



# CYBERKNIFE

European Cyberknife Center Munich

ACCURAY



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EXTENSIVE MEDICAL  
EXPERIENCE AT INTERNATIONAL  
AND SCIENTIFIC LEVEL



Prof. Dr. med. Alexander Muacevic



Dr. med. Alfred Haidenberger



Prof. Dr. med. Berndt Wowra

WELCOME!

# PRECISE TECHNOLOGY AT YOUR SIDE

Dear patient,

For many patients and their relatives, a tumour diagnosis gives rise to a state of considerable strain coupled with insecurity and anxiety. But today there are a number of encouraging methods to treat patients with such diagnose.

One of these is the innovative Cyberknife System, a leading-edge technology that provides an alternative or supplement to conventional surgery. Precise radiosurgical treatment can be effectively applied to eliminate a tumour in the brain, spine, eye or other parts of the body (e.g. liver, lungs, kidney or prostate).

The process affords optimal protection for surrounding healthy tissue. Treatment generally takes 30 minutes, must only be done once, is pain-free and is an outpatient procedure. As opposed to conventional surgery, it does not require an anaesthesia and you can continue your everyday routine soon after treatment.

We will be happy to tell you more about Cyberknife treatment personally. We will answer your questions about the course of treatment and give you details of the chances and risks involved. It is our responsibility to provide you, as a patient, with the best possible advice. The Cyberknife Center Munich has the latest generation of Cyberknife technology (Cyberknife M6) including Multileaf Collimator (MLC) and is one of the world's leading centers for radiosurgery.

If you would like to know more about Cyberknife treatment you can either contact us directly or through your treating physician.



Prof. Dr. med. Alexander Muacevic  
Radiosurgeon - Neurosurgeon



Dr. med. Alfred Haidenberger  
Radiooncology Specialist



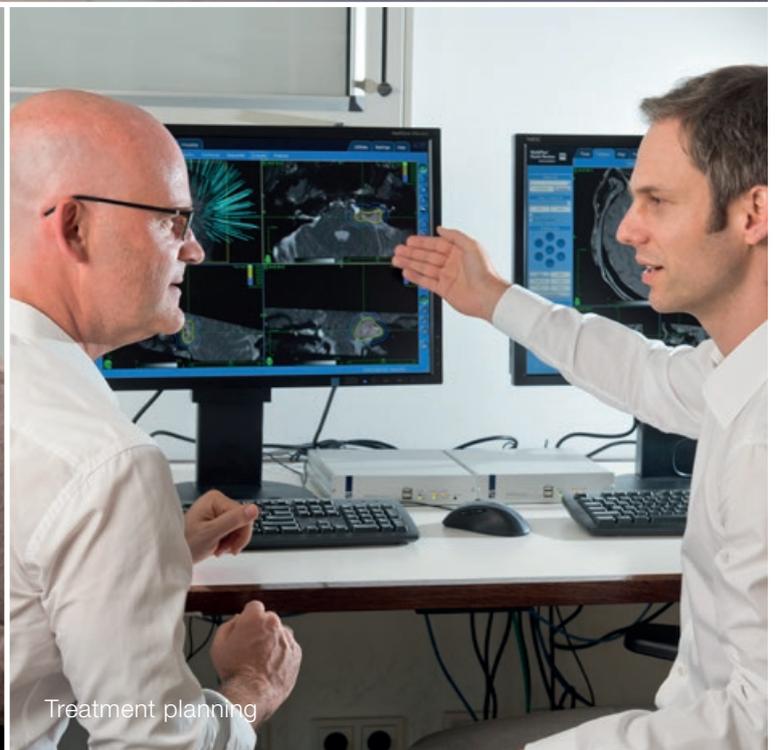
Prof. Dr. med. Berndt Wowra  
Neurosurgeon



Radiation delivery device



Imaging



Treatment planning

# THE TECHNOLOGY – WHAT IS THE CYBERKNIFE?

The Cyberknife is used for radiosurgical treatment of tumours in all parts of the body. Its technology is based on the optimal interaction between a digital imaging system and a robot-guided radiation technique. The exceptional success of the treatment is due to the ideal synchronisation of individual components.

