Riverside Cancer Services

2009 ANNUAL REVIEW

2009
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Ora Mae Jackson ..... *Protocol Manager*
Yvonne Pike..... *Breast Cancer Patient Navigator*
Debbie Outlaw ..... *Prostate Cancer Patient Navigator*
Terri Rose ..... *Lung Cancer Patient Navigator*
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Paige Williams..... *Registered Dietician, Dietary*
Fran Holcomb ..... *Cancer Education/Outreach Nurse*
Jennifer Brown ..... *Cancer Registry Supervisor*
Pauline Shofner..... *Cancer Registrar*
Carol Richards ..... *Cancer Registrar*
Pennie Faircloth..... *Representative, American Cancer Society*

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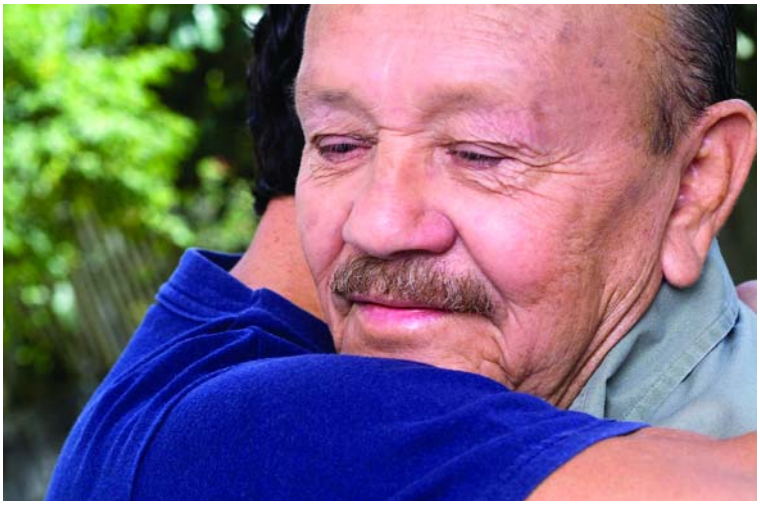
For additional information regarding Riverside Cancer Services, please call (800) 520-7006.
For comments or questions regarding this Annual Report or the Cancer Registry, please call (757) 594-3054.



Cancer Services Annual Report 2009

The Annual Report is a testament to the continuing evolution of the Riverside cancer program. The Riverside Heath System has placed a high priority on developing and growing a quality cancer program as will be evident by even a casual reading of the Annual Report. We do thank Golden Bethune, Faye Gargiulo, Bill Downey and Dr. Mark Ellis for years of service. In 2009 we have transitioned to Dr. Patrick Parcells and Mike Doucette assuming leadership roles, but the emphasis on the cancer program remains a priority. Following the physician–led model Dr. Mark Ellis serves as the Service Line Physician Chief of the cancer program along with Service Line Administrator Carrie Schmidt.

Riverside continues to attract new physicians to expand our program. In Radiation Oncology we welcome Dr. Veronica Eisen, a recent graduate of Georgetown University and in Medical Oncology Dr. George Kannarkat who joins us from the University of Virginia.

As the data shows, the number of new patients being seen and treated for cancer within the Riverside system continues to grow, most notably with the increases in the Stereotactic Radiosurgery program as well as the IMRT/IGRT program at the Riverside Cancer Center.

Several new faces in our program merit welcome. In the Patient Navigator program Terri Rose has assumed the position of Lung Cancer Patient Navigator and Debbie Outlaw is now the Patient Navigator for the Prostate Cancer program.

We acknowledge the efforts of all involved in the redesign and construction of the new 5-West Oncology unit at Riverside Regional Medical Center along with new Oncology ICU. Our Oncology patients will now have the benefit of private rooms with state of the art monitoring. The unit is beautiful as well as functional.

My thanks go to all the Riverside employees who may have been unmentioned in this introduction but who provide important services for our cancer patients.

Joseph D. Layser, MD
Chair, Riverside Oncology Committee
Medical Director, Riverside Cancer Care Center
Radiation Oncology

Once again, it is a privilege to greet you with this Annual Report on the Riverside Cancer Program. As the landscape of modern American medicine undergoes unprecedented change, we continue to be the region's leader in the delivery of cancer care, and our program continues to expand the services provided to the patients of our area.

In July, Riverside Regional Medical Center opened its completely renovated Hematology Oncology Unit and Oncology Intensive Care Unit. This new state-of-the-art inpatient facility for the care of our cancer patients, featuring all private rooms, is unrivaled in this region, and sets the standard for inpatient care of cancer patients. This facility was a truly collaborative effort, using top architectural principles, but driven by the Riverside clinical team of oncology physicians and nurses.

In conjunction with the organizational changes of the Riverside Health System, which now uses a Service Line structure, the Oncology Service Line will help to further focus our energies and resources to provide excellent cancer care to our patients. In addition, our Patient Navigator Program continues to grow, as does the Riverside Hereditary Cancer Risk Assessment Program. Our Riverside Cancer Research Program is thriving, and the newly formed alliance with the University of Virginia and the Massey Cancer Center of Virginia Commonwealth University, will allow us to continue to provide cutting-edge research protocols to our patients.

Thank you for choosing the Riverside Cancer Program for your cancer care needs. You can be assured that the Riverside Cancer Program will continue to provide the best care available to you and your family.

Mark E. Ellis, MD
Service Line Physician Chief, Riverside Cancer Care

Riverside Cancer Services

American College of Surgeons Accreditation: Riverside Regional Medical Center has been accredited as a Community Hospital Comprehensive Cancer Program by the American College of Surgeons' Commission on Cancer since 1982. Riverside Regional Medical Center was re-accredited in December 2006 and received approval with no contingencies and 7 of 9 possible commendations from the College. Accreditation by the ACOS indicates that the five key elements of a cancer program are in place:

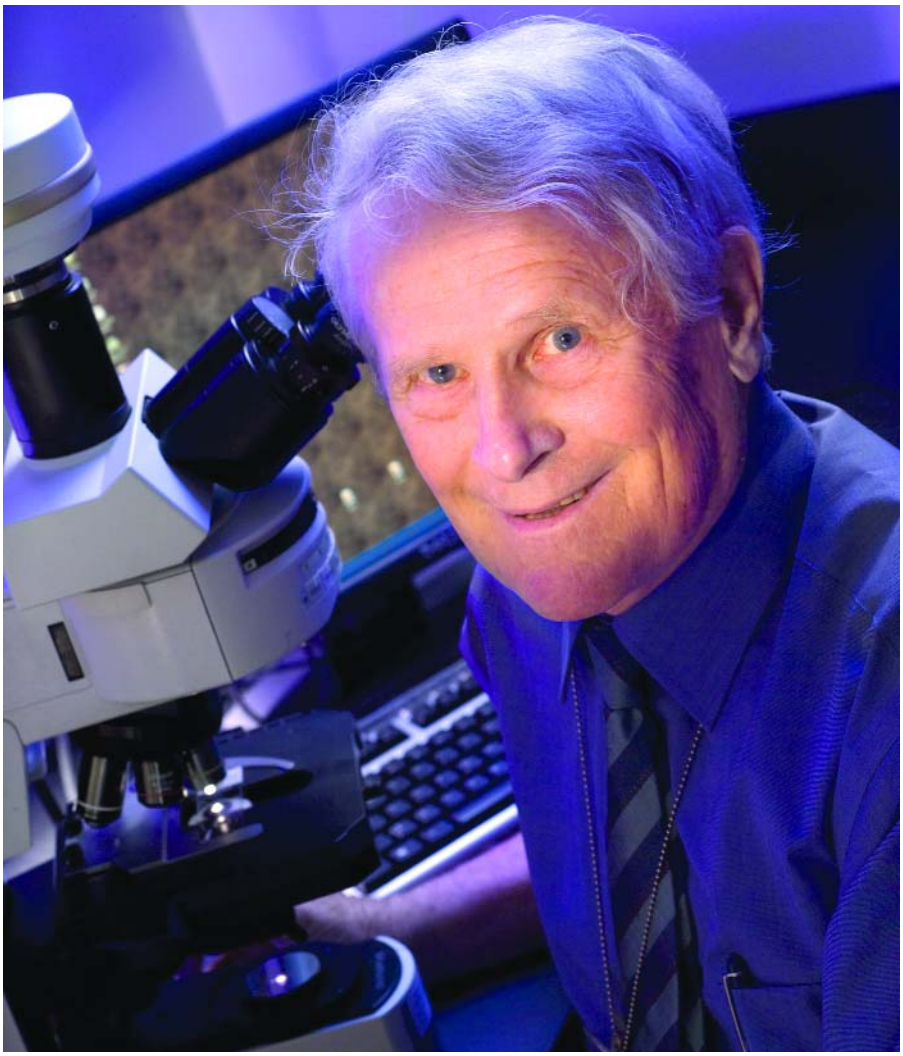
1) state of the art clinical services;
2) a multi-disciplinary cancer committee;
3) a cancer registry to monitor the quality of care;
4) patient oriented case-conferences; and
5) a quality improvement program for improving patient outcomes.

Oncology Committee: Riverside Regional Medical Center's Oncology Committee is a multi-disciplinary team that convenes every other month to provide leadership and professional guidance to the cancer care program.

Cancer Registry: To adhere to state, federal and ACOS guidelines, RRMC's Cancer Registry has been maintaining its database of cancer cases since 1979. Data from the registry is submitted to the Virginia Cancer Registry and the National Cancer Data Base (NCDB), which serves as a comprehensive clinical surveillance center for the entire country. Information on each case is submitted annually to keep the information current. The NCDB combines the data from 1,438 hospitals in all 50 states to provide insight into the long-term outcomes of treatments. This helps researchers and physicians better investigate and evaluate advances in diagnostics and treatment. This Annual Report contains a review of all 2008 accessions (new cases), as well as site-specific studies on brain tumors and lymphoma.

Cancer Case Conferences (Tumor Boards): Tumor Boards provide an opportunity for physicians to prospectively review cases with the multidisciplinary team. There are weekly general tumor boards, breast cancer case conferences, neurosciences case conferences and regular lung cancer case conferences. In addition to helping determine treatment plans, case conferences serve as important education offerings for the physicians and other members of the healthcare team.

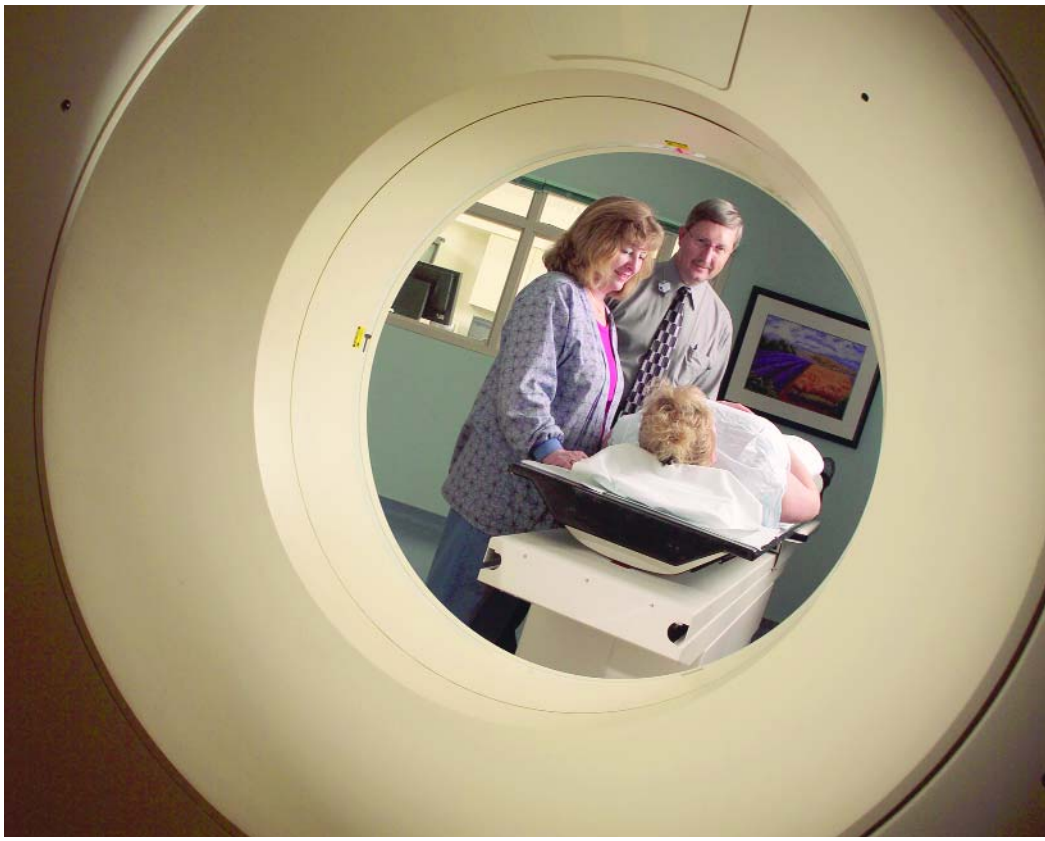
Research and Clinical Trials: Offering access to clinical trials is an important aspect of any cancer care program. While not appropriate for every patient, clinical trials can sometimes offer access to treatments that would be otherwise unavailable. The ACOS requires that 2% of the patients each year be enrolled in clinical trials, and Riverside is proud to once again exceed that benchmark.



Diagnostic Services

Imaging: Riverside offers a wide range of diagnostic imaging services across seven locations (Riverside Regional Medical Center, Riverside Diagnostic and Breast Imaging Center - Oyster Point, Riverside Diagnostic Center - Williamsburg, Riverside Walter Reed Medical Center and Riverside Tappahannock Hospital, Riverside Diagnostic Center - Hampton and Riverside Diagnostic Center - Smithfield). Riverside is proud to work with the physicians of Peninsula Radiologic Associates to bring you the following services:

- Mammography and Breast Imaging Services (screening, diagnostic, stereotactic, ultrasound, MRI, breast specific gamma imaging)
- X Ray
- Ultrasound
- CT
- MRI
- Nuclear Medicine
- PET/CT



Laboratory and Pathology: Riverside provides a complete range of laboratory and pathology services. The physicians of Peninsula Pathology Associates work closely with the referring physicians and surgeons to provide the most accurate diagnosis to allow for the most precise treatment plan. In addition to the expertise of the physicians on staff, Riverside has partnered with The Mayo Clinic in Minnesota as a reference lab for the more unique tests that may be required or for second opinions on some specimens.

