

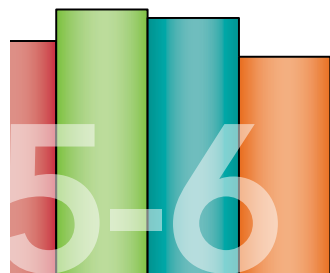
## THE UAB COMPREHENSIVE CANCER CENTER

To refer a patient to the UAB Radiosurgery Program or schedule appointments, contact UAB MIST at 1.800.822.6478.

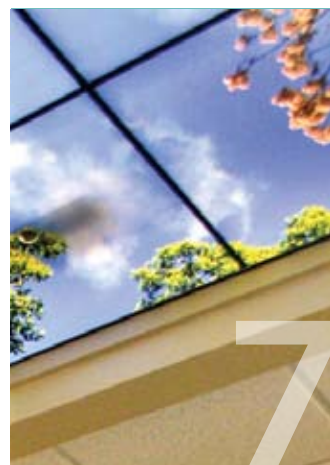
For more information about the UAB Radiosurgery Program, visit [uabmedicine.org/radiosurgery](http://uabmedicine.org/radiosurgery).



## 2010 UAB RADIOSURGERY PROGRAM outcomes



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Chair, Department of Radiation Oncology  
The University of Alabama at Birmingham

*This is our inaugural UAB Radiosurgery Program Outcomes book. I am hopeful that our 2010 edition provides you with some valuable insights into the clinical progress occurring in the fields of stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT).*

*Patients who place their trust in our care are our greatest priority. It is our mission to combine excellence in clinical care, research, and education toward the pursuit of curing cancer for our patients. As an institution, we have chosen to develop a multidisciplinary approach to the treatment of patients with complicated tumors requiring stereotactic radiation therapy. This program, as part of the UAB Comprehensive Cancer Center, has successfully integrated sub-specialized faculty and staff from both the Department of Radiation Oncology and the Department of Surgery. This structure will lead to further innovations, revolutionizing the diagnosis and treatment of patients with complicated cancer processes. Tumors that were untreatable just a few years ago now can be treated successfully with SRS or SBRT.*

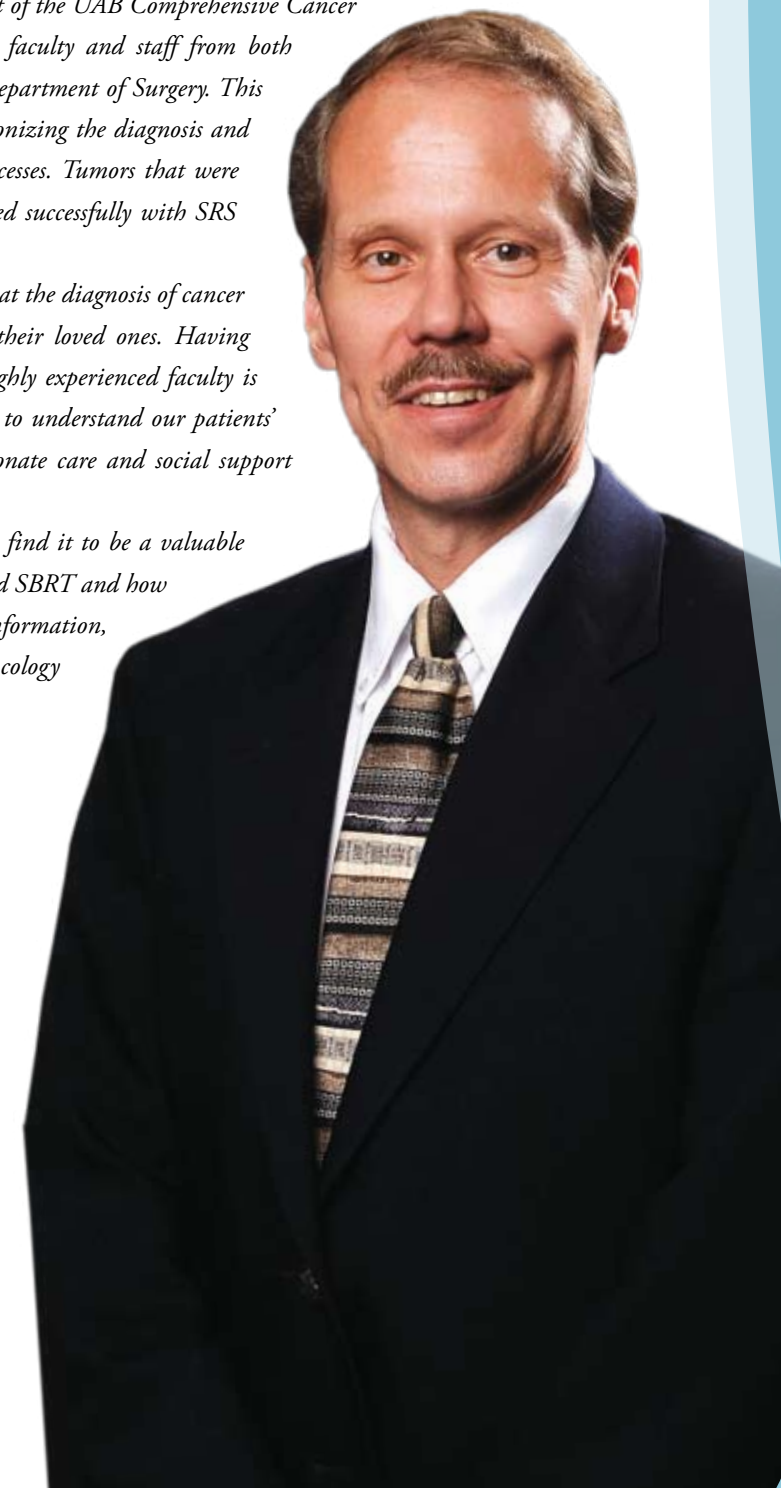
*Furthermore, our faculty and staff understand that the diagnosis of cancer is a life-altering event for both the patient and their loved ones. Having the most advanced technology available with a highly experienced faculty is not enough. Our team of associates makes a point to understand our patients' specific needs and subsequently provides compassionate care and social support services to ease these trying times.*

