patients. The first step in clinical drug development is the phase I clinical trial, which evaluates the safety of new therapeutic agents or combinations of cancer therapies. A key study this year from researchers at the University of Texas M.D. Anderson Cancer Center showed the benefits of matching gene alterations in tumors with specific drugs for patients participating in phase I clinical trials.

**NOTABLE ADVANCE**

**Innovative Model Shows that Matching Targeted Drugs to Tumor Alterations in Patients with Advanced Cancer Can Improve Outcomes, Even in Phase I Trials**

One of the overarching goals of modern cancer medicine is to target cancer treatments to each patient’s cancer, based on the precise genetics of their tumor.

This year, investigators at M.D. Anderson Cancer Center reported that matching patients with advanced cancer in phase I clinical trials with targeted drugs based on tumor make up was feasible, resulted in longer survival and caused stronger, longer-lasting treatment benefit compared with those without such matching.1

The findings could lead to a new model for conducting phase I clinical trials, which could ultimately speed the development of therapies for specific subsets of cancer patients based on their tumor biomarkers.

In the study, investigators analyzed tumors of 1,144 patients with advanced cancer who had a median of four previous therapies, identifying one or more gene alterations in 460 patients. Such alterations included those in genes such as **PIK3CA, mTOR, BRAF, MEK, KIT, EGFR and RET**. (Fig. 1) Researchers found that when patients could be treated with targeted drugs that matched one of their tumor gene alterations, they had better survival than patients who were not matched to targeted therapies.

Median survival was 13 months for patients with a genetic change who were treated with a matched therapy, compared with 9 months for those patients who did not receive a matched therapy. They also showed that patients with one known genetic alteration who received a matched therapy experienced a longer lasting benefit from treatment than those who received unmatched therapy: the median time to the treatment becoming ineffective was 5 months compared to 2 months in individuals without a matched therapy.

**REFERENCES**


Although early-stage clinical trials traditionally have focused on toxicity and identifying a tolerable drug dose for subsequent clinical development, it is equally important to begin to identify patients who are likely to benefit from such therapies. The incorporation of molecular and genomic information into early-stage clinical trials will ultimately speed the clinical development of effective therapies.

—Pasi A. Jänne, MD, PhD

![Image of a scientist performing research](image.png)

**Fig. 1. Proportions of Molecular Aberrations (1,144 patients)**

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<tr>
<th>Mutation</th>
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<th>Patients with aberration</th>
<th>Percent</th>
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*Includes mostly patients with medullary thyroid cancer
Researchers have made tremendous strides in understanding the biology of cancer, and are translating this progress into increasingly personalized cancer treatments. At the same time, research is leading to new ways to improve supportive care and quality of life for cancer patients. An important study this year centered on the evaluation of markers for predicting risk of experiencing a key side effect of certain cancer treatments.

**NOTABLE ADVANCE**

**Genetic Biomarker Predicts Taxane-Induced Neuropathy**

Peripheral neuropathy is a potentially severe complication of a very commonly used class of chemotherapy drugs called taxanes (docetaxel and paclitaxel) and it affects about one-third of patients with cancer receiving such treatment. The condition results from damage to nerves, causing pain and numbness in the hands and feet. In some cases, this side effect limits the dose of chemotherapy a patient can receive.

Currently, only a few factors seem to predict which patients are likely to get peripheral neuropathy. Now, investigators have identified the first genetic biomarkers for peripheral neuropathy brought on by taxane chemotherapy, potentially explaining why the side effect occurs in some patients but not in others. The finding may eventually lead to the development of a blood test to determine whether a patient is at high risk for neuropathy and, in turn, allow physicians to choose alternative treatments or treatment schedules and better counsel patients about their risks.

Investigators conducted a genome-wide association study on 2,204 patients who received taxane-based chemotherapy as part of a clinical trial conducted by the Eastern Cooperative Oncology Group. In a genome-wide association study, researchers search the genome—all of an individual’s genes—for small variations that occur more often in people with a particular disease than in those without the disease. This study looked for variations in DNA called single nucleotide polymorphisms (SNPs). With a median follow-up of 15 months, the study identified subgroups of patients with certain differences in their genes that made them much more likely to develop peripheral neuropathy. Those who carried two normal nucleotides in a specific type of gene had a 27 percent chance of having neuropathy. But those who carried one normal nucleotide and one SNP had a 40 percent chance and those who carried two SNPs had a 60 percent chance.