Inpatient Services

Riverside Regional Medical Center, the Peninsula's only Level II Trauma Center, offers a wide range of inpatient services. For oncology patients, the most commonly utilized departments and services include:

Care Management: The Inpatient Oncology Care Management team is there to help patients and their supporters navigate the often confusing array of tests, treatments and feelings. The care coordinator works with the entire inter-disciplinary healthcare team to focus on minimizing the length of necessary hospital stays, while maximizing access to the best care available and preparing the patient and family for discharge to home or another facility.

5-East Post Surgical Unit: 5-East is a general surgical unit, which specializes in the care of the post-operative patient. 5-East also offers a four bed step-down unit for patients requiring an increased level of nursing care following surgery. The nursing staff on 5-East are experts in helping a patient recover as rapidly as possible from a surgical intervention, including wound care issues, anesthesia recovery, pain management and getting the patient back to the activities of daily living.

Outpatient Services

5-West Oncology Unit: 5-West is a medical unit which specializes in the care of the oncology patient. Specialized offerings include lead-lined rooms for patients who have received cesium implants and radioactive iodine therapy. Additionally, all of the RNs are certified in chemotherapy, and there are Oncology Certified Nurses on the unit.

Hematology/Oncology Unit: The Hematology/Oncology Intensive Care Unit ("Hem/Onc") is a six-bed specialty care unit designed for the critically ill oncology patient. As on 5-West, the nursing staff is chemotherapy certified, and the unit boasts Oncology Certified Nurses. The Hem/Onc staff members are also trained in critical care nursing, and are able to accommodate the most complex oncology patients, including intra-peritoneal chemotherapy.

Surgeons: Riverside's surgeons are talented physicians who have spent years studying how to best operate on specific areas of the body. Depending on the type of cancer a patient has, they could see one of the following: Ear Nose & Throat (ENT) Surgeon, General Surgeon, Colorectal Surgeon, Gynecologic Oncologist, Neurosurgeon, Plastic Surgeon, Surgical Oncologist, Thoracic Surgeon or Urologist.

Surgical Services: For many cancer patients, their only inpatient stay is immediately following surgery. Riverside's Surgical Services – from pre-operative testing, to the Operating Room to the Post-Anesthesia Care Unit (PACU) – is there to ensure that the right patient has the right procedure in the most safe and effective manner, and recovers as quickly as possible.

Home Care: Riverside Home Care offers a variety of services to patients in the Peninsula, Middle Peninsula and Northern Neck regions including home health, infusion, pharmacy and hospice services. Admission begins with a referral from the physician and a visit from an RN, physical or speech therapist to identify needs, establish goals for treatment and begin planning for continued care when home care services are no longer required.

Hospice: The Hospice program affirms life and regards dying as a natural process. The hospice program exists to provide support and care for patients, their families and caregivers in the last phases of incurable disease so the patient might live as fully and comfortably as possible. Hospice services neither hasten nor postpone death.

Medical Oncology / Peninsula Cancer Institute:
Medical Oncology is a critical component of any cancer program. Riverside partners with the physicians of Peninsula Cancer Institute to offer medical oncology services, including outpatient chemotherapy at three sites (Newport News, Gloucester and Williamsburg).

Radiation Oncology: Riverside Cancer Care Center, Riverside Middle Peninsula Cancer Center and Williamsburg Radiation Therapy Center provided radiation oncology services to approximately 500 new patients in 2008. A full range of external beam radiation and brachytherapy services, with the latest treatment options such as Intensity Modulated Radiation Therapy (IMRT), Prostate Seed Implants and Mammosite, are available for the Newport News, Williamsburg and Middle Peninsula communities. The focus of the Riverside Cancer Care Center in Newport News encompasses new technology development for radiation oncology known as Image Guided Radiation Therapy (IGRT).

Riverside and University of Virginia Radiosurgery Center: Offering both Gamma Knife® and Synergy–S® technology, the Riverside and University of Virginia Radiosurgery Center opens up the world of knifeless surgery to patients with tumors in the brain, spine and other areas of the body. Using precise beams of intense radiation, the center allows outpatient surgery to previously inoperable tumors. Riverside is proud to offer the only Gamma Knife® in the Tidewater region, and is proud to be the only health system to offer both Gamma Knife® and Synergy-S® technology in the Commonwealth of Virginia.

Support Services

Bereavement Support: Riverside Hospice's Bereavement Aftercare Program provides support to adults as they adjust to life following the death of a loved one. Support and education are offered to help individuals learn about the grief process, and a support group meets twice a month.

Cancer Resource Library: Now located on the first floor of the Riverside Cancer Care Center, the library is for patients, family members, community members and staff who want to learn more about cancer issues. The library offers resources on specific types of cancer – including prevention, diagnosis and treatment issues. There is also a wide array of books on the important psychosocial concerns of facing a cancer diagnosis. Additionally, there are two computers where individuals can research issues online, as well as a children's section.

Cancer Services – Outreach and Community Education: Riverside's Cancer Services offers a wide range of support, outreach, education and early detection programs to the community. Working with medical staff, oncology nurses, allied health care professionals and community partners, such as The American Cancer Society and the Leukemia and Lymphoma Society, Cancer Services sponsors numerous educational and screening events throughout the year. Programs include: community health fairs, prostate, cervical, breast and skin cancer screenings, Look Good Feel Better classes, Tell A Friend programs, nutritional programs and continued work with the Healing Eagle Free Clinic.

Connections with Community Organizations: Riverside Cancer Services recognizes its role in the broader cancer community, and works actively with numerous local and national cancer organizations. In addition to its work with local health departments, Riverside works with American Cancer Society, Leukemia and Lymphoma Society, Susan G Komen Foundation, Colon Cancer Prevention Coalition, many local church groups, and the Lackey, Healing Eagle and Gloucester-Matthews Free Clinics.

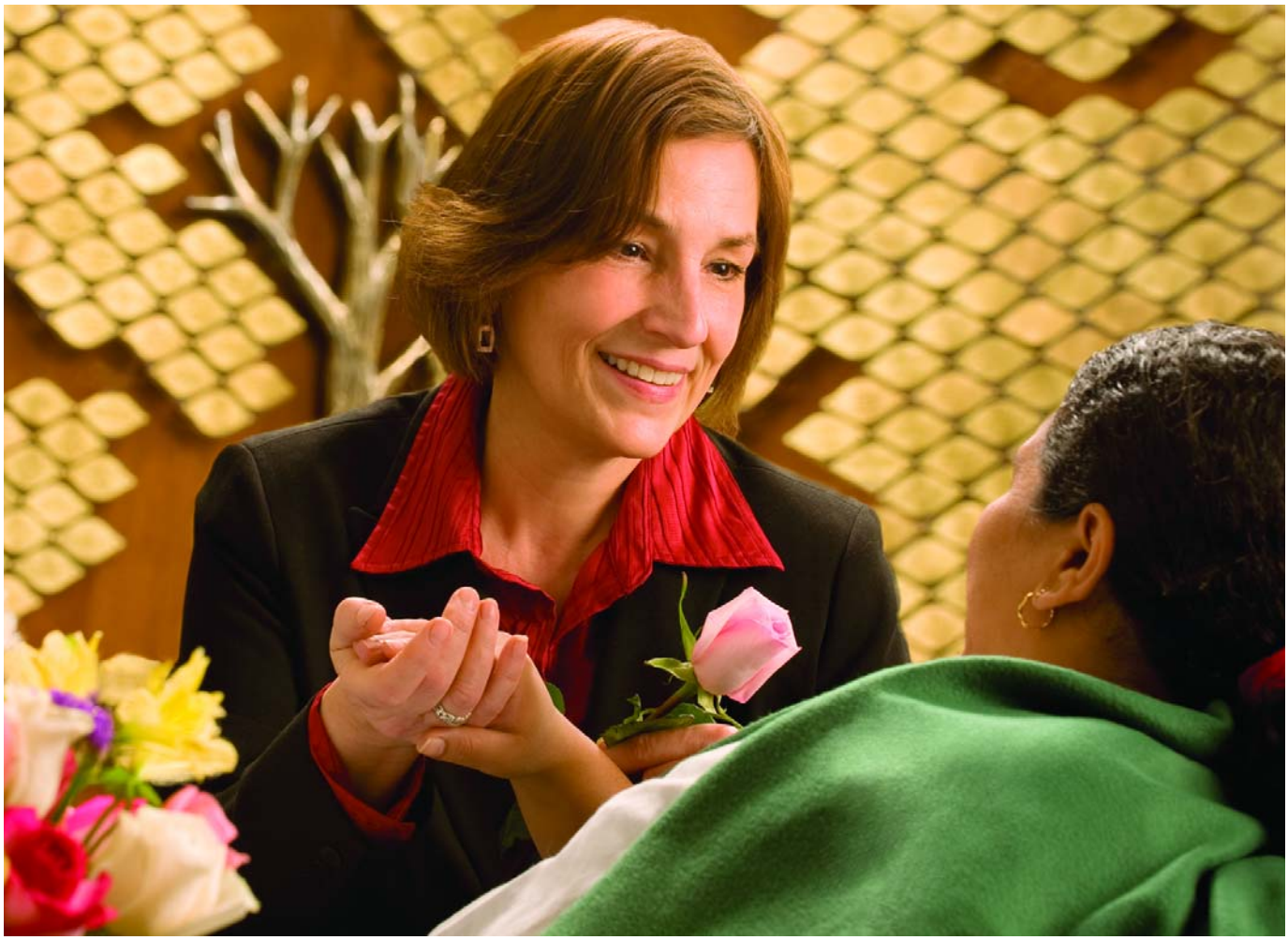
Grant Programs: Riverside is proud to be the recipient of two major grants that allow access to breast and cervical cancer screenings for women who might not otherwise be able to get screened. The Every Woman's Life Grant is a part of the Centers for Disease Control and Prevention's Breast and Cervical Cancer Early Detection Program as managed through the Virginia Department of Health. Additionally, Riverside also receives funds from the Susan G. Komen Foundation for the Breast Health Alliance Program. Between the two programs, Riverside is able to provide these critical screenings to uninsured or underinsured women who meet the necessary age and income guidelines. Additionally, those women who detect a breast cancer through the Breast and Cervical Cancer Early Detection Program (BCCEDP) can be enrolled in Medicaid to receive treatment.

Pastoral Care: The Riverside Chaplains are there to support cancer patients, families and friends in making use of faith or spiritual values to work with the challenges of cancer. Pastoral Care may include conversation, prayer, liturgy, worship, sacraments, scripture reading, reflection and referral. The pastoral care service is interfaith, personal, and specific for the individual and family in need. In addition to the community clergy and volunteers who support the program, Riverside's Pastoral Care consists of five full-time chaplains, including one chaplain dedicated to cancer care.

Patient Navigation: Patient Navigators are there for patients and their loved ones from diagnosis through the entire treatment process. As most cancer patients discover, the diagnosis and treatment process is often confusing, and involves many physicians, nurses, therapists and locations, not to mention the overwhelming emotional

component in addition to being sick. Patient Navigators are there to simplify the journey, and to be the one person you can always call with a question. They also help patients and caregivers know what to expect from various procedures and treatments. Currently, Riverside offers Patient Navigation to any patient in the breast, prostate or lung cancer programs. The hope is to expand that to additional diagnoses in coming years.

Support Groups: There are numerous support groups to support the cancer patient and their loved ones. Call Cancer Services for an up to date schedule of times and locations of the various groups.



Review of 2008 Accessions

Riverside's Cancer Registry is a vital piece to the Riverside Cancer Program. The registry is responsible for the daily casefinding, chart abstraction, and follow-up of all cancer patients who interact with the Riverside Health System. Through database analysis the registry provides valuable information to physicians and administrators regarding the cancer program's performance. As an ongoing effort to learn more about how to better approach cancer today, the hospital registry submits data to the Virginia Cancer Registry and the National Cancer Data Base for further use in state and national statistics. It is these statistics that can later be used to develop quality indicators for standards of care.

Since its inception in 1979, the Riverside Cancer Registry has documented and tracked its highest volume of analytic cases in 2008. With the continued growth of Riverside, these volumes are expected to increase over time.

During 2008 the registry identified a total of 1,624 new cancer cases, with 1,206 (74%) of those being analytic –either diagnosed and/or treated at Riverside Regional Medical Center. The remaining 26% represented cases where no interaction was made between the patient and Riverside during diagnosis or first course treatment. Upon review of Riverside's total caseload the top three cancer sites continue to be prostate (350 cases), breast (242 cases) and lung (230 cases). These three sites alone comprise 71% of our total caseload for 2008. Further breakdown shows that this trend is mirrored in the analytic case totals where prostate (230 cases), breast (216) and lung (192 cases) account for 71% of the analytic caseload as well.

This year the number of prostate cancers exceeded breast cancer by approximately 1%. Prostate cancer continues to be predominantly diagnosed as a Stage II (86.5%) as this is when the tumor has become clinically "noticeable" to the patient and/or the physician. Breast cancer alone accounted for 24% of the total analytic caseload. 78% of these breast cases were diagnosed at early stage (Stage 0, I, or II). Rounding out the top three sites, the lung caseload increased by almost 8% in 2008, resulting in 192 analytic cases. As expected, stage distribution among lung cases is as follows: 25% Stage I, 10.3% Stage II, 24% Stage III and 38% Stage IV. High volumes of regional to distant stage disease are typically seen in lung cancers as early detection methods are rare and symptom presentation is often not seen until the disease has spread.

From 2007 to 2008 gains in analytic caseload were most notable for ovary and brain. Over the past year Riverside has seen a 150% increase (9 cases) in analytic ovarian cases. In 2007 there were 6 analytic ovarian cases (83% Stage III, 16% Stage IV). In 2008 this grew to 15 analytic cases (14% Stage I, 6% Stage II, 71% Stage III and 6% Stage IV). In additional to the increased number of cases, because of its difficulty to detect, regional disease continues to be predominant among ovarian cancer.

Riverside's volume of analytic brain cancers increased 100% from 17 cases in 2007 to 36 cases in 2008. With program growth of the Radiosurgery Center, more patients are being treated at Riverside Regional Medical Center.