*As you explore this Outcomes book, I hope you find it to be a valuable tool as you learn more about the progress in SRS and SBRT and how it can help you and your patients. For further information, you may contact the Department of Radiation Oncology at (205)934-5670.*

Sincerely,

*James A. Bonner*

James A. Bonner, M.D.  
Merle M. Salter Professor and Chair  
UAB Department of Radiation Oncology



# Radiosurgery Outcomes 2010

THE UAB RADIOSURGERY PROGRAM is proud to introduce the first of its *Outcomes* book series. The *Outcomes* book contains a thorough description of the program and provides valuable data on patient volume and outcome measures on selected treatment procedures and disease sites. For more information about the UAB Radiosurgery Program, visit [uabmedicine.org/radiosurgery](http://uabmedicine.org/radiosurgery).

# Kirby I. Bland, M.D.

Chair, Department of Surgery  
The University of Alabama at Birmingham

We are delighted to introduce our first UAB Radiosurgery Program Outcomes book. The UAB Radiosurgery Program began in 1992, and since then we have successfully treated thousands of patients. We remain one of the busiest radiosurgical centers in the world.

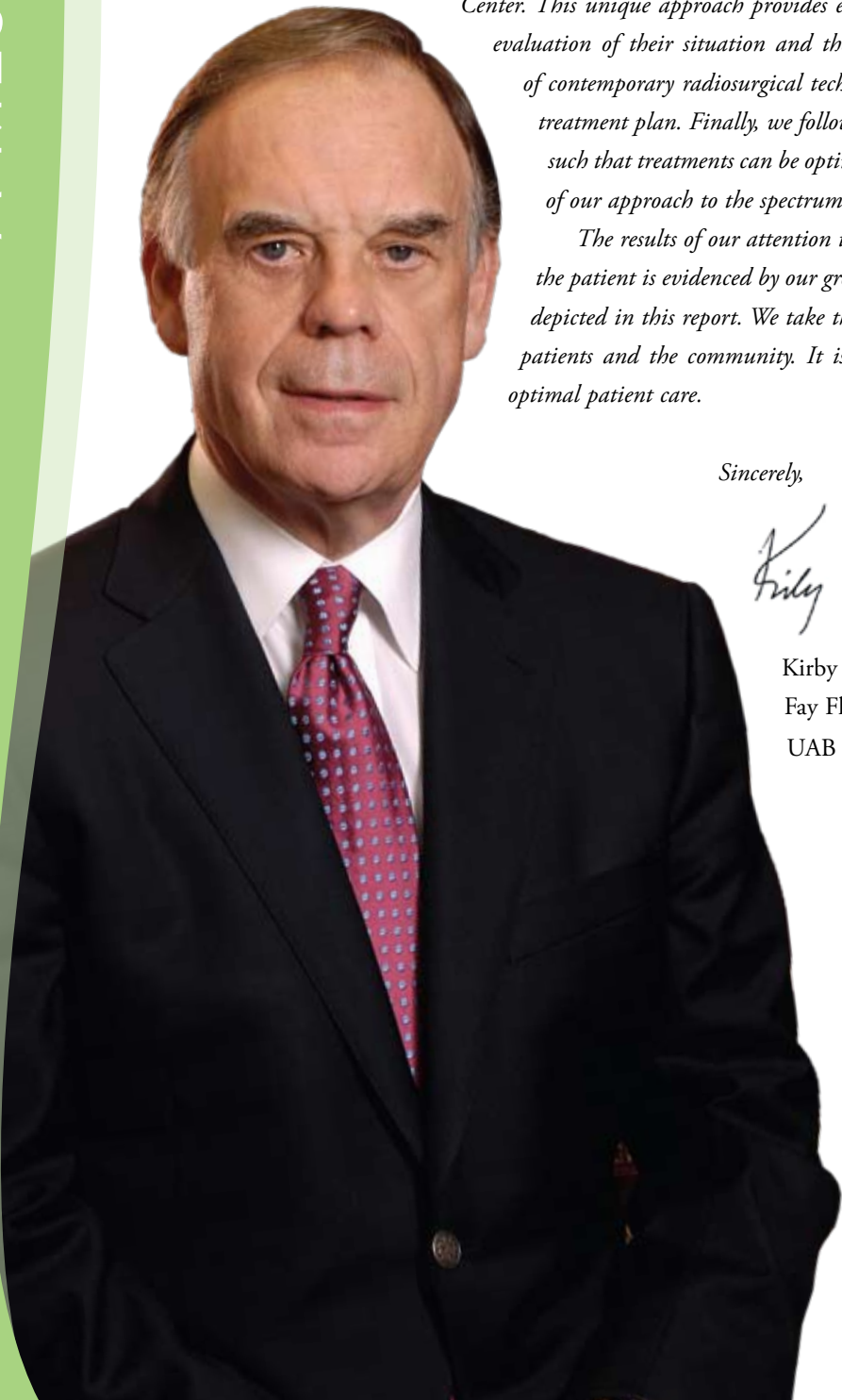
Our goal is to offer every patient compassionate, superior care by maximizing the value of our encounter with each patient. The UAB Radiosurgery Program accomplishes this in a number of ways. First and foremost is the unique collaborative effort among surgeons and radiation oncologists who are members of the UAB Comprehensive Cancer Center. This unique approach provides every patient with a thoughtful and thorough evaluation of their situation and therapeutic options. Second is the broad array of contemporary radiosurgical technology that is available to best carry out the treatment plan. Finally, we follow up with each patient and focus on outcomes such that treatments can be optimized, as we understand more about the value of our approach to the spectrum of disorders you will see in this report.