### **Robotic system**

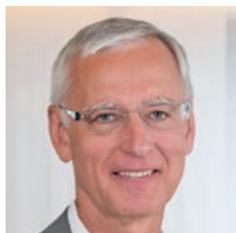
The robot used with Cyberknife is better known for its use in the automotive industry. The high level of technical precision required there is equally as suitable for use in medical applications. The robotic arm allows maximum flexibility and enables 3,000 different radiation beam projections, which facilitates tissue conservation to an extent not achieved by any other form of treatment.

### **Radiation delivery device**

The radiation delivery device comprises a linear accelerator (LINAC) attached to a robotic arm. The high-energy LINAC destroys tumour cells at genetic level. Cells then become unable to divide and the tumour dies. The Cyberknife technology effectively guides the radiation beam in such a way that a lethal radiation level is only attained in the tumour. Surrounding healthy tissue is afforded maximum protection.

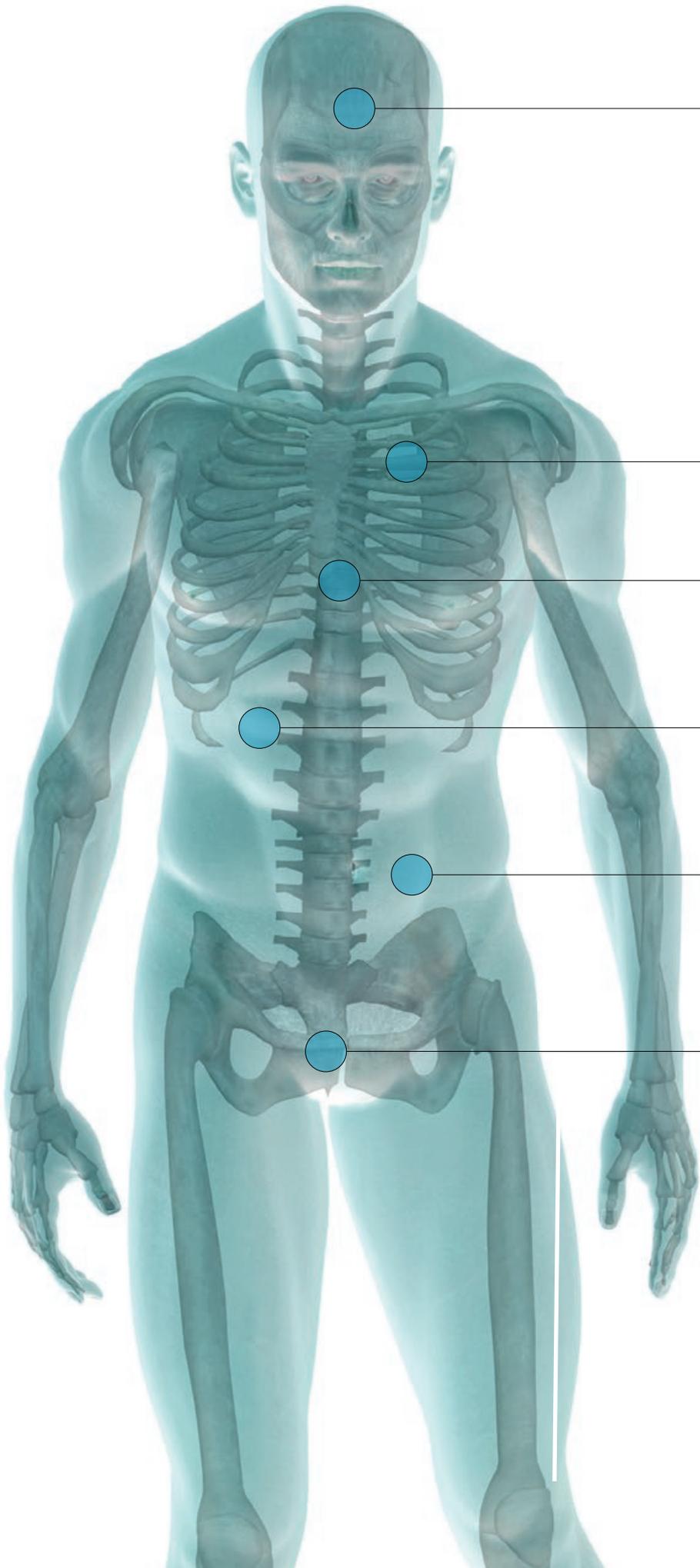
### **Imaging**

The robotic system is linked to a computer-guided localisation system, which supplies high-resolution digital images to ensure accurate targeting. During treatment, digitally reconstructed radiographs (DDR) are taken from the computed tomography planning scans and continuously compared in real-time with the respective images supplied by the imaging system. This even allows the precise treatment of tumours that normally move during normal respiration. This feature is unique to Cyberknife and allows radiation single-session treatment to other parts of the body, instead of over several weeks. A breath-holding technique or anaesthesia with induced respiratory arrest, as required with other systems, is no longer necessary.