Several other sites reflected an increase in analytic caseload including, but not limited to: leukemia, lymphoma, thyroid, colorectal, and kidney. From 2007 to 2008 a decrease in cases was observed for uterus (-38%), pancreas (-10%) and, although it remained the second top site for RRMC, breast (-5%).

Overall, Riverside Regional Medical Center experienced an increase in analytic caseload for nine of its key sites and a decrease in only four. These statistics are representative of Riverside Regional Medical Center.

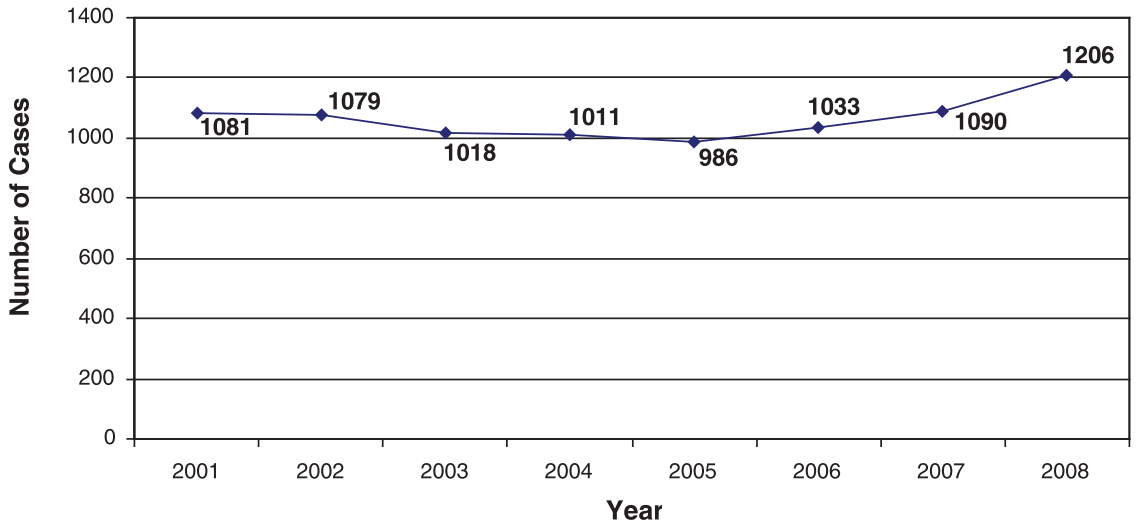
Jennifer L. Brown, BS
Cancer Registry Supervisor

Review of 2008 Accessions

Primary Site	Cases	%	Sex		Class of Cases		Stage Distribution - Analytic Cases Only						
			M	F	Analytic	Non-Analytic	0	I	II	III	IV	Unk	Blank/Inv
ORAL CAVITY & PHARYNX	**34**	**2.1%**	**29**	**5**	**28**	**6**	**1**	**5**	**3**	**4**	**13**	**1**	**0**
Lip	2	0.1%	1	1	2	0	0	1	1	0	0	0	0
Tongue	9	0.6%	7	2	8	1	0	2	0	0	6	0	0
Salivary Glands	3	0.2%	3	0	2	1	0	0	1	1	0	0	0
Floor of Mouth	1	0.1%	1	0	1	0	0	1	0	0	0	0	0
Gum & Other Mouth	7	0.4%	5	2	6	1	1	1	1	0	3	0	0
Nasopharynx	1	0.1%	1	0	1	0	0	0	0	0	1	0	0
Tonsil	6	0.4%	6	0	5	1	0	0	0	3	2	0	0
Oropharynx	2	0.1%	2	0	1	1	0	0	0	0	0	1	0
Hypopharynx	2	0.1%	2	0	1	1	0	0	0	0	1	0	0
Other Oral Cavity & Pharynx	1	0.1%	1	0	1	0	0	0	0	0	0	0	0
DIGESTIVE SYSTEM	**177**	**10.9%**	**104**	**73**	**136**	**41**	**5**	**25**	**30**	**31**	**33**	**5**	**1**
Esophagus	19	1.2%	17	2	14	5	0	1	1	1	8	3	0
Stomach	14	0.9%	6	8	8	6	0	1	0	2	4	0	0
Small Intestine	5	0.3%	2	3	5	0	0	0	0	1	2	0	0
Colon Excluding Rectum	61	3.8%	36	25	46	15	4	10	14	13	5	0	0
Rectum & Rectosigmoid	32	2.0%	21	11	24	8	1	3	6	8	4	0	1
Anus, Anal Canal & Anorectum	5	0.3%	2	3	5	0	0	0	3	1	0	1	0
Liver & Intrahepatic Bile Duct	13	0.8%	8	5	10	3	0	4	2	2	1	1	0
Gallbladder	2	0.1%	2	0	2	0	0	1	1	0	0	0	0
Other Biliary	1	0.1%	1	0	1	0	0	1	0	0	0	0	0
Pancreas	22	1.4%	9	13	18	4	0	4	3	2	9	0	0
Peritoneum, Omentum & Mesentery	2	0.1%	0	2	2	0	0	0	0	0	0	0	0
Other Digestive Organs	1	0.1%	0	1	1	0	0	0	0	1	0	0	0
RESPIRATORY SYSTEM	**251**	**15.5%**	**154**	**97**	**210**	**41**	**1**	**53**	**23**	**47**	**79**	**2**	**0**
Nasal Cavity, Middle Ear & Accessory Sinuses	2	0.1%	2	0	1	1	0	0	0	0	0	0	0
Larynx	19	1.2%	16	3	17	2	1	4	4	1	5	0	0
Lung & Bronchus	230	14.2%	136	94	192	38	0	49	19	46	74	2	0
BONES & JOINTS	**1**	**0.1%**	**1**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
Bones & Joints	1	0.1%	1	0	1	0	0	1	0	0	0	0	0
SOFT TISSUE	**9**	**0.6%**	**3**	**6**	**4**	**5**	**0**	**1**	**0**	**0**	**2**	**1**	**0**
Soft Tissue (including Heart)	9	0.6%	3	6	4	5	0	1	0	0	2	1	0
SKIN EXCLUDING BASAL & SQUAMOUS	**54**	**3.3%**	**33**	**21**	**33**	**21**	**8**	**20**	**2**	**0**	**0**	**2**	**0**
Melanoma — Skin	50	3.1%	31	19	31	19	8	19	2	0	0	2	0
Other Nonepithelial Skin	4	0.2%	2	2	2	2	0	1	0	0	0	0	0
BREAST	**242**	**14.9%**	**1**	**241**	**216**	**26**	**53**	**76**	**56**	**17**	**7**	**7**	**0**
Breast	242	14.9%	1	241	216	26	53	76	56	17	7	7	0
FEMALE GENITAL SYSTEM	**69**	**4.2%**	**0**	**69**	**54**	**15**	**4**	**23**	**7**	**14**	**2**	**1**	**0**
Cervix Uteri	9	0.6%	0	9	8	1	0	4	1	2	0	1	0
Corpus & Uterus, NOS	32	2.0%	0	32	24	8	0	16	2	3	1	0	0
Ovary	17	1.0%	0	17	15	2	0	2	2	9	1	0	0
Vagina	2	0.1%	0	2	1	1	0	0	1	0	0	0	0
Vulva	9	0.6%	0	9	6	3	4	1	1	0	0	0	0

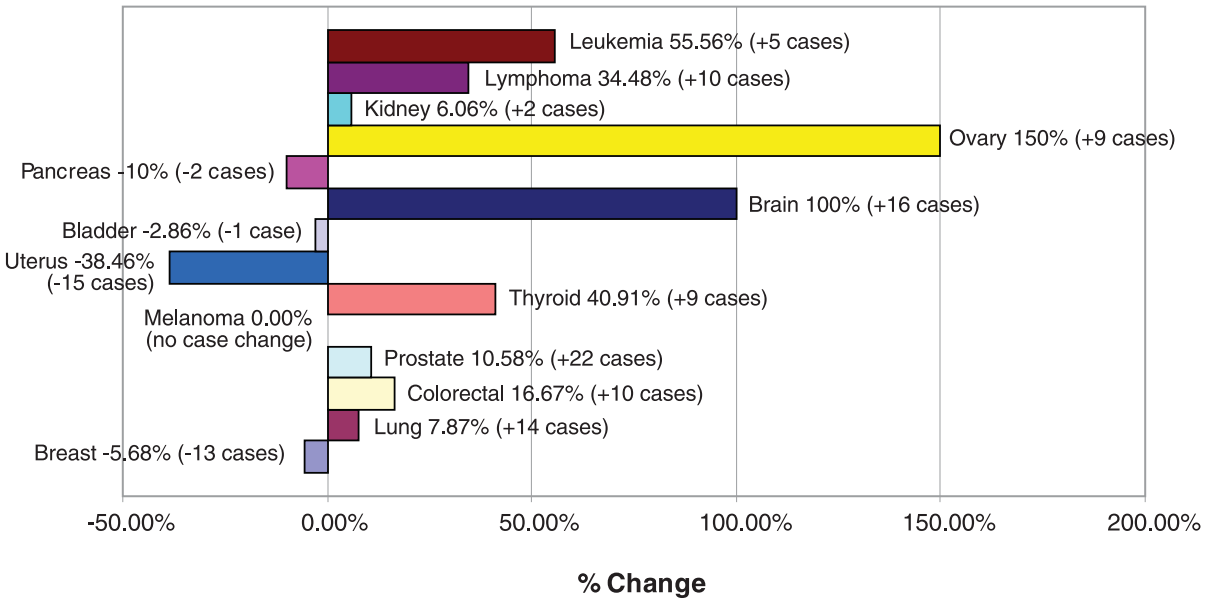
Primary Site	Cases	%	Sex		Class of Cases		Stage Distribution - Analytic Cases Only						
			M	F	Analytic	Non-Analytic	0	I	II	III	IV	Unk	Blank/Inv
MALE GENITAL SYSTEM	**357**	**22.0%**	**357**	**0**	**234**	**123**	**0**	**4**	**200**	**21**	**8**	**1**	**0**
Prostate	350	21.6%	350	0	230	120	0	2	199	21	8	0	0
Testis	7	0.4%	7	0	4	3	0	2	1	0	0	1	0
URINARY SYSTEM	**120**	**7.4%**	**80**	**40**	**74**	**46**	**18**	**25**	**9**	**10**	**12**	**0**	**0**
Urinary Bladder	73	4.5%	56	17	34	39	17	8	4	3	2	0	0
Kidney & Renal Pelvis	41	2.5%	20	21	35	6	1	15	4	7	8	0	0
Ureter	6	0.4%	4	2	5	1	0	2	1	0	2	0	0
BRAIN & OTHER NERVOUS SYSTEM	**83**	**5.1%**	**40**	**43**	**68**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Brain	33	2.0%	20	13	32	1	0	0	0	0	0	0	0
Other Nervous System	50	3.1%	20	30	36	14	0	0	0	0	0	0	0
ENDOCRINE SYSTEM	**41**	**2.5%**	**10**	**31**	**36**	**5**	**0**	**19**	**3**	**4**	**4**	**1**	**0**
Thyroid	34	2.1%	6	28	31	3	0	19	3	4	4	1	0
Other Endocrine (including Thymus)	7	0.4%	4	3	5	2	0	0	0	0	0	0	0
LYMPHOMAS	**66**	**4.1%**	**34**	**32**	**39**	**27**	**0**	**14**	**8**	**7**	**10**	**0**	**0**
Hodgkin Lymphoma	6	0.4%	5	1	5	1	0	0	2	2	1	0	0
Non-Hodgkin Lymphoma	60	3.7%	29	31	34	26	0	14	6	5	9	0	0
MULTIPLE MYELOMA	**24**	**1.5%**	**16**	**8**	**12**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Multiple Myeloma	24	1.5%	16	8	12	12	0	0	0	0	0	0	0
LEUKEMIAS	**27**	**1.7%**	**16**	**11**	**14**	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Lymphocytic Leukemia	15	0.9%	10	5	7	8	0	0	0	0	0	0	0
Myeloid & Monocytic Leukemia	12	0.7%	6	6	7	5	0	0	0	0	0	0	0
MESOTHELIOMA	**21**	**1.3%**	**20**	**1**	**18**	**3**	**0**	**3**	**4**	**5**	**5**	**1**	**0**
Mesothelioma	21	1.3%	20	1	18	3	0	3	4	5	5	1	0
MISCELLANEOUS	**46**	**2.8%**	**30**	**16**	**29**	**17**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Miscellaneous Sites	46	2.8%	30	16	29	17	0	0	0	0	0	0	0
Total	**1,624**		**930**	**694**	**1,206**	**418**	**90**	**269**	**345**	**160**	**175**	**22**	**1**

RRMC Cancer Registry Data Base
Analytic Cases 2001-2008



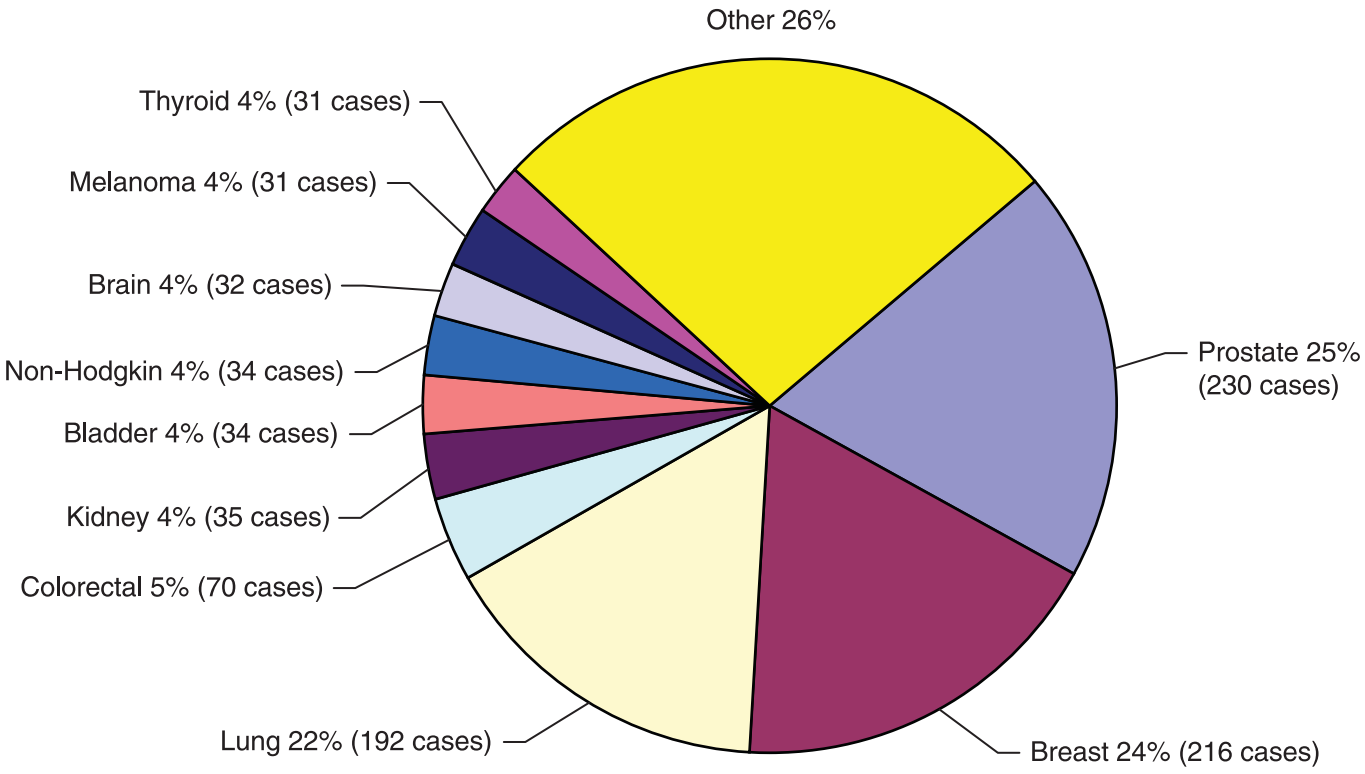
*NOTE: These are analytic cases ONLY (diagnosed and/or treated here during the first course of treatment). Since 2005, RRMC has experienced a steady increase in the analytic caseload.