The results of our attention to patient needs and maximizing our value to the patient is evidenced by our growth and consistently high patient satisfaction depicted in this report. We take this as an indication of excellent service to our patients and the community. It is our mission to continue along this path of optimal patient care.

Sincerely,



Kirby I. Bland, M.D.  
Fay Fletcher Kerner Professor and Chair  
UAB Department of Surgery



# OUR History

In April 1992 the first patient in Alabama was treated at UAB with stereotactic radiosurgery for a primary brain tumor. Physics team members modified a standard linear accelerator to provide the extra precision required for this exacting procedure. Because radiosurgery was in its early stages and commercial turnkey equipment was not available, many of the instruments and devices were designed and manufactured in the laboratory. The institution-designed equipment provided for submillimeter precision—the most accurate delivery reported at that time.<sup>1</sup> The 1992 multidisciplinary team included neurosurgeons, radiation oncologists, and medical physicists.

With the expansion of this modality to arteriovenous malformations and brain metastases, the number of patients benefiting from radiosurgery increased rapidly to the point that a system dedicated to central nervous system treatments became necessary. The UAB Radiosurgery Program added a Leksell Gamma Knife® (model B) in 1995. The first Gamma Knife was replaced in 2004 with a more advanced system that included automatic positioning (model C). With more than 4,300 patient treatments performed by the end of 2009, the UAB Radiosurgery program is one of the most experienced programs in the nation.