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**PEDIATRIC CANCERS**

*Specialty Editor: ZoAnn E. Dreyer, MD*

The large declines in childhood cancer death rates over the past several decades have been one of the great achievements in cancer care. Long-term survival rates for childhood cancer increased more than 20 percent between 1975 and 2006, approaching 80 percent overall. Pediatric oncologists have begun to focus not only on refining traditional chemotherapy approaches, but in other new directions as well. Targeted therapies that seek out specific genes or enzymes within the cancer cell have been developed and new immunotherapies are using novel delivery systems to attack only cancer cells. Personalized therapies that take advantage of specific genetic variations that exist within a tumor and use that information to increase the number of cancer cells killed are being explored. At the same time, researchers are seeking to develop less toxic therapies and improve the quality of life of long-term survivors, who face increased risks of developing new cancers, heart failure, lung damage, learning disorders and other health problems.

This year, results from two trials transformed therapy for two forms of childhood cancer. In one, researchers found that a new combination of chemotherapy drugs used prior to stem cell transplant in highly aggressive neuroblastoma significantly improved survival for children with this often deadly disease. In the second, investigators showed that a new, higher-dose chemotherapy regimen significantly improved the cure rate for children with acute lymphoblastic leukemia (ALL), pushing the cure rate to more than 80 percent.

**MAJOR ADVANCES**

**New High-Dose Chemotherapy Regimen Improves Survival in Children with Hard-to-Treat Neuroblastoma**

Neuroblastoma is the most common cancer in the first year of life, accounting for approximately 15 percent of childhood cancer deaths. About 40 percent of cases are considered high risk, meaning they are very likely to recur or progress, despite therapy. This year, results from a phase III trial showed that a new combination of chemotherapy drugs improved survival for children with high-risk disease, establishing a new standard of care.[1]

The typical therapy for children with high-risk neuroblastoma includes intense chemotherapy to bring about remission followed by surgery, radiotherapy, and myeloablative therapy to kill the remaining cancer cells combined with stem cell transplantation. This may be followed by additional treatment, including immunotherapy, to eliminate any remaining cancer cells.

The HR-NLB1 trial compared the effectiveness of two high-dose myeloablative chemotherapy treatments. Myeloablative chemotherapy is high-dose chemotherapy aimed at killing cancer cells prior to stem cell or bone marrow transplant. In the trial, 563 children (median age three) with stage IV, high-risk disease with distant metastases or local disease were randomized to receive either a combination of the chemotherapy drugs busulphan and melphalan (281 patients) or the standard regimen of three chemotherapy drugs, carboplatin, etoposide and melphalan (CEM, 282 patients). After three years, the event-free survival for patients treated with busulphan-melphalan was 49 percent compared with 33 percent for the CEM group. Overall survival after three years was 60 percent for those who received busulphan-melphalan compared with 48 percent in the CEM group. The busulphan-melphalan group also had lower rates of relapse (47 percent versus 60 percent). Based on these strong results early on, the randomization was stopped, and all patients enrolled in the trial were given busulphan-melphalan therapy.
New Chemotherapy Regimen Boosts Event-Free Survival for Children and Young Adults with ALL

Acute lymphoblastic leukemia (ALL) is the most common leukemia in children. Patients are treated with a chemotherapy regimen to bring the cancer into remission, followed by another course of chemotherapy—known as interim maintenance therapy—to keep the disease in remission. For many years, the standard interim maintenance therapy has consisted of treatment with the common chemotherapy drug methotrexate on an “escalating schedule,” giving the drug in gradually increasing amounts, followed by a second chemotherapy drug called asparaginase. However, the most effective dosages and treatment schedules have not been well established, and relapses continue to be a problem.

The phase III Children’s Oncology Group (COG) trial of nearly 2,500 children and young adults with ALL showed that giving methotrexate in large, consistent doses—rather than in gradually increasing doses—was more effective in preventing relapses and extending survival.1

Investigators divided 2,426 patients age 30 and under with newly diagnosed ALL into two groups. After initial treatment with chemotherapy to bring the disease into remission, patients in one group were treated with the standard escalating methotrexate plus asparaginase, while the other group received high-dose methotrexate at 50 times the starting dose of the escalating regimen. At a planned interim analysis, the five-year, event-free survival for patients who received high-dose methotrexate was 82 percent, compared with 75 percent for patients on the escalating methotrexate regimen. There were significantly fewer bone marrow and central nervous system relapses in the high-dose group. Based on these results, the standard of care for patients with high-risk ALL now includes high-dose methotrexate, rather than lower-dose methotrexate, during the interim maintenance phase of therapy.