Analytic Cases: % Change 2007-2008
(Diagnosed and /or Treated at RRMC)



RRMC 2008 Top 10 Cancer Sites
(Accounting for both Analytic and Non-Analytic Cases)

(n=1206 cases, "Other" includes but is not limited to oral cavity and pharynx, pancreas, female genital system, Hodgkin Lymphoma, multiple myeloma, leukemias and mesothelioma)



Brain Tumors at Riverside Regional Medical Center

Neurosurgeon

Matthew Chang, MD
Hampton Roads Neurosurgical and Spine Specialists

In the last several years, Riverside has acquired many new technologies for attacking brain tumors. The most common tumors we see include Metastatic lesions, Gliomas, Meningiomas, and Acoustic Schwannomas. Each is attacked in a different fashion depending on their number, size, location and sometimes grade.

In treating metastatic brain lesions we focus first on the number of metastases. Patients with a solitary metastasis can be treated with Gamma Knife radiosurgery if the lesion is small, or surgical resection if the lesion is larger and in a location that is amenable to resection. Either of these approaches is often followed by whole brain radiotherapy (WBRT), but in the last several years many centers have been holding WBRT for later in the course when, or if, a patient develops recurrence or multiple metastases. Patients with more than one metastatic lesion can typically receive Gamma Knife radiosurgery if the lesions are small and less than six in number, followed by WBRT. If a patient has greater than six metastatic lesions, or if there are multiple lesions that are too large to consider the Gamma Knife (>3cm), typically we utilize WBRT alone.

Gliomas are different in that we typically only see one lesion. A notable exception is a multifocal Glioblastoma. Gliomas are graded on a World Health Organization scale (WHO) with grades one through four. Grades one and two are considered low grade. Grade three is called an anaplastic astrocytoma. Grade four is considered a Glioblastoma. These are treated based on their grade, size and location. Low grade gliomas, if they are smaller and in a favorable location, are often resected and then followed for recurrence. Larger lesions or lesions in eloquent brain can sometimes benefit from chemotherapy and radiation therapy. Sometimes these can be followed with no therapy at all as they are often slow growing and asymptomatic. Higher grade lesions are typically treated with surgical resection if they are in a favorable location for resection. This is typically followed by radiation therapy and chemotherapy. High grade gliomas in a poor location can receive radiation and chemotherapy without resection. High grade gliomas typically recur, and therefore one of the main tenants of treatment is preserving the length of quality life and avoiding neurologic deficit. Gamma Knife radiosurgery has less of a role in gliomas. It is sometimes utilized in recurrent glioblastoma. It is extremely rarely a first line treatment for glioma.

Meningiomas are treated with multiple modalities as well. Small lesions <3cm are amenable to Gamma Knife radiosurgery or resection. Larger lesions that are symptomatic usually require surgical resection. As always, location is critical as lesions near eloquent brain or on the skull base are much more challenging to treat then lesions that are more accessible and near non-eloquent brain structures. Smaller meningiomas can often be followed without any treatment, as well as these lesions are typically slow growing. Meningiomas are typically curable if they are low grade, as most are.

Acoustic Schwannomas are more uncommon than the other brain tumors. Since the advent of radiosurgery and high resolution MRI, the treatment has advance significantly. The lesions are typically benign and slow growing. They can be followed non-operatively, treated by resection or Gamma Knife radiosurgery. Tumors less than 2.5cm that are asymptomatic are typically treated with radiosurgery. Larger or symptomatic tumors are typically treated with resection. Goals of treatment include maximizing tumor control while minimizing side effects, the most common being hearing loss or facial motor function.

Fortunately we have multiple modalities for treating brain tumors of all types. We are constantly seeing increased functional survival in many brain tumor patients. Because of recent technology acquisitions at Riverside, I am confident in saying that we have nearly every option for treating brain tumor patients at our disposal.

Radiation Oncologist

The treatment of tumors of the central nervous system involves a multidisciplinary team in theneurosciences with a combination of neurosurgeons, medical oncologists, radiation oncologists,neurologists, and neuroradiologists. Radiation oncology has played a major role in the management of CNS malignancies dating back to the late 1940s when therapy was carried out atthe Holt Radium Institute in Manchester, England. The development of improved equipment from the cobalt area of radiation oncology to linear accelerator-based treatment brought many changes in the time period of the 1950s to 1970s. Ultimately, the utilization of stereotactic radiosurgery with a gamma knife began in the United States in 1988 with the University of Virginia having the 4th Gamma Knife facility in the world. Today, Riverside and the University of Virginia partnered to build the Riverside and University of Virginia Radiology center on the campus of Riverside Regional Medical Center in Newport News. As home to the only center in Virginia to offer both Gamma Knife and Synergy-S technology we can offer state-of-the-art treatments for a wide spectrum of central nervous system and spinal malignancies.

Ronald Kersh, MD
Radiation Oncology
Specialist

An analysis of brain tumors at Riverside reveals that we still see a large amount of benign lesions including meningiomas, pituitary adenomas, and a mixture of nerve sheath tumors and rare other tumors (Figure 1). The incidence of patients seen for their diagnosis has markedly increased since the opening of the Gamma Knife facility in 2006 (Figure 2).

2004-2008 Benign Brain Tumor Histologies (n=132 cases)

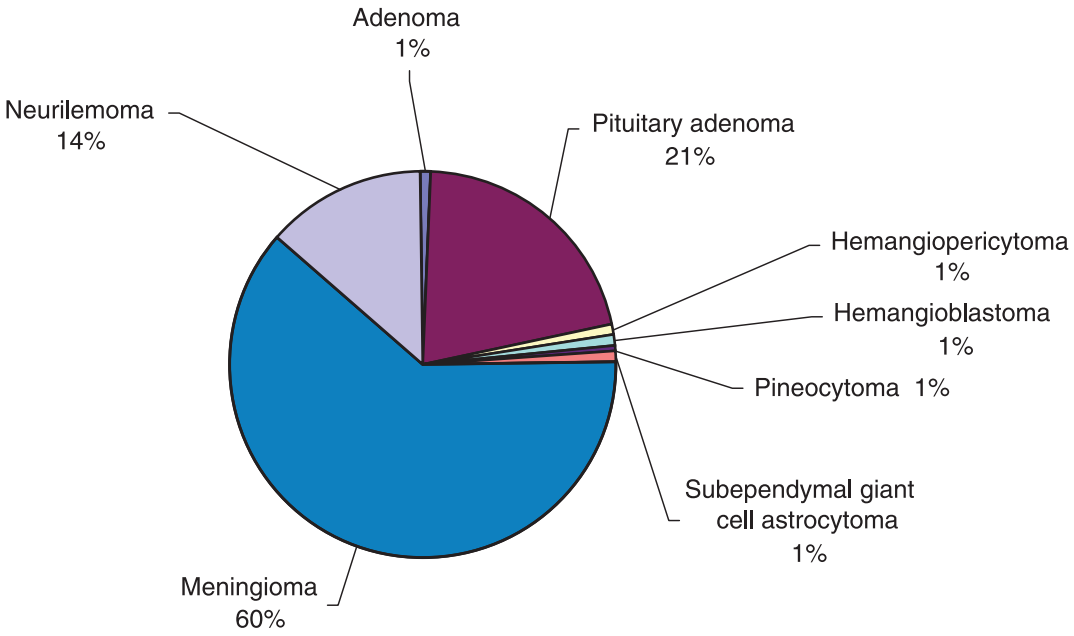
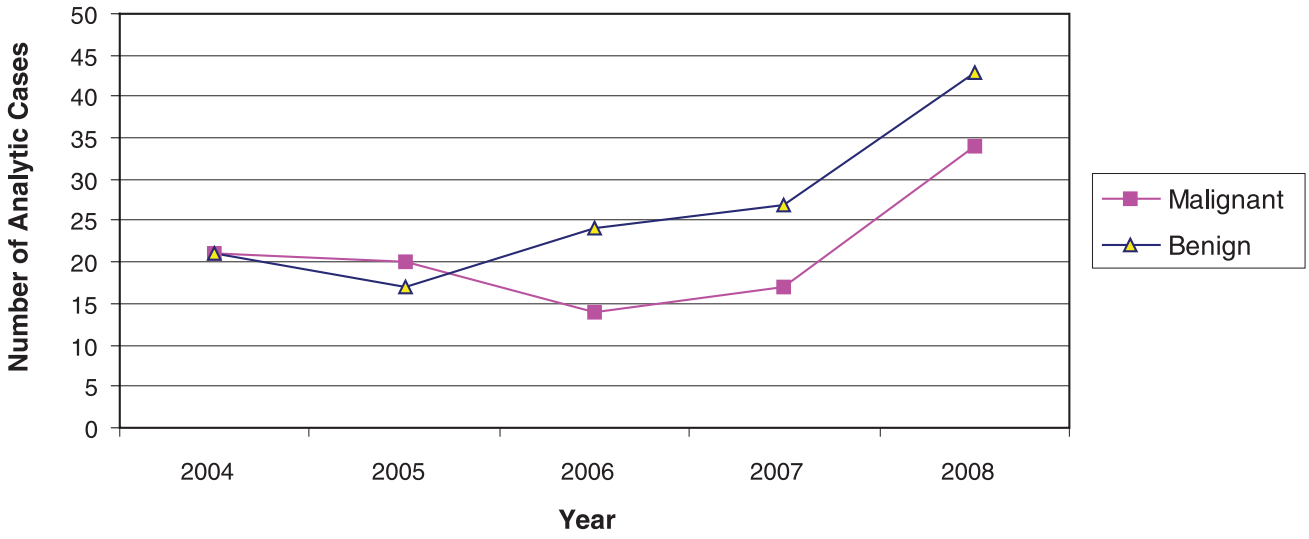
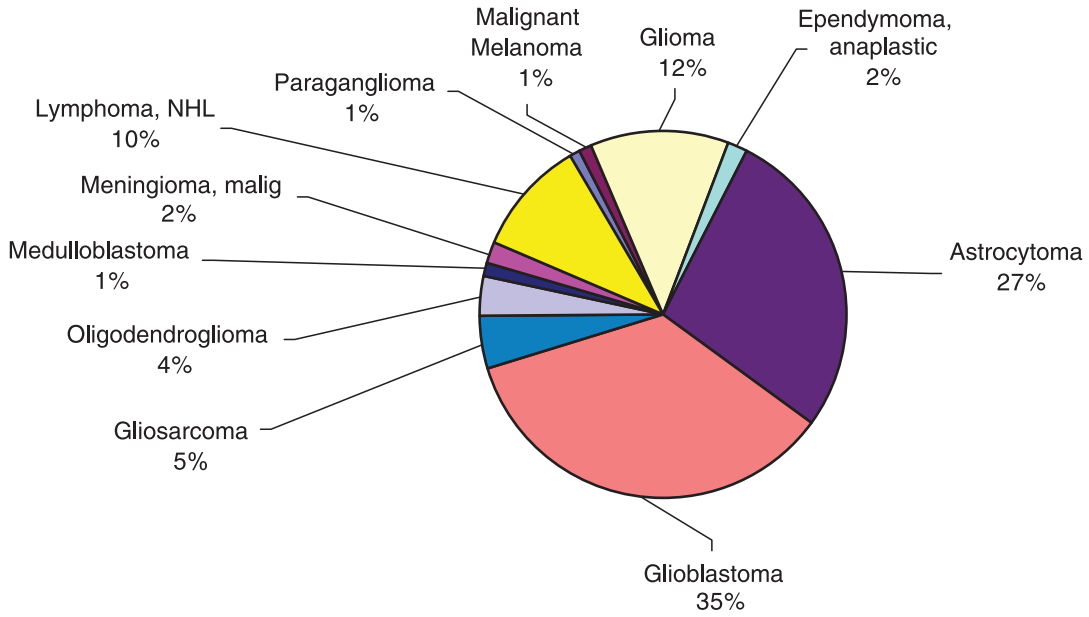


Figure 2: Change in Analytic Caseload - Benign vs Malignant 2004-2008



An analysis of the breakdown of our primary malignant brain tumors demonstrates 62% of patients presenting with a grade IV glioma (glioblastoma multiforme), or a grade I, II, III astrocytoma (Figure 3).