Further progress in linac technology and image guidance made it possible to extend stereotactic radiosurgery to areas beyond the brain. In 1999 UAB placed the Nomos Peacock® system into operation and initiated its stereotactic body radiation therapy (SBRT) program. This device was the first FDA-cleared, intensity-modulated radiation therapy (IMRT) device available. UAB was the first program in Alabama to treat a patient with IMRT and 32nd in the world. In 2001 a system based on a multileaf collimator with sliding window technology replaced the Nomos Peacock system, substantially shortening treatment delivery time. This technology allowed UAB faculty to treat tumors located near critical structures such as the spinal cord, heart, and gastrointestinal tract. Additionally, in 2001 UAB was the first center in Alabama to offer the Real-time Position Management™ (RPM) system, a noninvasive, video-based system that allows for clean imaging and treatment of lung, breast, and upper abdominal sites. RPM works by measuring the patient's breathing patterns (their gate) and aligning their respiratory cycle to the tumor's position. Only when alignment is correct is the linear accelerator allowed to emit a beam of radiation.

UAB's installation of the 14th TomoTherapy® unit in the world in 2004 was another first in Alabama. The TomoTherapy unit was the first clinically viable CT-based image guidance platform for radiation therapy. With the ability to image a tumor immediately before the application of the therapy beam, targeting precision was greatly enhanced increasing the physician's ability to treat complicated tumors with radiation.

Building on its longstanding experience with radiosurgery and SBRT, in May 2008 UAB became the first institution in the United States to treat patients with the newly developed volumetric arc therapy (RapidArc). The system provides high-quality CT images with greatly shortened treatment times, reducing the possibility of patient movement between imaging and radiation delivery. UAB physicists were instrumental in the final research stages of development and testing of RapidArc before its FDA approval.

In June 2010, UAB added the TrueBeam STx, the most advanced tool in our radiosurgery armamentarium. The TrueBeam STx was designed from the ground up to provide state-of-the-art radiotherapy techniques and to develop the techniques of the future. Flattening filter-free radiosurgical beams deliver the highest dose rates available on any radiation delivery system, up to four times faster than standard linear accelerators. In combination with RapidArc delivery technology, the TrueBeam STx can complete radiosurgery in minutes rather than hours.

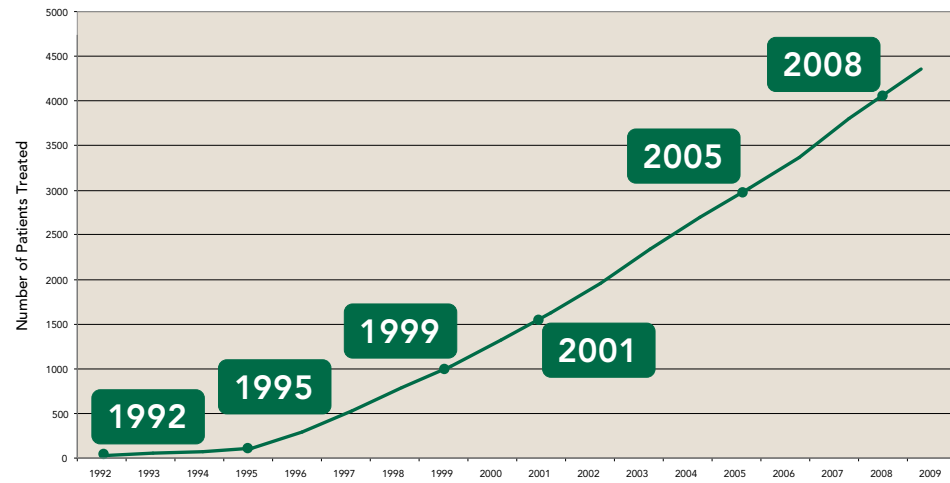
Currently UAB offers a variety of advanced technologies for frame-based or frameless radiosurgery and SBRT for tumors. UAB brings together a multidisciplinary team of radiation oncologists, neurosurgeons, and physicists with decades of experience in radiosurgery to design and evaluate each treatment plan. The radiosurgery team at UAB continues to evaluate, pursue, and develop the most advanced technology available for cancer treatment in the world.

<sup>1</sup>Brezovich, Ivan, Prem Pareek, Eugene Plott, and Richard Jennelle. "Quality Assurance System to Correct for Errors Arising from Couch Rotation in LINAC-Based Stereotactic Radiosurgery." Int. J. Radiation Oncology Biol. Phys Vol. 38 (1997): 883-890.