*„The system’s high degree of accuracy means the side-effect profile is extremely favourable.“*

Prof. Dr. med. Berndt Wowra



**BRAIN**

Acoustic neuroma  
Meningioma  
AVM  
Brain metastases  
Trigeminal neuralgia  
Uveal melanoma

**LUNG**

Lung cancer (stage I/II)  
Lung metastases

**SPINE**

Spinal metastases  
Spinal neurinoma  
Spinal meningioma

**LIVER**

Primary liver carcinoma  
Liver metastases

**KIDNEY**

Renal cell carcinoma  
Urothelial carcinoma

**PROSTATE**

Prostate cancer

## INDICATIONS

# WHAT CAN BE TREATED?

Which tumours can be treated with the Cyberknife? The indication criteria for radiosurgery are relatively strict – e.g. tumours should:

- not be too big (depending on the organ system) and
- be clearly definable.

If all the criteria are met, the Cyberknife can be used in many different parts of the body. We are continually extending our treatment range in line with scientific developments in the field of medicine.

It is therefore important that we discuss your individual situation with you personally.



*„Specialist medical physicists examine the Cyberknife for technical accuracy and safety every day.“*

Dr. techn. Christoph Fürweger



Planning



Treatment



Treatment



Check-ups

## STAGES OF TREATMENT

# TREATMENT INVOLVES THE FOLLOWING STAGES

### Planning

A team of specialist physicians and medical physicists evaluate the results of examinations and transfer the CT and MRT images to the Cyberknife treatment plan on the computer. After determining the exact nature of the tumour and surrounding structures, this then calculates the radiation dosage and beam direction for treatment. Depending on the size and location of the lesion this can take up to 24 hours.

### Treatment

Treatment begins with your normal breakfast. Any medication can also be taken as normal. You will then meet our medical team and take up a comfortable position to prepare for treatment (with your favourite music in the background, if you wish). You maintain contact with the medical team during the entire treatment process by means of a number of cameras and a microphone. Cyberknife treatment is generally only carried out once, but can be repeated on further treatable tumours during the process. It lasts, on average, 30 minutes, depending on the diagnosis. Treatment can be interrupted at any time, e.g. to drink something, or go to the bathroom. Treatment then continues as before. There is a final meeting at the end of treatment to discuss further medication and the required check-up intervals. You are then free to go about your normal daily activities. You are not required to remain in hospital after treatment.