Figure 3: Malignant Brain Tumor Histologies 2004-2008 (n=106 cases)



The management of primary brain tumors has improved from a radiation oncology standpoint with the ability to localize therapy to the brain. This is an integration of radiologic utilization of MRIs and a combination treatment planning approach which is performed in the radiosurgery center with the neurosurgeons, neurologists, neuroradiologists, and radiation oncologists. By careful treatment planning and the utilization of image-guided radiation therapy (IGRT), we are able to treat the brain to higher doses than previously achieved, and with higher doses we areachieving a control rate at 5 years of 25%o overall in our malignant brain tumor histology population. Our survival rates appear slightly better than national averages as observed in comparative analysis with patients treated between 1998 and 2001, and with improved techniques we would expect this trend to continue to improve (Figure 4).

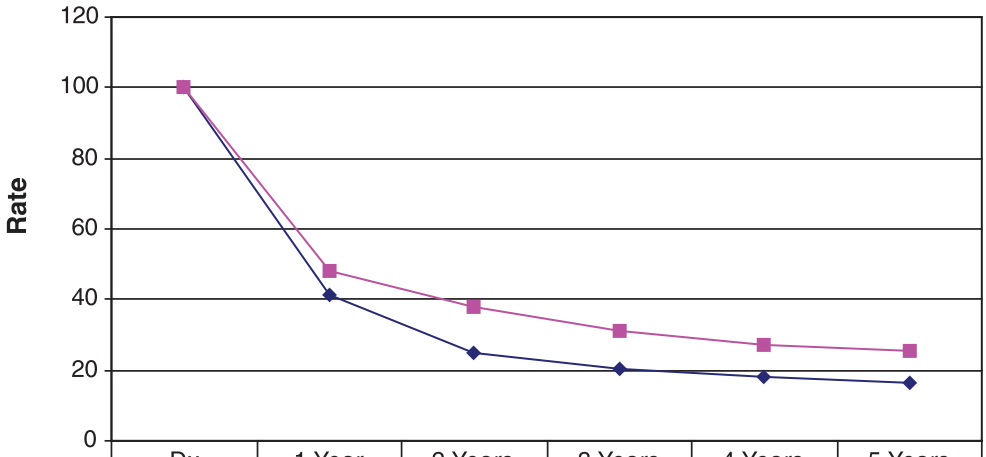
Radiation for tumors such as glioblastoma or grade II or III astrocytomas would involve the utilization of image-guided radiation therapy. This could be performed at the Cancer Treatment Center at Riverside under the direction of Drs. Layser, Gillespie and Eisen, and would utilize a daily treatment for approximately 6 to 7 weeks. Patients will also usually be receiving some therapy through our medical oncology clinics. The patients are treated on an outpatient basis, and daily treatments require approximately 20 minutes per day.

The utilization of treatment in the radiosurgery center with either the Gamma Knife or with the Synergy-S unit is normally done in the setting of a primary brain tumor which has recurred or in brain tumors that have undergone surgical resection by a neurosurgical staff where the surgical margins of the resection cavity are treated.

The establishment of the neuro-oncology clinic, which utilizes the services of radiation oncology, medical oncology, pathology, medical physics, and neurosurgery has been well received at Riverside, and patients receive a multimodality approach to their care. Clinical trials that are available through Riverside and the University of Virginia are discussed with the patient.

Riverside continues to be a leader in the field of neuro-oncology, and radiation oncology plays a major role. We have one of 4 dedicated radiosurgery centers in the United States, and will continue to offer care to patients regionally so that they do not have to travel to a university based facility to receive their therapy.

Figure 4: 1998-2001 5-Year Observed Survival Rates for Malignant Brain Tumors National Cancer Data Base vs. RRMC



	Dx	1 Year	2 Years	3 Years	4 Years	5 Years
National Cancer Data Base (n=18527)	100	41.4	24.8	20.5	18.1	16.6
RRMC (n=90)	100	48.3	38	31.2	27	25.6

Medical Oncologist

Kimberly Schlesinger, MD
Peninsula Cancer Institute

Primary malignant brain tumors account for less then 2-3% of all cancer diagnoses in the United States, but their impact on patients often exceeds that of more common tumor types. Due to their location within the brain, their presentation may include intractable headaches, seizures, mood and personality changes, and difficulty with movement or speech. Treatment itself, be it surgery, radiation, medical or combination, may further impact function and quality of life with its side effects. Indeed the management of some side effects, such as anticonvulsants for seizures and steroids for brain swelling, can further compromise performance status with their own set of untoward effects. The total impact of brain tumors and their management is difficult to study, but together yield distressing morbidity among patients with an already high mortality rate.

Overall survival among adults with malignant brain tumors is 33% at 5 years, one of the lowest of all cancers. Primary brain tumors are classified according to histology, with 80% of tumors categorized as gliomas and 20% percent categorized as medulloblastomas, meningiomas, and others. Gliomas are further subdivided according to histopathology, ranging from low grade astrocytomas, to 'intermediate grade' anaplastic astrocytomas, to high grade glioblastoma multiforme. Treatment and prognoses vary according to subtype such that patients with anaplastic astrocytoma have a 30% 5 year survival and patients with glioblastoma multiforme have only a 3% survival over the same time period.

Although the last century has seen an increase in the incidence of malignant brain tumors throughout the industrialized world, medical management options are only now coming into their own. Using a team approach, neurosurgeons, radiation oncologists, and medical oncologists can work together to define a specific treatment and follow-up plan for patients, utilizing the best of what each field has to offer. Genetic studies on individual tumors add insight to specific tumor biology, impacting treatment options and decisions.

Temozolomide, an oral chemotherapy drug, was approved in 1999 for patients with refractory anaplastic astrocytomas and in 2005 for patients with glioblastoma multiforme during and after radiation therapy. There are many different ways of using this drug, alone or in combination with radiation. When radiation and temozolomide are used together, the pills are taken every day, usually for 42 days. Patients typically then enter a 'maintenance' phase, taking the temodar alone 5 days out of each month for 6-12 months. This can significantly improve overall survival in certain patients with glioblastoma multiforme to up to 17% at five years. Side effects from temozolomide are fairly well tolerated, with low platelets and an increased risk of infection being the most common. Interestingly, researchers and clinicians are now able to identify patients who may respond better to temozolomide, based upon the activity of a protein in the brain (and other tissues) which can repair the damage temozolomide does to the tumor cells. High levels of MGMT (*m*ethyl*g*uanine *m*ethyl*t*ransferase) are associated with a less favorable response (i.e. less tumor kill) by certain chemotherapy drugs, including temozolomide. Indeed, this comes into play when a patient's tumor seems to 'grow' despite therapy. When this occurs, it can be difficult to tell if the change is due to true tumor growth or side effects of treatment that mimic tumor growth, termed pseudo-tumor progression. Patients with MGMT overexpression are more likely to have 'real' progression and may require treatment change. In these situations, testing is available for MGMT expression and may assist in differentiating real from pseudo-tumor progression. Interestingly, adjusting the temozolomide dose and schedule (how often it is given) may overcome high levels of MGMT to some degree. This is an area of active research and is likely to impact how we treat individual patients, based upon their tumor behavior and biology.

The May 2009 FDA approval of bevacizumab for patients with progressive glioblastoma was a welcome (and much anticipated) addition to the medical oncologist's treatment armamentarium. Formerly only available on clinical trial or through compassionate use protocols, bevacizumab joins temozolomide as an emerging standard agent in an area of oncology which has historically had few options for patients beyond surgical resection and radiation. Although not a true chemotherapy agent, bevacizumab targets new blood vessel formation – blood vessels that tumor cells require for their own growth and survival. Studies have examined bevacizumab in patients who have progressive glioblastomas, as a single agent and with chemotherapy. Bevacizumab alone yields an impressive 6 month progression free survival of 40-45% and an overall survival of 9 months. While these statistics may seem dismal within the context of other solid tumors, it represents a tremendous advance in the management of progressive high grade brain tumors. Side effects of bevacizumab are

related to blood vessel damage and can include bleeding, blood clots, hypertension, and wound breakdown, all of which can range from minor to severe in terms of patient impact. The addition of traditional chemotherapy such as irinotecan to bevacizumab is one of debate with studies ongoing. Studies are also underway examining combinations of bevacizumab with temozolomide; we can expect preliminary results in the very near future.

As the first decade of the 21st century draws to a close, neuro-oncology patients and their families can look ahead with both hope and anticipation for more advances in the understanding and management of malignant, and non-malignant, brain tumors. Newer drugs and drug combinations, coupled with genetic information from individual tumors, will shape the future of this subspecialty and lead to individualized treatment plans for those affected with this highly aggressive and life-changing disease.

Pathologist

Thomas Reagan, MD
Peninsula Pathology Associates

Brain tumor is a general term that is used to include any tumor growing inside the skull, whether or not it arises in the brain itself. The pathologist plays a central role in the diagnosis of brain tumors. Clinical examination and imaging can lead to a high degree of suspicion of a brain tumor and even to a fairly confident guess as to its nature. However, ultimately it is the role of the pathologist to determine whether the suspect lesion is a tumor or some other process, like an infection, that can mimic a tumor clinically and on imaging studies. If it is a tumor, he must decide what kind of tumor it is. This will be the determining factor in all further treatment decisions including the value of additional surgery, or the need for post-operative radiation or chemotherapy.

The first clinically relevant distinction that needs to be made is between **primary** and **metastatic** brain tumors. **Metastatic brain tumors** spread to the brain from cancer in other organs and are, by definition, malignant. They are 5 to 10 times more common than primary brain tumors. Brain metastases occur in about 15% of cancer patients. Lung and breast cancers are the most common solid tumors that metastasize to the brain. Although melanoma, testicular, and renal carcinoma have the greatest propensity to metastasize to the brain, their relative rarity in large series of patients with brain metastases is due to their much lower overall incidence as compared with lung or breast cancer.

Primary brain tumors are considered those that arise from either the substance of the brain, the coverings of the brain (meninges), or associated structures such as the pituitary gland and cranial nerves. The overall annual incidence of primary brain tumors in the United States population is about 14 cases per 100,000 persons. Thus about 44,000 new primary brain tumors are diagnosed each year in the US, and there are about 360,000 people currently living with that diagnosis. Although there are over 30 different types of primary brain tumors recognized by pathologists, most fall into just a few major categories. About 25% are benign tumors arising from the covering of the brain called **meningiomas**. These are usually surgically curable tumors. Other benign "brain" tumors include nerve sheath tumors (Schwannomas), arising from cranial nerves inside the skull, and pituitary tumors, which together account for about 15 % of intracranial tumors.

The remaining 60% of primary intracranial tumors are the "true" brain tumors and arise from the various cell types that make up the normal brain. In this group of tumors, the distinction between benign and malignant is of limited clinical value since complete surgical removal is rarely possible without damaging normal brain function. Rather than being called benign or malignant, these tumors are usually assigned a grade from 1 to 4 by the pathologist, grade 1 being the most slowly growing and grade 4 the most aggressive.

Among the cell types that make up the normal brain, **neurons**, the primary functional cell of the nervous system, rarely gives rise to tumors. However, primitive precursor cells of neurons are the origin of a significant percentage of brain tumors in children, most notably a highly aggressive tumor called a **medulloblastoma.**

Supporting cells of the nervous system, called glial cells, are the origin of most of the "true" primary brain tumors that, as a group, are called **gliomas**. Astrocytes are the main supporting cells in this group and the most common cell type to give rise to tumors. Thus, **astrocytomas** account for 75% of the glioma group. More than half of astrocytomas (about 30% of all primary brain tumors) are

highly malignant (grade 4) tumors associated with average survival of less than a year. This type of tumor is commonly called **glioblastoma multiforme**. Other supporting cells of the brain, such as ependymal cells that line the cavities of the brain, oligdenroglial cells that form the myelin of the brain, and blood vessels, all give rise to a variety of tumors. Overall there are over 30 recognized varieties of primary brain tumors that a pathologist must distinguish.

The pathologist usually becomes involved in a case while the patient is still in surgery. Unless the neurosurgeon is very confident that he is dealing with a benign and surgically curable lesion, most tumor removal begins with taking a small biopsy. Many biopsies are done through a small hole in the skull using a needle like instrument guided by previously obtained imaging studies. This procedure is called a **stereotactic biopsy** and the amount of tissue obtained is usually very small. Typically the first, or even the first several biopsies, are examined by the pathologist using one or more of several techniques that allow rapid microscopic assessment of the tissue while the patient is still in the operating room. The two commonly used techniques are smear preparations and frozen sections. In the former, a tiny fragment of the tissue is literally smeared on a glass slide, stained, and looked at under a microscope. It has the advantages of being almost instantaneous and using little tissue. The procedure of freezing, cutting thin sections, and staining the tissue takes a few minutes longer and requires slightly more tissue but may offer a more precise diagnosis. In any case the surgeon will usually wait for the report from the pathologist before proceeding further. If the tissue does not reveal a definite diagnosis, additional biopsies and frozen sections are obtained. Once the pathologist is confident that the biopsies are from within a tumor, even though the exact type of tumor may be indefinite, additional biopsies or as much of the tumor as is considered safe are removed and placed in a fixative solution for more definitive studies.

The pathologist must then work with the fixed tissue to arrive at a final diagnosis and may need to apply a number of techniques depending on the complexity of the case. In the simplest cases the diagnosis can be ascertained by looking through a microscope at thin sections of the fixed tissue stained with "routine" dyes (e. g. hematoxylin and eosin). Routine staining will usually reveal the basic nature of the tumor. However sometimes different tumor types may look similar in stained sections, especially when dealing with the tiny fragments. In those cases additional special staining methods may be necessary. The pathologist has a large array of special stains that will sort out almost any difficult diagnostic situation. Many of these are based on antibodies to unique tissue components that can be labeled and then reacted with the tissue sections to determine if that component is present. This technique is called **immunohistochemistry**. Beyond that, if the diagnosis is still questionable, **electron microscopy** can be employed. It allows us to look at cells magnified thousands of times. It is an expensive and time consuming technique and is rarely necessary since the advent of immunohistochemistry.

Even more sophisticated studies at the sub-cellular level, such as analyzing the chromosomes contained in the tumor cells **(cytogenitics**), are becoming meaningful in some situations. For example, it has been found that some patients with a particular type of brain tumor (oligodendroglioma) have deletions of parts of two chromosomes in their tumor cells. These patients have a much better outlook and response to treatment than patients with identical tumors but without the cytogenetic abnormality. It is likely that in the future, molecular and genetic analysis may have increasing significance both in diagnosis and therapy of brain tumors.