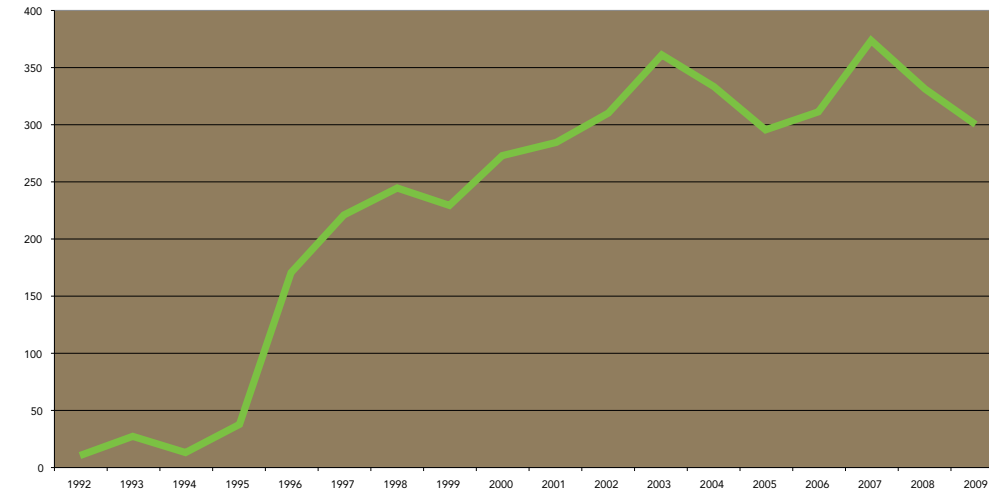
# QUALITY AND OUTCOME MEASURES

## Timeline of Our Success



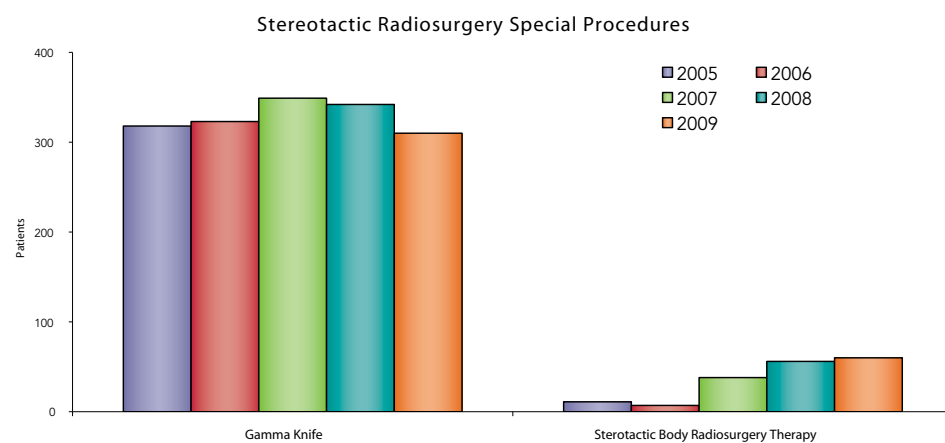
- 1992** First patient treated with stereotactic radiosurgery (linac)
- 1995** First CNS case treated with Gamma Knife
- 1999** First FDA-approved IMRT-delivering device
- 2001** First in Alabama to offer RPM Gating System
- 2005** First in Alabama to treat with stereotactic body radiation therapy
- 2008** First in the U.S. to treat with volumetric arc therapy (RapidArc™)

## Cranial Radiosurgery Procedures



The Leksell Gamma Knife is a highly advanced technology that delivers 201 tightly focused cobalt radiation beams to one point in the brain. The radiation beams and doses are so precise they affect only the targeted tissue and relatively spare the surrounding healthy tissue.