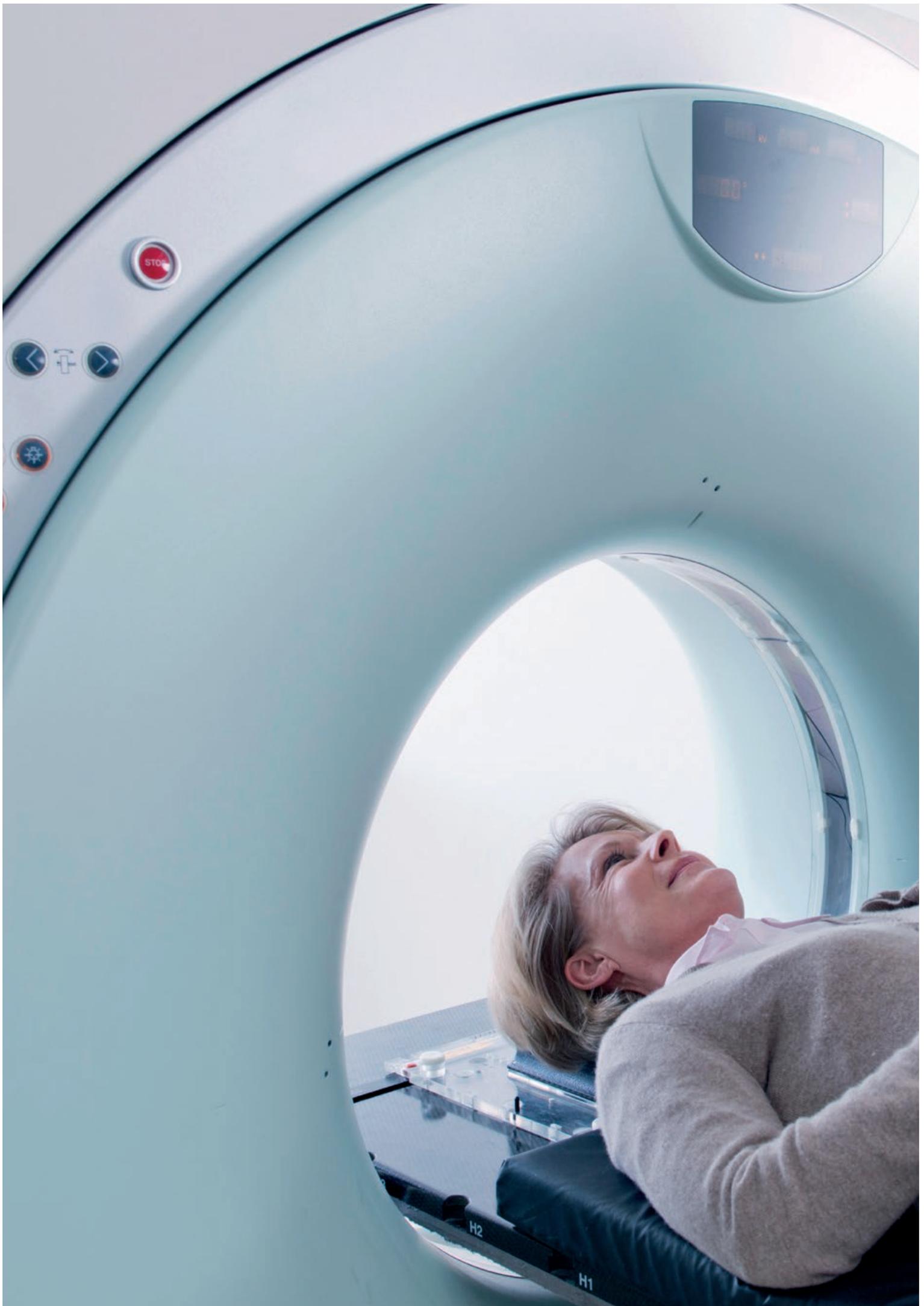
### Check-ups

The healing rate is recorded through regular medical check-ups and imaging. A first check-up is scheduled for 3 months after treatment, depending on the diagnosis. This normally involves a new CT or MRT being made. This can be done in your home country and the results conveyed to us.



*„The centers processes are highly optimized. We offer individual and friendly service. In addition patients needs are always in focus.“*

Nadja Malenoff



## PATIENT QUOTES

*“My brain is my personality! That was why I wanted safe and effective treatment with no post-operative side-effects for my meningioma. On leaving the Cyberknife Center after treatment, I was even able to go on a sight-seeing tour of Munich.”*

Natasha H. McD., Ljubljana (Slovenia)

*„Cyberknife treatment for my prostate cancer changed the quality of my life. At the time, my greatest concerns and fears were that cancer treatment would mean having to deal with serious and onerous complications as a result. But I was able to continue with my normal daily routine immediately after Cyberknife treatment. Today – several years after treatment – my PSA values are below 1ng/ml and I am in good physical shape.“*

Ronald H., Kressbronn (Germany)

*„I experienced no adverse effects from outpatient treatment for a brain angioma and travelled home by tube immediately afterwards. I had no side effects whatsoever and found it amazing that I notice no symptoms at all, neither at the time, nor up to the present day – more than eight years after treatment. No one needs to be anxious about Cyberknife treatment.“*

Ute H., Munich (Germany)



## PATIENT QUOTES

*„Cyberknife treatment for an acoustic neuroma allowed me to continue with my mountain biking hobby shortly afterwards. Treatment was entirely pain-free and I was able to travel home to Austria immediately afterwards. I'm really glad to have been able to avoid major brain surgery and a long physical recovery period. That was several years ago, and I'm still going strong.“*