Finally, a great deal of the current research in brain tumors is focused on an array of specific genes and gene products that are known to either stimulate or inhibit growth and then formulating drug regimens that either block or enhance these factors. This suggests the possibility that the role of the pathologist in the future may be not only to establish a histologic diagnosis but also to further define each tumor in terms of its genetic and molecular make-up in order to assess its sensitivity to various therapeutic agents.

Radiosurgery Nurse

What is Stereotactic Radiosurgery?
This is a very common question asked today by patients that have been diagnosed with a brain tumor and are exploring their treatment options. Stereotactic Radiosurgery is a non-surgical procedure that delivers a high-dose of precisely targeted radiation that converges on the specific area or areas where the tumor or other abnormality resides, minimizing the amount of radiation to healthy tissue.

At the Riverside and University of Virginia Radiosurgery Center we have two separate machines that deliver Stereotactic Radiosurgery: The Elekta Gamma Knife which is used to treat intracranial tumors or abnormalities smaller than 3.5cm, and the Elekta Synergy S which is used to treat intracranial tumors larger than 3.5cm as well as tumors located elsewhere in the body, such as the lungs, liver and adrenal gland.

Once it has been decided that stereotactic radiosurgery is the selected treatment for a patient with a brain tumor, they are scheduled for Stereotactic Radiosurgery-Gamma Knife, an outpatient procedure.

One of the most frequently asked questions is, "How do they cut it out?" This is where the Radiosurgery Center staff spends extra time educating patients about the Gamma Knife procedure. With the Gamma Knife, there is no knife involved. The procedure works the same way as other forms of radiation treatment. It does not actually remove the tumor; rather, it damages the DNA of tumor cells causing them to be unable to reproduce or grow through precise, high dose radiation.

Gamma Knife Patient Experience
Upon arrival to the Radiosurgery Center, an intravenous access is obtained allowing the anesthesiologist to give medication that will relax the patient for the placement of the head frame. The head frame is made of titanium; therefore it is Magnetic Resonance Imaging (MRI) compatible and weighs approximately 1 pound. The head frame allows for immobilization of the patients head during the MRI or Computed Tomography (CT), for localization of the target area (the tumor) during the planning phase of the treatment process, as well as immobilization of the patient's head during the treatment session. The neurosurgeon places the head frame carefully on the patient's head using specifically designed pins after he/she injects a local anesthetic to numb the four areas where the pins will be placed.

Beverly Bowden, RN
Riverside & University of Virginia Radiosurgery Center

The patient is then taken to MRI or CT, and these images are used by a highly skilled multidisciplinary team, which includes a neurosurgeon, radiation oncologist and medical physicist, to develop the treatment plan. As no two treatment plans are alike, the planning process can take anywhere from 30 minutes to several hours, depending on the complexity of the plan.

Once the plan has been developed, the patient is ready for treatment. The treatment is delivered by the Elekta Gamma Knife, which houses 201 sources of cobalt 60 radiation. All 201 sources are in a stationary position. The head frame will be attached to the helmet, part of the Gamma Knife machine, that will keep the patient's head in a stationary position, allowing the treatment to be delivered with sub millimeter accuracy. During treatment, patients will not hear, feel or see anything.

Once the treatment session is complete the head frame is removed, and the patient is monitored for approximately one hour before they are discharged.

The patient follows up in approximately two weeks with the neurosurgeon and has another MRI or CT in approximately 6 to 12 weeks to follow the progress of the treatment.

Lymphoma at Riverside Regional Medical Center

Medical Oncologist

Nancy McKinney, MD
Peninsula Cancer Institute

Lymphoma is a systemic disease that involves the lymphatic system of the body. The lymphatic system is a well organized body system that is designed to help fight and prevent infections. It includes the lymph nodes (pea-sized organs that produce and store lymphocytes, a type of infection-fighting white blood cell), lymph vessels that carry lymph fluid around the body, as well as the spleen, the thymus, and the bone marrow.

In lymphoma, a type of lymphocyte mutates and multiplies uncontrollably. This leads to enlargement of the involved lymph node, and if it is allowed to progress, it may spread through the lymphatic vessels to other lymph nodes, and to other lymph organs. As the lymphoma progresses, cancerous cells crowd out the normal infection-fighting cells, decreasing the person's ability to fight infection.

There are two major types of lymphomas: **Hodgkin's lymphoma** (also known as Hodgkin's disease) and **non-Hodgkin's lymphoma**. There are 6 sub-types of Hodgkin's lymphoma and over 40 sub-types of non-Hodgkin's lymphoma.

Lymphoma Symptoms. Lymphomas can cause many non-specific symptoms. Swollen lymph nodes in the neck, under the arms or in the groin area are the most common finding. These are usually not painful, however in Hodgkin's lymphoma, drinking alcohol sometimes makes the cancerous lymph nodes hurt. If the lymphoma involves the spleen, patients may experience abdominal pain, the feeling of being full, and an increase in abdominal size. Fatigue, fevers, drenching night sweats, and unexplained weight loss are also symptoms that may accompany the diagnosis of lymphoma. Since cancer cells may crowd out the normal infection-fighting cells, patients may also develop recurrent infections.

Lymphoma Staging. Lymphomas, both Hodgkin's lymphoma and non-Hodgkin's lymphoma, are grouped into four main stages, I-IV, depending on the extent of spread. These classifications help with treatment decisions and prevent over-treatment with potentially toxic drugs.

- Stage I lymphoma is localized to one lymph node area, or a single organ.
- Stage II lymphoma is confined to two or more lymph node regions on one side of the diaphragm (the level of the bottom of the ribcage).
- Stage III lymphoma involves lymph node regions or lymphatic organs on both sides of the diaphragm.
- Stage IV lymphoma is advanced disease, involving not only lymph nodes, but other organs such as the lungs, liver, or bone marrow.

Further sub-classifications of lymphoma staging:

- The letters "A" and "B" denote the presence or absence of symptoms related to the lymphoma. If a patient has unexplained fevers, drenching night sweats, and unintentional weight loss, these constitute "B" symptoms, and the letter "B" is placed after the stage. If the patient does not have symptoms, the letter "A" is placed after the numeric stage. For example, a patient with non-Hodgkin's lymphoma involving lymph nodes of his neck, arm pit, and groin, without any symptoms of fever, night sweats or weight loss would have stage IIIA disease.
- The letter "E" stands for "extra nodal," and denotes the presence of disease outside the lymphatic system (lung, thyroid, skin, etc.).

Lymphoma Work-Up. Once lymphoma is suspected, several tests need to be performed to determine the extent of disease and the type of lymphoma.

- *Biopsy:* Most important in the lymphoma work up is a tissue biopsy. The piece of tissue that is removed must be large enough that the pathologist can examine it under the microscope, see how aggressive the lymphoma is, and perform special stains as well as genetic testing to search for specific DNA mutations.
- *Radiographic tests:* Next, the stage of lymphoma must be determined. This work-up includes diagnostic radiographic tests such as a CT (computerized axial tomography) scan of the chest, abdomen and pelvis area, and the more recently adopted PET (positron emission tomography) scan. With a PET scan, a small amount of radioactive glucose is injected into a patient's vein, and this is sucked up by the cells that are rapidly dividing (such as cancer cells). A special camera then records these areas as "hot" or "bright."

- *Bone marrow biopsy:* This involves removing a small amount of the bone marrow, which is the spongy material in the center of most large bones that produces blood cells. If cancer cells have invaded the bone marrow, this is by definition stage IV disease.
- *Blood tests:* Some simple blood tests can help determine the patient's prognosis and the need for immediate treatment along with the pathologic type and stage. Erythrocyte sedimentation rate (ESR) is a commonly tested marker of systemic inflammation, and, generally speaking, the higher the ESR, the more aggressive the tumor. Lactate dehydrogenase (LDH) is a marker of cell turnover, and the more aggressive the tumor, the higher the LDH. Both of these markers can be inexpensively followed during therapy to help monitor treatment response. Routine laboratory studies of liver, kidney, and bone marrow function are also very important, as these reflect a person's general health and ability to tolerate aggressive therapy.

Hodgkin's Lymphoma. Hodgkin's lymphoma is a specific form of lymphoma that involves a mutation of Reed-Sternberg cells, a form of B-lymphocyte (infection-fighting white blood cell). These are cancerous, continuously dividing, and do not die. Of interest, most cells in involved lymph nodes are non-cancerous cells that are produced by the body in response to the Reed-Sternberg cells. However, they cause significant problems by replacing the normal infection-fighting mechanism of the lymphatic system.

- *Incidence:* Hodgkin's lymphoma is rare, accounting for less than 1% of all cancers diagnosed in the United States per year and 10-15% of all lymphomas. Historically, it is very important, as it was the first lymphoma to be described, and is an example of a type of cancer that can be cured by chemotherapy and/or radiation therapy alone.
- *Age:* Hodgkin's lymphoma is found most commonly in patients between the ages of 15 and 24, and in patients older than age 60.
- *Risk factors:* Most patients who develop Hodgkin's lymphoma have no risk factors for lymphoma. However, some risk factors do exist. These include a family history of Hodgkin's lymphoma, previous infection with mononucleosis, HIV, and a weakened immune system.
- *Variants:* There are two major subtypes of Hodgkin's lymphoma: **Classical Hodgkin's Lymphoma**, and **Nodular Lymphocyte Predominant Hodgkin's Lymphoma**. Classical Hodgkin's lymphoma is by far the most common, and includes nodular sclerosis, mixed cellularity, lymphocyte depleted, and lymphocyte rich HL. These are distinguished by differing histologic features under the microscope.
- *Prognostic markers*: Several factors have been identified that may predict a worse prognosis for patients with Hodgkin's lymphoma. These include: older age, more advanced stage, lower blood cell counts, male gender, low albumin level (a circulating protein in the blood), presence of "B" symptoms, high ESR, and large volume of disease.
- *Prognosis:* Hodgkin's lymphoma is one of the diseases whose survival rate has drastically improved over the last 50 years with novel combinations of chemotherapy medications, and the appropriate use of radiation therapy. Current studies show that the 5-year survival rate is 98% in favorable groups, and even in those with poor prognostic markers, the 5-year survival rate is 70-85%.

Treatment of Hodgkin's Lymphoma: Without treatment, Hodgkin's lymphoma (HL) will progress in an organized manner, from a single lymph node, to surrounding lymph nodes, to other lymph node regions on the same side of the diaphragm, to lymph node regions on both sides of the diaphragm, to other lymphatic organs such as the spleen and bone marrow, and finally to distant organs such as the lungs and liver. . Treatment of HL is based on the stage of disease as well as prognostic markers. The mainstays of therapy include combination chemotherapy and radiation therapy. Surgery is almost never used, except in obtaining a diagnosis.

- *Combination chemotherapy*: Chemotherapy involves the administration of strong medications with the goal of halting the growth of cancer cells. Classical chemotherapy works by non-specifically killing rapidly dividing cells, working on the premise that most adult cells are not actively dividing, while cancer cells divide quickly. Thereby chemotherapy preferentially destroys cancer cells. However, there are normal cells in the body that continually grow and divide as well. These include the cells of the bone marrow, the cells that line the gastrointestinal tract and the mouth, and hair follicles. This is the reason that chemotherapy commonly causes side effects from low blood counts such as bleeding, infection, and fatigue, as well as nausea, mouth sores, diarrhea, and hair loss. The maximum dose of chemotherapy that can be delivered is limited by the side effects caused from damage to healthy cells. Using combinations of different chemotherapy medications allow more medicines to be given to attack the tumor with non-overlapping side effects. In Hodgkin's lymphoma, typically at least four intravenous chemotherapy medications are given at one time, and then the body is allowed time to recover, after which

time the chemotherapy medications are given again. This is called a "cycle."

- *ABVD*: This is the most common chemotherapy regimen used in the United States, and includes 4 chemotherapy drugs: *A*driamycin, *B*leomycin, *V*inblastine, and *D*ecarbazine. Two doses of these medicines given 14 days apart constitute one cycle. Patients commonly receive between 4 and 8 cycles of chemotherapy for curative treatment.
- *BEACOPP*: This is the most common chemotherapy regimen used to treat Hodgkin's lymphoma in Europe, while in the United States it is generally reserved for patients with advanced and high risk disease. This includes *b*leomycin, *e*toposide, *A*driamycin (doxorubicin), *c*yclophosphamide, *O*ncovin (vincristine), *p*rocarbazine, and *p*rednisone. While the response rates of this regimen are somewhat higher than with ABVD, the adverse effects are also higher, as is the long-term risk of cancer caused by the treatment.
- *Side effects*: The side effects of systemic chemotherapy may be both immediate and long-term. Immediate side effects include nausea, vomiting, diarrhea, hair loss, fatigue, increased risk of infection, bruising and bleeding. Many of these can be prevented or reduced with medications to treat nausea, and medications to prevent infection by keeping the white blood count high. One concerning long-term side effect is infertility. This is less common with the newer chemotherapy regimens, but the incidence is still around 20%. Specific chemotherapy medications also have unique adverse effects. For example, bleomycin can cause lung toxicity, doxorubicin can cause heart failure, and vinblastine can cause nerve damage.

- *Radiation therapy*: Radiation treatment uses a focused beam of radiation directed to the area involved with tumor (involved field radiation). In early stage nodular lymphocyte predominant Hodgkin's lymphoma, radiation therapy alone is sufficient to cure the patient. In early stage classical Hodgkin's lymphoma, or with bulky disease, radiation is used in combination with chemotherapy to improve response, and to decrease the amount of chemotherapy required. Radiation is given in small daily doses (fractions) over a period of several weeks in order to minimize side effects.
  - *Side effects*: As with chemotherapy, radiation therapy has both short- and long-term side effects. Possible short-term side effects include skin burning (like a sunburn) and fatigue. Possible long-term side effects include an increased risk of breast cancer (if the field includes the breast), heart disease (if it includes the heart), or thyroid disease (if it involves the neck).
- *Stem cell transplant (bone marrow transplant):* In the rare patient who does not respond to appropriate therapy or who relapses after achieving a remission, autologous stem cell transplantation is the treatment of choice. This involves removing stem cells from the patient after he or she achieves a maximum response to therapy, followed by giving a high dose of chemotherapy and often whole body radiation therapy with the goal of killing all the remaining lymphoma in the body. The patient's healthy stem cells are then given back to the patient, and the patient is allowed to recover their bone marrow. This process allows a much higher dose of chemotherapy and radiation therapy to be given.