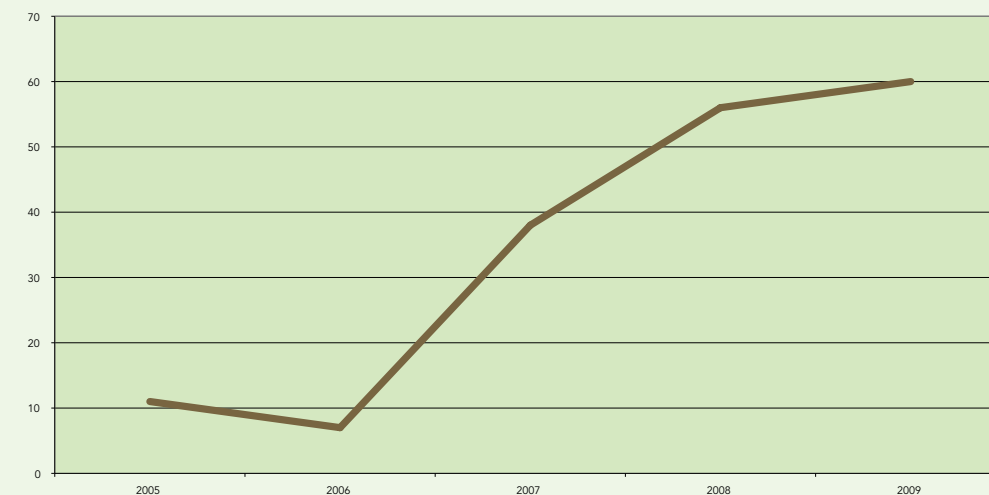
## Selected Disease Sites



The UAB Radiosurgery Program offers state-of-the-art treatment therapies and technologies for a wide variety of body sites including central nervous system (CNS), lung, spine, and others. CNS tumors essentially are treated with the Gamma Knife. Tumors or malformations of the liver, lung, spine, and other body sites are treated using SBRT. The following charts show the outcome measures of selected body sites treated with cranial radiosurgery and SBRT at UAB.

Special Procedures on Selected Disease Sites			
<b>Gamma Knife</b>	<b>1642</b>	<b>Stereotactic Body Radiation Therapy</b>	<b>172</b>
Benign	350	Brain	2
Malignant	861	Lung	57
Trigeminal Neuralgia	301	Liver	8
Vascular	130	Spine	63
		Other	42

## SBRT Procedures



Stereotactic Body Radiation Therapy (SBRT) uses a high dose of radiation shaped to conform to the patient's tumor. It delivers radiation to the intended target and avoids healthy tissue. Small tumors are accurately identified and located with precise coordinates.

# Stereotactic Radiosurgery

## AT UAB

At UAB a team of sub-specialists from multiple disciplines—radiation oncology, surgery, medical oncology, GYN oncology, radiology, and pathology—evaluate multiple parameters related to an individual patient’s cancer and derive a treatment plan based on UAB expertise and current protocols. If radiosurgery is indicated, the patient will be referred to the UAB Radiosurgery Program. Relying on their 18 years of experience treating patients with complicated tumors, the radiation oncologists and surgeons will design a patient-specific plan and implement it with the most advanced technology available.

The UAB Radiosurgery Program is a recognized national leader in providing quality comprehensive care and using state-of-the-art technology. Starting in 1992 with a linear accelerator, the program added the Leksell Gamma Knife in 1995. Soon thereafter the program expanded its treatment procedures by introducing stereotactic body radiation therapy (SBRT). SBRT enabled physicians to treat spinal and lung tumors with high precision. Technological leadership on treatment therapies contributes to the program’s success, but the UAB Radiosurgery Program also offers an extensive, highly qualified group of neurosurgeons and radiation oncologists with many years of experience in this field that sub-specialize in the full range of tumor types.

Cranial radiosurgery at UAB offers patients with certain disorders a safe, effective alternative to conventional neurosurgery. The program offers cranial radiosurgery on the Leksell Gamma Knife at UAB Highlands. The highly advanced technology allows UAB specialists to treat

arteriovenous malformations, benign and malignant brain tumors, select vascular malformations, and other functional brain disorders without an incision and without damage to healthy tissue.

The UAB Radiosurgery Program offers SBRT on the TomoTherapy unit at The Kirklin Clinic at Acton Road and also on the Varian iX linear accelerator with RapidArc at the Hazelrig-Salter Radiation Oncology Center. In addition, in June 2010, TrueBeam Technology became available at the Hazelrig-Salter Radiation Oncology Center. This highly advanced radiation therapy allows physicians to deliver high-energy X-ray beams precisely to tumor targets throughout the body. Physicians can use higher doses of radiation and reduce toxicity, resulting in fewer side effects and shorter treatment times as compared with other treatment modalities. Lungs are the most common SBRT treatment site, but spine, liver, and other sites also can be treated.

UAB offers cranial radiosurgery and SBRT as part of its comprehensive cancer program recognized for its excellent care, innovative research, specialists, and advanced technology.