Johannes W., Götzis (Austria)

*„All the other doctors I saw refused to treat my large brain angioma. Doctors at the Cyberknife Center were able to strengthen my resolve. My symptoms, such as lack of concentration, headaches and leg spasms, improved within the first three months of treatment. I'm really glad I had Cyberknife treatment.“*

Iden J., Munich (Germany)

## TEAM

Professor Muacevic and Professor Wowra established Germany's first Cyberknife Center in cooperation with University Clinic Munich in 2005. Our physicians, often in cooperation with specialist colleges in the clinic's respective medical departments, embody the best there is in personalised patient care.

### Prof. Dr. med. Alexander Muacevic

Radiosurgeon – neurosurgeon

#### **Education and professional background**

1989 – 1995	Studied medicine at Johannes Gutenberg University Mainz, Germany
1990	Grant from Boehringer Ingelheim KG pharmacology dept. in Ridgefield, Connecticut, USA (Dr. Wegner)
1991 – 1995	Stay in Los Angeles (USC), Charlottesville Virginia and London (Institute of Neurology and Neurosurgery)
1995	Doctoral studies under Prof. Dr. A. Perneczky, Mainz
1996 – 2003	Houseman, junior doctor and then specialist registrar for neurosurgery, Clinic for Neurosurgery, Grosshadern Clinic, Ludwig-Maximilian University Munich
2005	Completed further radiosurgery training
2006	Habilitation at the Ludwig-Maximilian University, Munich
Since 2011	President of The Radiosurgery Society
2013	Appointed professor at the Ludwig-Maximilian University, Munich

#### **Awards**

2003	Aesculap prize of the European Association of Neurosurgical Societies
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#### **Professional societies**

Since 2007	Supervisory Board Member of The Radiosurgery Society (RSS)
2011 – 2013	President of The Radiosurgery Society
2014 – 2015	Chairman of Board of Directors, The Radiosurgery Society

#### **Official memberships**

ASTRO (American Society of Radiation Oncology), ISRS (International Stereotactic Radiosurgery Society), EANS (European Association for Neurosurgery), DEGRO (German Society for Radiation Oncology), Stereotaxis committee

#### **Scientific engagement**

More than 100 publications, numerous lectures at national and international scientific congresses and conferences, Founder of cureus.com, innovative scientific publication platform 2012 together with Dr. John R. Adler, Stanford School of Medicine, USA

## Dr. med. Alfred Haidenberger

Radiooncology Specialist

### Hospital appointments and other professional positions

1991 – 1999	Studied medicine at the Leopold-Franzens University, Innsbruck, Austria, Graduation as “Doktor der gesamten Heilkunde“ (MD)
1999 – 2005	Resident at the Dept. of Radiooncology, University Hospital, Innsbruck, Austria
2005	Board Exams and Certification, Austria (European Union)
2005 – 2007	Specialist in Radiooncology, Medical University Innsbruck
2007 – 2008	Specialist in Radiooncology, Hospital Wiener Neustadt, Austria
2008 – 2010	Specialist in Radiooncology, Hospital Vöcklabruck, Austria
2010 – 2013	Chief Physician and Head of Department Proton Therapy Certification Germany, Rinecker Proton Therapy Center Munich, Germany
2014 – 2015	Specialist on Radiooncology, Department Prof. Wilkowski, Agatharied, Germany

### Committee appointments

2001 – 2010	Member of the Board of Directors, “Österreichische Gesellschaft für Radioonkologie, Radiobiologie und Medizinische Radiophysik“ (ÖGRO)
2007 – 2010	Member of the Board of Directors, “Tiroler Arbeitskreis Experimentelle Onkologie“ (TEXO)
2010 – 2014	President and Member of the Board of Directors, “Zukunftsorientierte Radioonkologie“ (ZORO)

### Awards and honors

2002 and 2003	ÖGRO Prize
2004 and 2006	Research support grant from the “Österreichische Krebshilfe Tirol“
2009	Research support grant from “Roche“ (Neurooncology)
2010	Research support grant from “Roche“ (NSCLC)