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2. Larsen, EC, et al: Comparison of high-dose methotrexate (HD-MTX) with Capizzi methotrexate plus asparaginase (C-MTX/ASNase) in children and young adults with high-risk acute lymphoblastic leukemia (HR-ALL): A report from the Children’s Oncology Group Study AALL0232. Presented at the 47th Annual Meeting of the American Society of Clinical Oncology; June 2011; Chicago, IL.

PREVENTION AND SCREENING

Specialty Editor: Gregory A. Masters, MD

For many cancers, effective methods of detecting disease at an earlier, more treatable, stage remain elusive. Screening for some cancers—most notably breast, colon and cervix—has been tremendously successful at reducing cancer-related deaths. Similar progress in other cancers, such as lung, ovarian and pancreatic, has proven frustratingly difficult, however. At the same time, researchers continue to seek new ways to reduce the risk of cancer ever developing.

This year, just prior to press time, a special federal panel recommended against routine screening for prostate cancer using prostate-specific antigen (PSA) test. Earlier, the results of a landmark national trial found that routine screening with a CT scan greatly reduced the risk of lung cancer-related death among current and former smokers (also described on page 21). In another study, researchers reported a novel PSA testing strategy that can identify men...
who are at the highest risk of dying from prostate cancer, and those that could avoid PSA testing. Another large study provided new insights into the use of both HPV and Pap testing for cervical cancer screening. Finally, an important study showed for the first time that aromatase inhibitors could lower the risk of developing breast cancer (also described on page 9).

**MAJOR ADVANCES**

**Study Shows Low-Dose CT Scanning Reduces Lung Cancer Deaths**

Until now, screening has had little impact on reducing the risk of dying from lung cancer. However, results published this year from a large national screening trial of more than 50,000 current and former heavy smokers found that three annual low-dose CT scans reduced the death rate from lung cancer by 20 percent compared to those who were screened with three annual chest X-rays.

In the study, 53,454 individuals ages 55 to 74 at high risk for lung cancer—they smoked the equivalent of a pack of cigarettes a day for 30 years—were enrolled from 2002 to 2004 at 33 medical centers in the United States. They were randomized to receive three annual screenings with either low-dose CT (26,722 participants) or single view chest X-ray (26,732), and were followed for a median 6.5 years. The study was halted after 8 years when researchers saw a clear benefit associated with routine CT scanning.

The rate of positive screenings was 24 percent in the low-dose CT group and 7 percent in the chest X-ray group over the three screening rounds. The false-positive results were likely due to chronic inflammation in the lungs associated with smoking, suggesting a need to carefully select patients for screening.

Overall, there were 1,060 cancers diagnosed in the low-dose CT group compared with 941 in the chest X-ray group, and 356 and 443 deaths from lung cancer, respectively—equating to a 20 percent reduction in lung cancer-related deaths in the CT-screened population. This is the first randomized trial to find a definitive reduction in lung cancer deaths with a screening regimen.

Based on these results, ASCO is developing a clinical practice guideline on lung cancer screening in conjunction with the National Comprehensive Cancer Network, American Cancer Society and the American College of Chest Physicians.
Exemestane Significantly Reduces Risk of Invasive Breast Cancer in High-Risk, Postmenopausal Women

Although the anti-estrogen drugs tamoxifen and raloxifene are FDA-approved for breast cancer prevention in women at high risk, only 4 percent of the approximately 2 million high-risk women in the United States who could benefit from tamoxifen actually take it because of concerns over the increased risk of developing endometrial cancers and blood clots with available treatments.

A phase III trial showed that exemestane—a member of a family of drugs called aromatase inhibitors—greatly reduces the risk of developing breast cancer compared with placebo in high-risk, postmenopausal women. This is the first evidence that an aromatase inhibitor is effective in reducing the risk of a first breast cancer, and now opens the door for exemestane to become an option for postmenopausal women who are at high risk for breast cancer.