Non-Hodgkin's Lymphoma. Non-Hodgkin's lymphomas (NHL) comprise 85-90% of lymphomas. This is a very diverse group of over 40 diseases that vary in aggressiveness, in disease course, and in response to therapy. The incidence of NHL is increasing, and has nearly doubled in the last 30 years. However, in the same timeframe our therapies have improved, and the number of deaths due to NHL has decreased significantly. We also have a better understanding of the cause of the disease, and have more targeted therapies that preferentially attack the cancer cells while not affecting healthy cells. These newer treatments have not only improved survival, but have also improved patients' ability to tolerate therapy.

How Do Hodgkin's Lymphoma and Non-Hodgkin's Lymphoma Differ? Hodgkin's lymphoma (HL) is far less common than non-Hodgkin's lymphoma (NHL). For both types of cancers, men are affected slightly more than women. In NHL, the incidence increases with age, and it is rare in young patients. The staging system is similar for both HL and NHL, although the progression of NHL is far less predictable and orderly than in HL. Also in NHL, extra-nodal disease (not involving the lymph nodes or lymphatic organs) is far more common and comprises about 25-35% of NHL. The presenting symptoms of enlarging lymph nodes, fatigue, fever, night sweats and weight loss may be seen with any lymphoma, however these "B" symptoms are more commonly seen with HL and aggressive NHL.

Classification of Non-Hodgkin's Lymphoma. The classification of NHL is quite confusing, even for doctors, because there are so many different types, and because the classifi-

cations change as we learn more about the disease. NHL is classified by the type of lymphoid cell affected (i.e. large or small cell, and B-cell or T-cell), and the aggressiveness of the lymphoma (i.e. indolent vs. aggressive). It is important to accurately identify the subtype of NHL, since this can help predict a patient's prognosis as well as his or her response to therapy. The two most common types of NHL are **diffuse large B cell lymphoma** and **follicular lymphoma**.

Risk Factors for Non-Hodgkin's Lymphoma. As with Hodgkin's Lymphoma, the cause of most cases of non-Hodgkin's lymphoma is never determined. However, several factors have been identified that increase one's risk of developing NHL. These include increasing age, male gender, and a weakened immune system. Some infections also may increase the risk of developing certain types of lymphomas. Helicobacter pylori infection can increase lymphoma development of the stomach lining, and Ebstein-Barr virus (the virus that causes mononucleosis) is believed to increase the incidence of both Hodgkin's lymphoma and some types of non-Hodgkin's lymphoma. HIV/AIDS may also increase the incidence of HL and NHL.

Treatment of Non-Hodgkin's Lymphoma. In general, the more aggressive the NHL, the tougher the treatment. With aggressive NHL, the goal of therapy is cure, and if it is not treated, the lymphoma will soon threaten the patient's life. In contrast, slow-growing NHL is very hard to cure. Often the goal of treating these tumors is disease control and symptom management, and patients will commonly live a normal lifespan and die of causes other than their lymphoma.

Diffuse Large B Cell Lymphoma. This is the most common type of NHL, accounting for approximately one-third of new cases. This is a fairly aggressive lymphoma, and is so named because the cells appear large and uniform under the microscope. If left untreated it is fatal. However, with appropriate therapy, over 50% of patients can be cured and will live normal lives.

- The symptoms of diffuse large B cell lymphoma (DLBCL) are similar to those of Hodgkin's lymphoma, including swollen nodes, fever, night sweats and weight loss. Unlike with HL, a high proportion of cases of DLBCL are extranodal (originating outside the lymphatic system). The most common site of extranodal lymphoma involvement is the gastrointestinal tract. However nearly any organ can be involved, including the brain, the skin, the bone, the liver, the testis, the breast, the tonsil, etc.
- Treatment of early stage DLBCL involves a combination of involved field radiation therapy, combination chemotherapy, and immunotherapy. Treatment of advanced stage DLBCL involves combination chemotherapy and immunotherapy (generally twice the duration of therapy as early stage disease).
- *Combination chemotherapy*: the most common regimen is CHOP, which consists of 4 drugs: *c*yclophosphamide, *h*ydroxydaunorubicin (Adriamycin), *O*ncovin (vincristine), and *p*rednisone. The first three are given in the vein over the course of one day every 3 weeks, and prednisone is taken by mouth for 5 days every 3 weeks. The most common side effects are low blood counts, nausea, vomiting, and allergic reaction to the medications. Most of these can be prevented or minimized by premedication with anti-nausea drugs, and a medicine to prevent infection by keeping the white blood count high. Tumor lysis syndrome is a potentially serious adverse effect of chemotherapy that occurs from a large number of tumor cells dying at once, releasing their toxic substances into the patient. This can lead to serious kidney problems and heart problems. However, with current medications that help clear the toxins and with close monitoring, this side effect is fairly rare. Long-term side effects of combination chemotherapy for DLBCL are similar to those for Hodgkin's lymphoma, and include heart failure, nerve damage, infertility, and an increased risk of second cancers.
- *Immunotherapy:* The addition of a medication that is targeted against lymphoma cells has improved remission rates and overall survival in non-Hodgkin's lymphoma. The medication most commonly used is rituximab, which is a monoclonal antibody directed against a specific receptor on most lymphoma cells (CD 20), that most of the patient's normal cells do not possess. This has the advantage over traditional chemotherapy which kills all rapidly dividing cells, in that it primarily kills tumor cells, while not harming non-cancer cells. Rituximab, when added to combination chemotherapy, does not significantly increase side effects, therefore, CHOP-R is currently the standard treatment of choice for DLBCL.
- *Stem Cell Transplant:* In patients whose lymphoma recurs following appropriate chemotherapy for diffuse large B cell lymphoma, autologous stem cell transplant can still lead to long-term survival and cure. As discussed previously, this technique allows the administration of higher doses of lymphoma-killing chemotherapy and radiation therapy than could otherwise be given.

Follicular Lymphoma: This is the second most common type of non-Hodgkin's lymphoma, (comprising about 20%

of lymphomas). It is named because of its characteristic appearance under the microscope, as the cells tend to grow in a circular or nodular pattern. Unlike diffuse large B-cell lymphoma or Hodgkin's lymphoma, this tends to be a slow growing disease. It is usually diagnosed in advanced stages (involving numerous lymph node sites and the bone marrow), and is difficult if not impossible to cure. However, a person can often live with follicular lymphoma for decades.

- *Classification*: Follicular lymphoma is divided into three grades, according to how aggressively it behaves.
  - Grade I: this is the most common type of follicular lymphoma, and the least aggressive form.
  - Grade II: this is an intermediate form, however it is generally considered to be slow growing.
  - Grade III: this form of follicular lymphoma is more aggressive, and behaves more like diffuse large B cell lymphoma.
- *Treatment*: The treatment for follicular lymphoma is quite variable, and depends on the person's symptoms, the tumor grade, the tumor stage, and the general health and preferences of the patient. It is not uncommon for patients to receive no treatment for several years- the "watch and wait" approach. With these slow growing lymphomas, immediate treatment has not been shown to improve survival over treatment when symptoms become bothersome. Indications for starting treatment include symptomatic/enlarging lymph nodes, "B" symptoms, and low blood counts.
  - Early stage disease: Treatment of stage I or II follicular lymphoma is usually radiation alone.
  - Advanced stage disease: Treatment of stage III or IV follicular lymphoma depends on the severity of symptoms, and on patient's preference (some patients do not feel comfortable with the "watch and wait" approach.) Most advanced stage follicular lymphoma is treated with one or more chemotherapy agents, usually in combination with immunotherapy to improve response. Since the goal of treatment is generally not cure, quality of life and symptom management are of paramount importance, as often the treatment can be more harmful than the disease. It is essential to make a personalized treatment plan that is acceptable to both the doctor and to the patient.
- *Transformation*: One of the most feared risks of follicular lymphoma is transformation to a more aggressive lymphoma, such as diffuse large B cell lymphoma. This occurs in up to 1/3 of patients with FL, and if this occurs, the disease is very difficult to treat, and patients usually expire within a year of disease transformation.

Future Treatment Options for Non-Hodgkin's Lymphoma. Much research is being done to improve the overall survival of lymphoma patients, as well as their quality of life while living with lymphoma.

- *Radioimmunotherapy*: One such treatment option is radioimmunotherapy. This uses radiation isotopes linked to monoclonal antibodies (such as rituxamab). In this way radiation therapy can be directly delivered to the cancer cells, reducing the exposure of radiation to healthy tissues. Currently there are two approved radioimmunotherapy treatments, 90Y-ibritumomab tiuxetan (Zevalin) and 131I-tositumomab (Bexxar). These are both quite expensive, only given at certain centers, and may have significant side effects; however, this is an example of a new approach to the treatment of lymphoma.
- *Clinical Research*: Clinical trials are a great way to study the effectiveness and safety of new therapies. Clinical trials can offer treatment options to patients that are not commercially available otherwise. They are also important in the advancement of medical knowledge, so that patients in the future may be cured of their disease. Hodgkin's lymphoma is an excellent example of a treatment success, since in the course of less than a century a uniformly fatal disease has become curable in about 90% of cases. This could only have been achieved by clinical studies that continuously strive to improve upon our current standard of care.

Sources and Further Reading:

National Cancer Institute
800-4-CANCER
www.cancer.gov

The Leukemia and Lymphoma Society
800-955-4572
www.leukemia-lymphoma.org

Lymphoma Research Foundation
800-500-9976
212-349-2910
www.lymphoma.org

The Lymphoma Information Network
www.lymphomainfo.net

Patients Against Lymphoma
610-346-8419
www.lymphomation.org

Radiation Oncologist

The lymphomas represent a broad spectrum of diseases of lymphocytes predominantly presenting in lymph nodes. Lymphomas are broadly classified as Hodgkin(s) or non-Hodgkin. Within the non-Hodgkin group are the more common B-cell lymphomas and less common T-cell lymphomas. All lymphomas make up roughly 5% of all malignancies in men and 4% in women. Non-Hodgkin lymphomas are five times more common than Hodgkin. While the incidence of Hodgkin lymphoma presents in two age groups, teens to early twenties and forty to fifty, the incidence of non-Hodgkin lymphoma increases with increasing age. Lymphocytes are among the most sensitive cells in the body to the effects of radiation therapy so the doses used in their treatment are typically lower than those used for solid tumors such as breast or prostate cancer.

Hodgkin Lymphoma

In the late 1920s, early pioneers in radiation oncology discovered that x-ray therapy could shrink enlarged lymph nodes caused by Hodgkin lymphoma, but it was not until the late 1940s and early 50s that the use of radiation therapy to involved and adjacent lymph nodes led to the realization this treatment could be curative in a small number of patients. Building on this body of evidence, Kaplan and colleagues at Stanford in the 1960s developed the concept of "total nodal radiation" which led to cure in a significant number of patients with all but advanced cases of Hodgkin lymphoma. Also, in the 60s, multiagent chemotherapy regimens were developed that also demonstrated the ability to cure Hodgkin lymphoma, even in advanced cases. Since most patients with Hodgkin lymphoma are young, a large body of information on the long-term effects of radiation therapy has accumulated. This has led to the finding that patients whose hearts were irradiated have an increased incidence of coronary artery disease. Also, treated young women have an increased incidence of breast cancer. While these are the predominant long-term adverse sequelae of large volume treatment with radiation therapy, there are others including solid tumors and leukemia, which can be seen in patients treated with chemotherapy and/or radiation. Because the cure rate for Hodgkin lymphoma is so high, recent investigations have concentrated on reducing both short and long-term toxicity of treatment. Currently, most patients with Stage I or II Hodgkin lymphoma are initially treated with combination chemotherapy followed by moderate dose radiation therapy to only those areas involved with lymphoma at the time of diagnosis. Long-term survival rates now exceed 90%. Current investigations are focused on less toxic chemotherapy and on the possibility of eliminating radiation therapy as part of first line treatment for Hodgkin lymphoma.

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Radiation Oncology Specialist

Non-Hodgkin Lymphoma

Non-Hodgkin lymphoma represents a large group of diseases of either B or T cells. They are further divided into indolent lymphomas with typically long survivals with little or mild treatment, but are rarely cured and the more aggressive lymphomas that, despite their ominous name, are potentially curable with appropriate therapy.

Of the indolent lymphomas, early follicular lymphomas are potentially curable with moderate doses of local radiation therapy. In more advanced or refractory cases, radiation therapy may provide palliation for symptoms caused by large masses of lymph nodes. This is also true for B-cell chronic lymphocytic leukemia where enlarged nodes may cause symptoms. Zevalin a radiolabelled monoclonal antibody has been approved by the FDA for treatment of relapsed or refractory low grade or follicular B-cell lymphoma. This is a radioactive treatment that is administered systemically.

Of the aggressive lymphomas, diffuse large B-cell lymphoma is most common. Early stage disease is typically treated with chemotherapy followed by radiation therapy to the area of adenopathy seen at presentation. The same treatment may also be used in patients presenting with advanced disease who attain complete response to chemotherapy.

MALT lymphomas affect mucosa associated lymphoid tissue, most commonly the stomach. These lymphomas are often found in association with chronic h. pylori infection where eradication of the h.pylori can eliminate the lymphoma. Non-h.pylori associated gastric MALT lymphomas are most commonly treated with local radiation therapy although they may also be treated with rituximab if radiation therapy is contraindicated. Most other non-Hodgkin lymphomas are often treated with radiation therapy only when diagnosed in the earliest stages or in combination with chemotherapy for later stages. Clinical trials in the less common lymphomas are difficult to conduct because of the rarity of these diagnoses.

T-cell lymphomas are divided into extranodal, cutaneous and nodal. Non-cutaneous peripheral T-cell lymphomas are treated with a combination of chemotherapy and local radiation therapy. The cutaneous lymphomas typically referred to as mycosis fungoides/Sezary Syndrome are usually treated with topical treatments although individual symptomatic skin lesions may be treated with radiation therapy. More advanced cases may be treated with total body electron beam therapy which is a specialized form of radiation therapy.