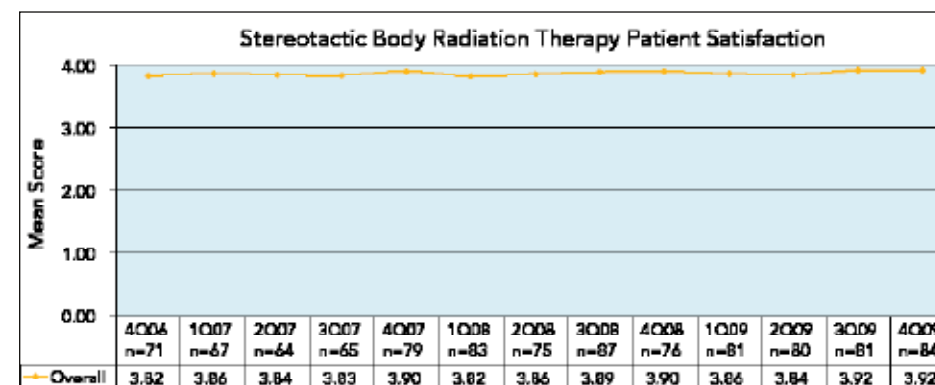
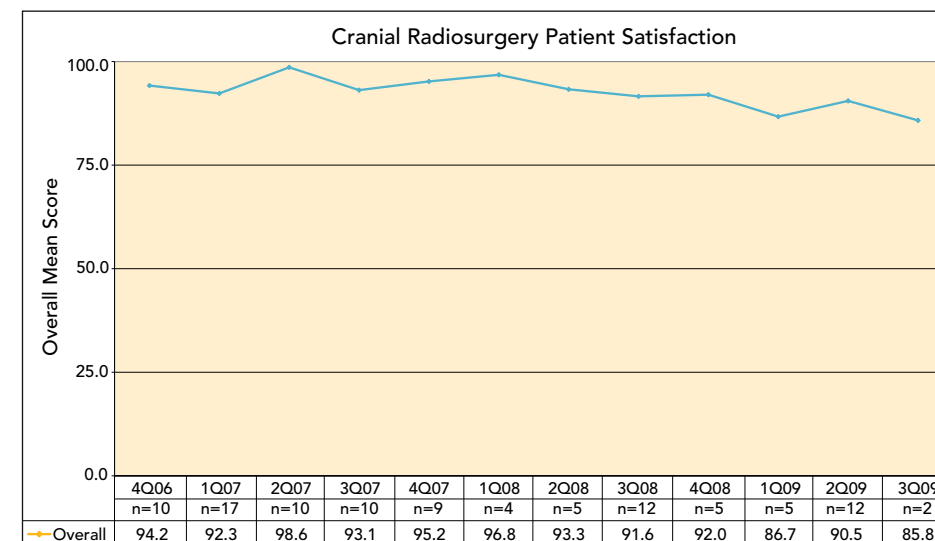
Top left: Leksell Gamma Knife®  
Bottom left: Varian TrueBeam™ STx  
Bottom right: TomoTherapy Hi-Art®



## PATIENT experience



The UAB Radiosurgery Program strives to provide high quality health care with compassion. To track our success and to measure our patient satisfaction we ask our patients about their experience with our clinical services, personnel, and facilities. We attend to every detail, from parking issues to checkout services. Even though we have consistently been highly rated by our patients as an outstanding health care provider, we are dedicated to improving our services.



Note: The patient satisfaction chart for Hazelrig-Salter Radiation Oncology Center includes overall performance for Stereotactic Body Radiation Therapy (SBRT).

## Locations



**UAB Highlands**  
Cranial radiosurgery with the Leksell Gamma Knife®  
1201 11th Avenue South  
Birmingham, AL 35205



**The Kirklin Clinic® at Acton Road**  
SBRT with TomoTherapy® and with the Varian EX® linear accelerator  
2145 Bonner Way  
Birmingham, AL 35243



**Hazelrig-Salter Radiation Oncology Center**  
SBRT with the Varian iX linear accelerator and TrueBeam accelerator  
1700 6th Avenue South  
Birmingham, AL 35233

# NOTEWORTHY publications

## Hitting a moving target: Evolution of a treatment paradigm for atypical meningiomas amid changing diagnostic criteria

Pearson BE, Markert JM, Fisher WS, Guthrie BL, Fiveash JB, Palmer CA, Riley K. *Neurosurgery Focus*. 2008; 24(5):E3. PMID: 18447742 [PubMed - indexed for MEDLINE]

## Predictors of distant brain recurrence for patients with newly diagnosed brain metastases treated with stereotactic radiosurgery alone

Sawrie SM, Guthrie BL, Spencer SA, Nordal RA, Meredith RF, Markert JM, Cloud GA, Fiveash JB. *Int. J Radiat Oncol Biol Phys*. 2008 Jan 1; 70(1):181-6. Epub 2007 Sep 4. PMID: 17768015 [PubMed - indexed for MEDLINE]

## Gamma knife radiosurgery for refractory medial temporal lobe epilepsy: Too little, too late?

Spencer SS. *Neurology*. 2008 May 6;70(19):1654-5. No abstract available. PMID: 18458224 [PubMed - indexed for MEDLINE]