Aromatase inhibitors, which work differently than tamoxifen by preventing estrogen synthesis, have proven superior to tamoxifen in preventing recurrences in early-stage, post-menopausal breast cancer patients. The current study, known as MAP-.3 (Mammary Prevention Trial.3), included 4,560 postmenopausal women who were 60 or older and who were considered high risk for breast cancer. After a median follow up of three years, the group receiving exemestane had a 65 percent reduction in invasive cancers. There was also a 60 percent reduction of invasive breast cancer and pre-invasive DCIS (ductal carcinoma in situ, the earliest form of breast cancer) in the exemestane group, and fewer precancerous conditions seen.

Novel Screening Approach Suggests PSA Levels Among Men Age 44-50 May Predict Long-Term Risk of Metastatic Prostate Cancer or Death

Doctors and patients have long sought an effective way to distinguish men at high risk for prostate cancer who need more vigilant monitoring from those at low risk. A major concern, which led to the recent public health recommendation against PSA screening use, has been that, in the general community, PSA screening has not been proven to lower death rates from prostate cancer and is associated with over-treatment of non life-threatening cancers. The test identifies conditions that are not cancer, and it misses some actual prostate cancers.

This year, a large retrospective, case control study of previously unscreened Swedish men showed that PSA levels on initial screening among men age 44 to 50 can accurately predict the risk that a man will die of prostate cancer or develop metastatic prostate cancer up to 30 years later. This predictability included men with the highest PSA levels and who were at the highest risk of death years later and men with the lowest PSA levels and who were at the lowest risk of death many years later. The authors suggest that an initial PSA test, provided that is low in this age group, could enable approximately 50 percent of men to undergo just three PSA tests in their lifetime.

Researchers analyzed PSA levels in stored blood samples from 12,090 men provided between 1974 and 1986, and nearly 5,000 repeat samples collected six years later as part of the Swedish Malmo Preventive Project. Using these samples, the investigators assessed the median PSA levels for men in three age groups: 44 to 50, 51 to 55 and 60 years of age. These median levels at baseline served as the base to distinguish men at high or low risk of dying of prostate cancer or developing metastatic prostate cancer. As men aged, if their PSA levels remained below the median for the population in their age group, the risk of death from metastatic prostate cancer progressively declined. They found that 28 percent of metastases or deaths from prostate cancer over the next 27 years occurred in men ages 44 to 50 who had a PSA level below the median in the population (0.7 ng/mL). For men ages 51 to 55 with a PSA level less than the median (0.8 ng/mL), the relative risk of metastatic
prostate cancer or death was even lower—only 18 percent. At age 60, only 0.5 percent of deaths or metastases occurred in men with a PSA level less than median for that age (1.1 ng/mL).

The researchers concluded that men with PSAs below the median in the population in each age group remain at progressively lower risk of dying of prostate cancer as they age, and that three tests between ages 44 and 60 could be enough for 50 percent of men. The findings could have important implications in deciding who should be screened with increased frequency.

The study also found that 44 percent of prostate cancer deaths occurred in men who had the top 10 percent of PSA levels when they were tested between the ages of 44 and 50. As a result, the authors say, nearly half of all prostate cancer deaths could potentially be prevented by intense surveillance of this small group of men.

Large Study Finds Most Women Can Safely Extend Cervical Cancer Screening to Three Years; HPV Testing Also Appears to be Superior to Pap Testing

Cervical cancer is caused by infection with human papillomavirus (HPV), a common sexually transmitted infection, which can be detected by performing DNA testing on a sample of cervical cells. HPV infection is almost always cleared by the body, but if it is not, cancer may develop, typically decades after initial infection. Immunization can prevent HPV infection in both men and women, lowering the risk of future cervical and other cancers. While Pap testing has dramatically reduced cervical cancer rates, screening guidelines from medical and health organizations such as the American College of Obstetricians and Gynecologists and the American Cancer Society have endorsed the use of routine HPV testing together with Pap tests as a safe alternative to routine Pap testing alone for women 30 and older, recommending cotesting every three years for women who are HPV-negative and have a normal Pap test. However, cotesting has not been widely adopted by physicians and women, many of whom are unsure about the safety of extending testing intervals for more than one year.

This year, the first large-scale study of cotesting in routine clinical practice showed that women can safely be tested every three years instead of every year. The study also found that a single HPV test may be more accurate than a conventional Pap test in determining cervical cancer risk.