Primary CNS lymphomas occur in two distinct groups of patients. Currently the majority occurs in patients who are chronically immunosuppressed either because of AIDS or organ transplantation. The prognosis for immunosuppressed patients is poor regardless of treatment. CNS lymphomas occurring in immunocompetent patients tend to occur in older patients and are usually treated initially with chemotherapy, which may be followed by whole brain radiation therapy.

Current radiation therapy research for lymphomas is concentrating on defining the appropriate volume and dose to be treated with external beam radiation therapy. An exciting field is the use of radiolabelled monoclonal antibodies such as Zevalin (ibritumomab) and Bexxar (tositumomab), which are radioimmunotherapy agents used to treat follicular lymphomas. As the genetic abnormalities seen in lymphomas become better characterized there is the possibility of rapid growth in the field of radioimmunotherapy.

Treatment recommendations in this report reflect the recommendations of NCCN Clinical Practice Guidelines in Oncology V.2.2009

Riverside Cancer Registry Data

Figure 1: 2004-2008 Hodgkin's versus Non-Hodgkins Lymphoma Analytic Caseload for RRMC

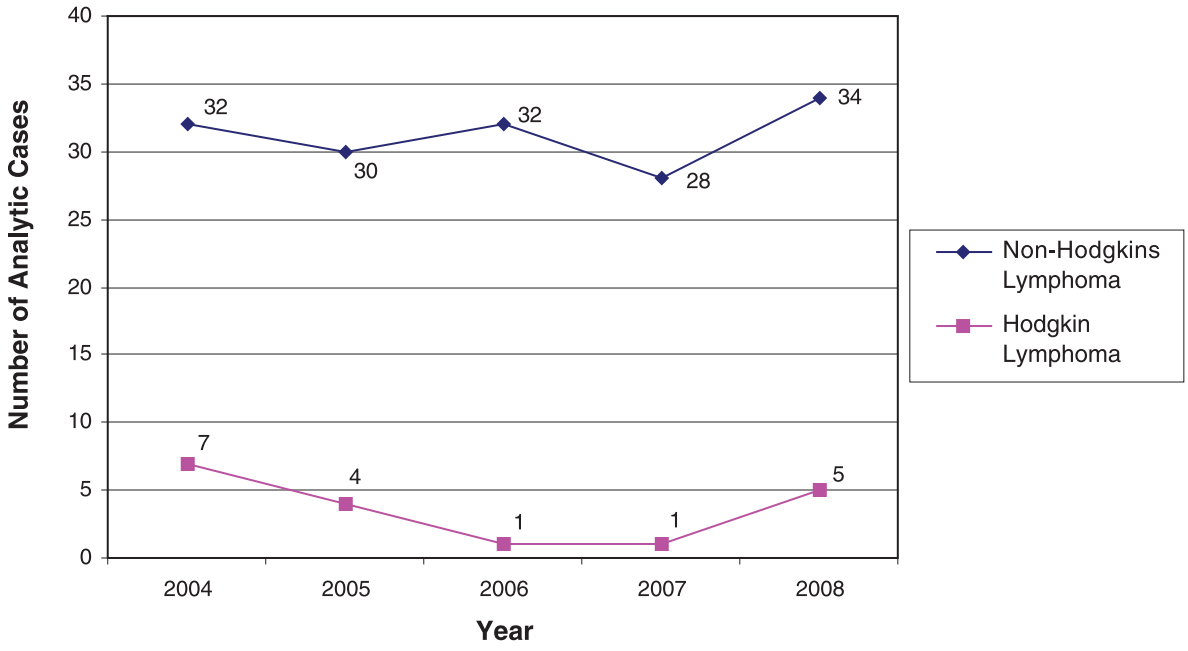


Figure 2: Age at Diagnosis of Hodgkin Lymphoma versus Non-Hodgkin Lymphoma for 2008 (Analytic cases only)

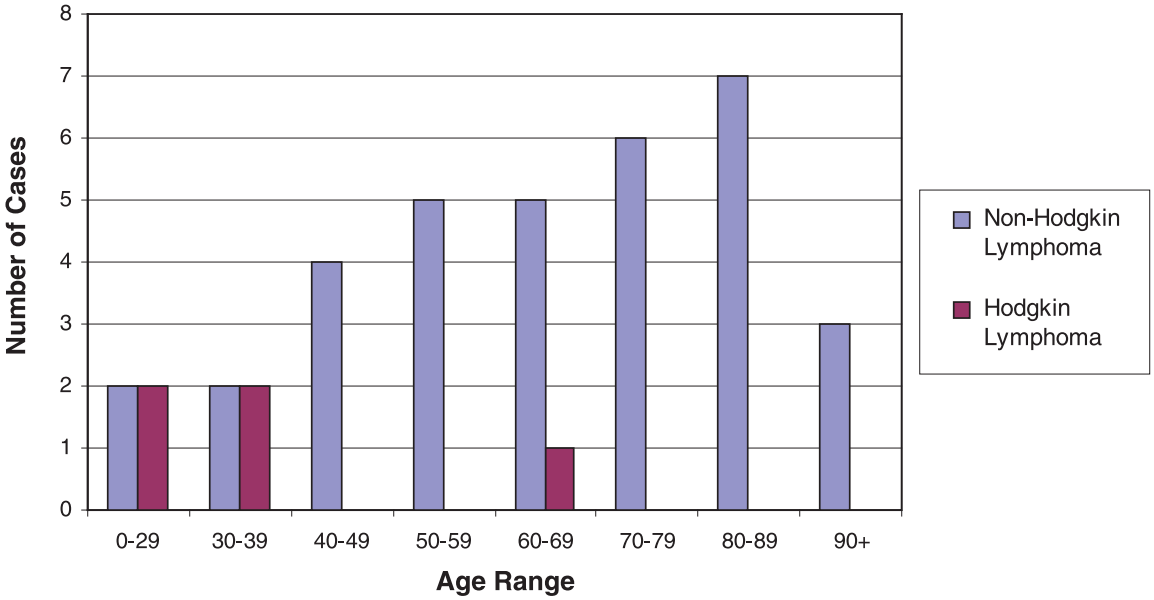
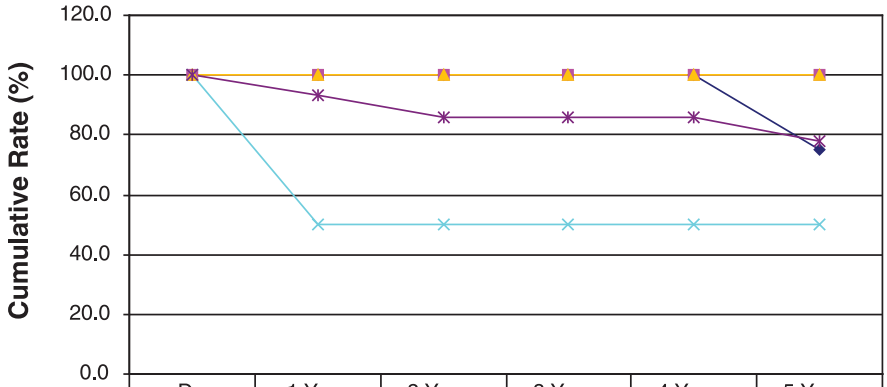


Figure 1 illustrates the expected prevalence of Non-Hodgkin Lymphoma over Hodgkin lymphoma observed at RRMC for the last several years. Figure 2 supports the claim that the incidence of NHL increases with age, while HL presents in two focused age groups.

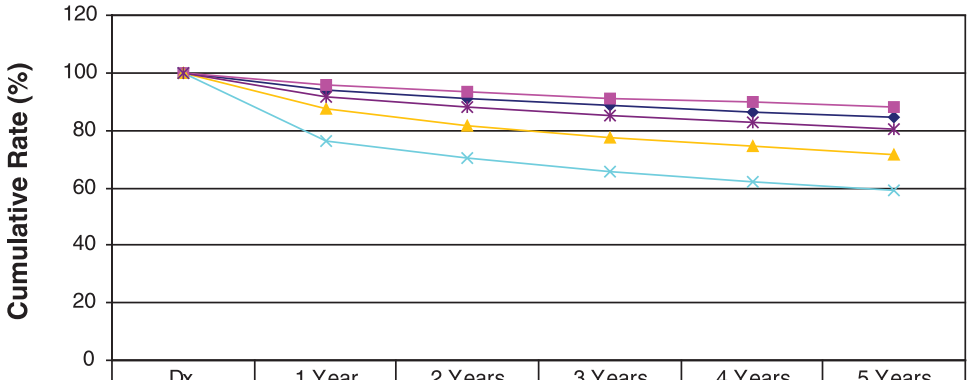
Riverside Cancer Registry Data

Figure 3: 1998-2001 Observed 5-Year Survival Rate for Hodgkin Lymphoma at RRMC



	Dx	1 Year	2 Years	3 Years	4 Years	5 Years
Stage I (n=4)	100.0	100.0	100.0	100.0	100.0	75.0
Stage II (n=6)	100.0	100.0	100.0	100.0	100.0	100.0
Stage III (n=1)	100.0	100.0	100.0	100.0	100.0	100.0
Stage IV (n=2)	100.0	50.0	50.0	50.0	50.0	50.0
Overall (n=15)	100.0	93.1	85.9	85.9	85.9	78.1

Figure 4: 1998-2001 Observed 5-Year Survival Rate for Hodgkins Lymphoma - NCDB Comprehensive Community Cancer Center (536 Facilities)

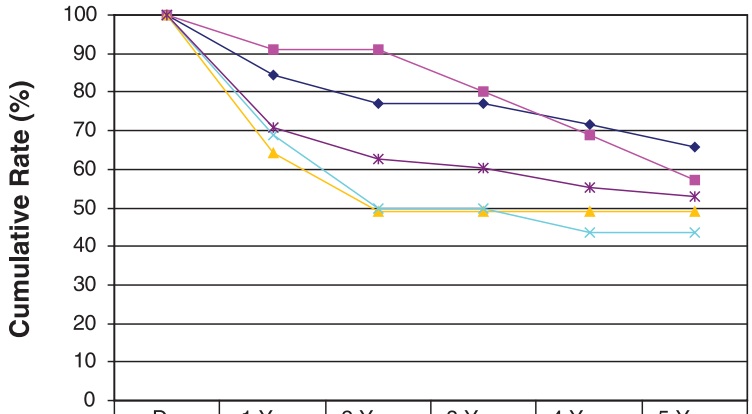


	Dx	1 Year	2 Years	3 Years	4 Years	5 Years
I n=1907	100	93.8	91	88.7	86.4	84.4
II n=3404	100	96	93.3	91.2	89.9	88.1
III n=1210	100	87.6	81.8	77.4	74.2	71.7
IV n=1005	100	76.5	70.3	65.4	62.1	59.2
OVERALL n=7526	100	91.5	87.8	84.9	82.8	80.6

Riverside Regional Medical Center is classified as a Comprehensive Community Cancer Center. Figures 3 and 4 offer a peer review comparison between the observed 5-year survival rates for Hodgkin Lymphoma (HL) at RRMC to other comparable CoC approved programs. It appears that Riverside has better survival for Stage II and Stage III HL than the nation average, however this variance between local and national data can be attribute to the low caseload volume. The overall 5- year survival rate for Hodgkin Lymphoma at RRMC is comparable to the national average.

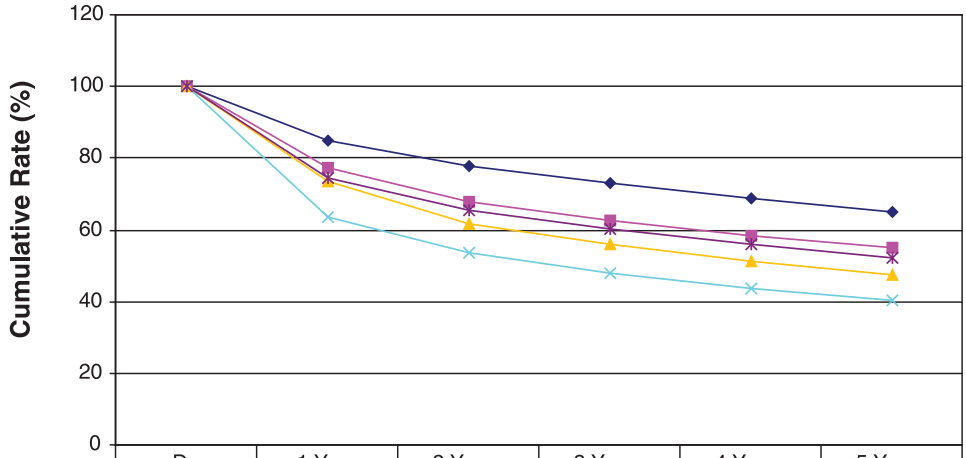
Riverside Cancer Registry Data

Figure 5: 1998-2001 Observed 5-Year Survival Rate for Non Hodgkin Lymphoma at RRMC



	Dx	1 Year	2 Years	3 Years	4 Years	5 Years
Stage I (n=39)	100.0	84.6	76.9	76.9	71.5	65.9
Stage II (n=11)	100.0	90.9	90.9	80.2	68.8	57.3
Stage III (n=14)	100.0	64.3	49.2	49.2	49.2	49.2
Stage IV (n=16)	100.0	68.8	50.0	50.0	43.8	43.8
Overall (n=130)	100.0	70.7	62.8	60.4	55.4	52.8

Figure 6: 1998-2001 Observed 5-Year Survival Rate for Non Hodgkin Lymphoma - NCDB Comprehensive Community Cancer Centers (550 facilities)



	Dx	1 Year	2 Years	3 Years	4 Years	5 Years
I n=13735	100	84.7	77.6	73.1	68.7	64.8
II n=7335	100	77.1	67.8	62.8	58.5	55.1
III n=6260	100	73.4	61.7	56	51.3	47.6
IV n=13432	100	63.4	53.7	48	43.7	40.2
OVERALL n=40762	100	74.5	65.5	60.3	56	52.3

When comparing the 5-year survival rates for RRMC's Non-Hodgkin Lymphoma (NHL) patients (n=130) to the Commission on Cancer's National Cancer Data Base (NCDB) (n=40762), RRMC is in accordance with the national survival rates for all stages of NHL.

Notes

Cancer Services

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