## Treatment of adults with recurrent malignant glioma

Nabors LB, Fiveash J. *Expert Rev Neurother*. 2005 Jul;5(4):509-14. Review. PMID: 16026234 [PubMed - indexed for MEDLINE]

## Brain metastases

Shaffrey ME, Mut M, Asher AL, Burri SH, Chahlavli A, Chang SM, Farace E, Fiveash JB, Lang FF, Lopes MB, Markert JM, Schiff D, Siomin V, Tatter SB, Vogelbaum MA. *Curr Probl Surg*. 2004 Aug;41(8):665-741. Review. No abstract available. PMID: 15354117 [PubMed - indexed for MEDLINE]

## Radionecrosis of the inferior occipital lobes with altitudinal visual field loss after gamma knife radiosurgery

Monheit BE, Fiveash JB, Girkin CA. *J Neuroophthalmol*. 2004 Sep;24(3):195-9. PMID: 15348983 [PubMed - indexed for MEDLINE]

## Initial treatment of melanoma brain metastases using gamma knife radiosurgery: An evaluation of efficacy and toxicity

Radbill AE, Fiveash JF, Falkenberg ET, Guthrie BL, Young PE, Meleth S, Markert JM. *Cancer*. 2004 Aug 15;101(4):825-33. PMID: 15305416 [PubMed - indexed for MEDLINE]

# RESEARCH advancements

UAB is one of America's premier research universities, with a world-renowned academic medical center and 80 interdisciplinary research centers. UAB consistently ranks among the top 20 academic medical centers in funding from the National Institutes of Health. The UAB Radiosurgery Program contributes to this success by exploring new research methods and performing studies and clinical trials in an effort to bring new solutions and hope for our patients and their families. Two prospective clinical trials of radiosurgery have been conducted at UAB. Four others are planned and may be potentially performed. Active or completed studies include:

- A phase 2 trial of temozolomide and radiosurgery in patients with 1 to 4 brain metastases. In this trial systemic chemotherapy was utilized in an attempt to decrease the risk of new brain tumors after radiosurgery alone.
- A phase 2 trial of spinal radiosurgery. In this study the quality assurance procedures for spinal stereotactic radiation were defined. Patients were treated with a single large dose of focused radiation instead of 2 to 6 weeks of treatment.



# UAB Radiosurgical Clinical faculty



**James A. Bonner, M.D.**  
Radiation Oncology  
*Specialties: lung, head and neck*



**John Fiveash, M.D.**  
Radiation Oncology  
*Specialties: CNS, G.U., gynecological, ocular melanoma, pediatrics, sarcoma*



**Richard Popple, Ph.D.**  
Medical Physicist  
*Specialties: physics*



**Ivan Brezovich, Ph.D.**  
Medical Physicist  
*Specialties: physics*



**Barton L. Guthrie, M.D.**  
Neurosurgery  
*Specialties: brain tumors, face pain*



**Prem Pareek, Ph.D.**  
Medical Physicist  
*Specialties: physics*



**O.L. Burnett III, M.D.**  
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**Kristen Riley, M.D.**  
Neurosurgery  
*Specialties: brain tumors, epilepsy, spine*



**Jennifer De Los Santos, M.D.**  
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**Kimberly Keene, M.D.**  
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*Specialties: breast, G.I., head and neck, pediatrics, skin*



**Sui Shen, Ph.D.**  
Medical Physicist  
*Specialties: physics*



**Michael Dobelbower, M.D., Ph.D.**  
Radiation Oncology  
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**Robert Kim, M.D.**  
Radiation Oncology  
*Specialties: G.U., gynecological, ocular melanoma, orbital tumors*



**Sharon Spencer, M.D.**  
Radiation Oncology  
*Specialties: breast, CNS, G.I., gynecological, head and neck, lung, lymphoma, orbital tumors, ocular melanoma, pediatrics, sarcoma, skin*



**Juan Duan, Ph.D.**  
Medical Physicist  
*Specialties: physics*



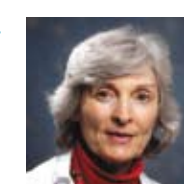
**James A. Markert, M.D.**  
Neurosurgery  
*Specialties: brain tumors, spinal radiosurgery, trigeminal neuralgia*



**Christopher Willey, M.D., Ph.D.**  
Radiation Oncology  
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**Winfield S. Fisher, M.D.**  
Neurosurgery  
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**Ruby Meredith, M.D., Ph.D.**  
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**Xingen Wu, Ph.D.**  
Medical Physicist  
*Specialties: physics*