Researchers followed 331,818 women ages 30 and older who enrolled in Kaiser Permanente Northern California’s cotesting program for five years. They found that the five-year cancer risk for women who had both a normal Pap test and tested negative for HPV was very low: 3.2 per 100,000 women per year. Looking at each test individually, HPV-negative women had half the cancer risk of women with a normal Pap test (3.8 per 100,000 women per year compared to 7.5 per 100,000), suggesting that HPV testing alone is more accurate than Pap testing alone. The study also showed that the cancer risk with a negative HPV test alone was similarly low, compared with HPV and Pap testing together (3.8 versus 3.2 per 100,000).

According to the authors, these findings serve as a formal confirmation that cotesting every three years is a safe and highly effective cervical cancer screening strategy for most women over age 30.

REFERENCES
1. Lilja, H, et al: Towards a rational strategy for prostate cancer screening based on long-term risk of prostate cancer metastases and death: Data from a large, unscreened, population-based cohort followed for up to 30 Years. Presented at the 47th Annual Meeting of the American Society of Clinical Oncology; June 2011; Chicago, IL.
Year In Review: Cancer Policy Developments in 2011

Continued Progress Depends on Access to Clinical Trials and Quality Care
Forty years after the National Cancer Act of 1971, the advances described in this report represent the continued legacy of that landmark legislation, which led to major improvements in the care of people with cancer. Cancer survival rates in the United States are increasing thanks to better detection and newer treatments combined with advances in cancer prevention. Yet, much remains to be done. More than half a million Americans will die of cancer this year in the United States alone, and the disease is projected to become the nation’s leading cause of death as the population ages.

Continued progress requires accelerating the pace of clinical cancer research, while expanding access to quality cancer care for patients. In many cases, action by policymakers will be crucial to our success. This section of Clinical Cancer Advances describes key cancer policy developments and ASCO policy initiatives from the past year that are likely to influence cancer care over the coming years.

New ASCO Report Recommends Steps to Transform Clinical Cancer Research
Clinical cancer research is the engine that drives progress against the disease. With our rapidly growing understanding of the biology of cancer, cancer science is rapidly moving into a “genomic” era in which each patient’s cancer can be understood, and treated, based on its unique molecular features. Yet the nation’s clinical research system has not kept pace with recent scientific advances.

In a comprehensive report, ASCO lays out a vision for a clinical research system that takes full advantage of today’s scientific and technological opportunities. The report makes recommendations in three areas:
- Establishing an approach to the development of new treatments based on a more thorough understanding of cancer’s biology
- Designing faster and smarter clinical trials appropriate for the era of molecularly targeted therapies
- Harnessing information technology to seamlessly integrate clinical research and patient care.

Over the next three years, ASCO will be working with other stakeholders throughout the cancer community in order to help make the report’s vision a reality.

Progress Made in Revitalizing Federally Funded Clinical Trials
In 2010, a report by the Institute of Medicine (IOM) made recommendations to modernize and strengthen one key component of the nation’s cancer research system—the National Cancer Institute’s Clinical Trials Cooperative Group Program. Because a strong, federally funded clinical trials system is essential to the progress against cancer, ASCO supports the full implementation of the IOM’s recommendations. Over the past year, IOM, ASCO and many others have
provided input into NCI’s efforts to implement key elements of the report. For example, a joint ASCO-IOM workshop this past March brought together clinical trials stakeholders, ASCO members and federal agency representatives to discuss the need for increased efficiencies and greater prioritization of trials, as well as sustained resources, to move this federally supported system into the future.

**Analysis Examines Potential Impact of Healthcare Reform on Cancer Disparities**

Although survival rates have improved steadily in the United States, not all patients have benefitted equally. For many Americans, racial and economic disparities continue to limit their opportunities to receive the best possible cancer care. To examine how the 2010 Patient Protection and Affordable Care Act might help to alleviate these disparities, ASCO conducted a thorough assessment of the legislation and issued a policy statement outlining specific provisions that may help to address disparities. ASCO also made specific recommendations to ensure that these provisions of the law are carried out effectively and urged additional steps to address systemic issues, including:

- adopting patient-centered quality improvement initiatives
- attracting more minority physicians and improving the training of the oncology workforce to meet the needs of racially and ethnically diverse patients with cancer
- improving data collection on cancer disparities and determining what must be done to make meaningful medical evaluations
- ensuring access to cancer specialists for all patients who seek treatment at federally qualified community health centers
- allowing for cancer-centered services to be at the direction of oncology professionals in community health centers and medical homes where many seek medical care

**Severe Cancer Drug Shortages Gain Attention from Media and Congress**

Patient access to cancer therapy has been severely impacted in recent years by the growing problem of oncology drug shortages. The affected treatments include many mainstays of chemotherapy treatment for both adults and children with cancer. Shortages continued to become more widespread and frequent over the past year, and have received much needed attention from media and policymakers. ASCO is a leading voice advancing legislative and regulatory strategies to promote both short- and long-term solutions to this health care crisis. For example, in November 2010, ASCO joined with other societies and stakeholders to hold a summit on drug shortages that resulted in 21 recommendations for short- and long-term solutions. In addition, ASCO has been working with Members of Congress on legislation that has been introduced in both the U.S. Senate and the House of Representatives to address the shortage. Most recently, ASCO testified at a congressional hearing and at a meeting convened by the FDA and is in ongoing discussions with the Department of Health and Human Services (HHS) to advance solutions at the highest levels.
ASCO Takes Steps to Improve Advanced Cancer Care Planning

For patients with advanced cancer (defined as incurable disease), quality care involves considering the full range of treatments for their cancer and palliative care options to maximize their quality of life. However, research from the Dartmouth Atlas Project, highlighted in this report, found that many patients do not fully benefit from available palliative care services. To help improve patients’ quality of life, ASCO issued a comprehensive statement calling for a new approach in which all available treatment options are discussed as soon as possible after a patient’s diagnosis with advanced cancer, and patients’ needs and preferences are addressed throughout the course of treatment. ASCO also called on policymakers and insurers to help ensure appropriate coverage for time devoted to these difficult but essential discussions with patients and their loved ones.

Research Highlights Potential Solutions for Oncology Workforce Shortages

With the incidence of cancer projected to grow as the U.S. population ages and the number of cancer survivors increases, the demand for oncology services is projected to soon exceed the capacity of available oncologists. If not addressed, these workforce shortages could have a major impact on access to high-quality cancer care for patients in the years ahead. To address this critical issue, ASCO commissioned a study supported by the Susan G. Komen Foundation for the Cure®, which found that increasing the role of nurse practitioners (NPs) and physician assistants (PAs) can effectively help practices manage the increasing demand for care. This national survey of 226 practices, 33 of which provided additional in-depth data, found high levels of patient satisfaction and improved efficiency in practices where all NPs and PAs collaborate with physicians and see a wide variety of patients.

United Nations Summit Addresses Cancer Crisis in Developing Countries

While significant progress has been made against cancer in recent decades, by 2030, cancer deaths around the globe are projected to surpass 11 million per year. Cancer mortality is most severe in low- and middle-income countries, where access to modern cancer care is limited or even nonexistent. In September, the cancer crisis in developing countries received unprecedented new attention at a United Nations High-Level Meeting to address non-communicable diseases (NCDs), including cancer, heart disease, diabetes and chronic lung disease. In a declaration issued at the end of the summit, global leaders agreed to establish specific targets by 2012 for combating NCDs and a mechanism for measuring progress towards those targets. ASCO and other medical societies advised on the development of key recommendations put forth at the meeting.
## 2011 ASCO GUIDELINES

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<tr>
<th>Date</th>
<th>Guideline</th>
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<tr>
<td>February 22, 2011</td>
<td>American Society of Clinical Oncology Clinical Practice Guideline Update on the Role of Bone-Modifying Agents in Metastatic Breast Cancer</td>
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<tr>
<td>July 25, 2011</td>
<td>American Society of Clinical Oncology Clinical Practice Guideline Update on the Use of Chemotherapy Sensitivity and Resistance Assays</td>
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<tr>
<td>September 6, 2011</td>
<td>American Society of Clinical Oncology Clinical Practice Guideline Update on Chemotherapy for Stage IV Non-Small Cell Lung Cancer</td>
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<tr>
<td>September 6, 2011</td>
<td>American Society of Clinical Oncology Endorsement of the Cancer Care Ontario Practice Guideline on Adjuvant Ovarian Ablation in the Treatment of Premenopausal Women with Early Stage Invasive Breast Cancer</td>
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<td>September 26, 2011</td>
<td>Antiemetics: American Society of Clinical Oncology Clinical Practice Guideline Update</td>
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## FDA APPROVALS OF ANTICANCER AGENTS, SEPTEMBER 2010–SEPTEMBER 2011

### Newly Approved Agents

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<th>Generic Name</th>
<th>Trade Name</th>
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<tr>
<td>Denosumab</td>
<td>Xgeva</td>
<td>Prevention of skeletal-related events (SREs) in patients with bone metastases from solid tumors</td>
<td>November 18, 2010</td>
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<tr>
<td>Ipilimumab</td>
<td>Yervoy</td>
<td>For the treatment of unresectable or metastatic melanoma</td>
<td>March 25, 2011</td>
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<tr>
<td>Vandetanib</td>
<td>Vandetanib</td>
<td>For the treatment of symptomatic or progressive medullary thyroid cancer in patients with unresectable, locally advanced, or metastatic disease</td>
<td>April 6, 2011</td>
</tr>
<tr>
<td>Abiraterone Acetate</td>
<td>Zytiga</td>
<td>Use in combination with prednisone for the treatment of patients with metastatic castration-resistant prostate cancer (mCRPC) who have received prior chemotherapy containing docetaxel</td>
<td>April 28, 2011</td>
</tr>
<tr>
<td>Vemurafenib</td>
<td>Zelboraf</td>
<td>Treatment of patients with unresectable or metastatic melanoma with the BRAFV600E mutation as detected by an FDA-approved test</td>
<td>August 17, 2011</td>
</tr>
<tr>
<td>Brentuximab Vedotin</td>
<td>Adcetris</td>
<td>Accelerated approval for the treatment of patients with Hodgkin lymphoma after failure of autologous stem cell transplant (ASCT) or after failure of at least two prior multi-agent chemotherapy regimens in patients who are not ASCT candidates and the treatment of patients with systemic anaplastic large cell lymphoma (ALCL) after failure of at least one prior multi-agent chemotherapy regimen</td>
<td>August 19, 2011</td>
</tr>
<tr>
<td>Crizotinib</td>
<td>Xalkori</td>
<td>Treatment of patients with locally advanced or metastatic non-small cell lung cancer (NSCLC) that is anaplastic lymphoma kinase (ALK)-positive as detected by an FDA-approved test, Vysis ALK Break-Apart FISH Probe Kit</td>
<td>August 26, 2011</td>
</tr>
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ASCO Resources

Oncologist-approved cancer information from the American Society of Clinical Oncology

**Basic Cancer Information**
[www.cancer.net/cancertypes](http://www.cancer.net/cancertypes)
Comprehensive information on more than 120 cancer types and cancer-related syndromes
- Risk factors
- Staging
- Diagnosis
- Questions to ask the doctor
- Treatment
- Spanish language section
- Symptoms

**Coping Resources**
[www.cancer.net/coping](http://www.cancer.net/coping)
Resources to help people with cancer and those who care for them
- Caregiving
- Sexuality
- Personal stories
- End-of-life care
- Relationships
- Mental health

**Survivorship**
[www.cancer.net/survivorship](http://www.cancer.net/survivorship)
Information and resources for cancer survivors and their families and friends
- About survivorship
- Next steps to take
- Late effects
- Childhood cancer survivorship
- Treatment summaries and follow-up care plans
- Survivor stories and artwork
- Rehabilitation

**Guidelines**
[www.asco.org/guidelines](http://www.asco.org/guidelines)
Information on ASCO guidelines, Provisional Clinical Opinions (PCOs) and guideline endorsements

**ASCO Connection**
[ascoconnection.org](http://ascoconnection.org)
The professional networking site for ASCO’s worldwide oncology community

**Conquer Cancer Foundation**
[www.conquercancerfoundation.org](http://www.conquercancerfoundation.org)
A not-for-profit organization working to create a world free from the fear of cancer by funding breakthrough research and sharing cutting-edge knowledge worldwide
Cancer Progress
www.cancerprogress.net
A dynamic and interactive history of progress against cancer, expert perspective on remaining challenges and other useful tools

ASCO in Action
ascoaction.asco.org
Public policy news and information from ASCO

ASCO Progress Reports
www.cancer.net/cca
Clinical Cancer Advances: ASCO’s Annual Report on Progress Against Cancer (2006-present)