## Prof. Dr. med. Berndt Wowra

Neurosurgeon

### Education and professional background

1974 – 1981	Studied medicine at Eberhard Karl University Tübingen, Germany
1981	Doctoral studies under Prof. K. Hayduk, Tübingen
1986 – 1992	Clinical cooperation partner in DFG-project Neuronal plasticity with brain tumours
1989 – 1992	Medical project manager Carrier-mediated chemotherapy and neurosurgical project manager Stereotactic convergence radiation at the tumour Center Heidelberg/Mannheim in Germany
1990	Consultant neurosurgeon
1992	Bestowal of pro venia legendi for neurosurgery, appointed associate professor
1993 – 2005	Medical director of the Gamma Knife Center in Munich
Since 1994	Panel doctor for neurosurgery (KV Munich)

### Awards

1990	Claudius-Galenus Award
1992	Awarded the Farmitalia-Carlo-Erba Prize by the Internistic Oncology Society of the German Cancer Society (AIO)
1992	Vincenz-Czerny Prize of the German Society for Haematology and Medical Oncology (DHO)



## OUR COOPERATION PARTNERS

# TOGETHER, FOR THE PATIENT

The European Cyberknife Center Munich enjoys the support of numerous national and international sponsors and cooperation partners in the field of medicine. This benefits our patients. We maintain close international contacts with numerous clinics and scientists involved in Cyberknife technology. Regular conferences with the manufacturer's (Accuray) team of developers ensure the continuous optimisation of both the system and treatment.

Prof. Dr. Alexander Muacevic is a supervisory board member and former president of the Radiosurgery Society (therss.org), a medical association with responsibility for improving international treatment standards. Our physicians regularly speak at national and international symposiums and congresses.

The close collaboration with University Clinic Munich, with which we have concluded a formal clinical/scientific cooperation agreement, is of particular importance. The Cyberknife Center maintains close contacts with the departments of neurology, radiology, internal medicine, oncology, urology, thorax surgery and ophthalmology.

The center has also entered into a scientific cooperation with the Institute for Robotics and Cognitive Systems at Lübeck University, where central components of the Cyberknife system (software control) were developed. Medical/scientific issues are dealt with in cooperation with the major German university clinics that apply Cyberknife technology (e.g. Charité, Berlin).

All therapeutic measures are scientifically monitored and data is evaluated to ensure their continued technological and medical development. The Cyberknife Center Munich is one of the most up-to-date and experienced centers for radiosurgery in the world.



*„Our patients benefit from the intensive level of scientific exchange.“*

Prof. Dr. med. Alexander Muacevic



## CYBERKNIFE FAQs

### **What exactly is radiosurgery?**

Radiosurgery is the extremely accurate, high-dose radiation of a precisely defined target volume and is usually performed in just one treatment session. Radiosurgical treatment destroys tumour cells.

### **How exactly is the tumour destroyed?**

The radiation delivery device moves to between 150 – 250 different positions (from possible 3,000) around the patient. The radiation beams cross at the area to be treated (tumour) to produce the high radiation dose required to destroy the tumour. The high radiation concentration effectively destroys the DNA of the diseased cells without affecting surrounding healthy tissue.

### **What are the advantages of this treatment for the patient?**

- non-invasive
- pain-free
- no head-frame
- no anaesthesia
- outpatient procedure
- no rehabilitation

### **Is treatment always non-invasive?**

A local anaesthesia may be needed to position gold fiducial markers in tumours located in moving organs or that move during breathing. These gold markers serve to identify the exact location of the tumour during treatment.

### **Will my health insurance pay for the cost of treatment?**

Most health insurances have undertaken to cover the costs of Cyberknife treatment. These include, e.g. AOK Bavaria, Barmer GEK, LKK, Deutsche BKK, KKH and most Bavarian BKKs. Private health insurers have also undertaken to reimburse costs. International patients need to inquire for a cost estimate.

### **Are there any side effects?**

Most patients only experience minor or short term effects. Details of possible side effects will be discussed with you personally prior to beginning treatment.

### **How safe is Cyberknife treatment?**

A precision robot places a high radiation dose into the tumour from different angles and with pinpoint accuracy. An imaging system monitors all target movements, which are then compensated by the robot. If the tumour is mobile during breathing, a 3D camera is used to dynamically track external respiration and the robot adjusts to 'breathe' in time with movement. The Cyberknife accurately targets the tumour – healthy surrounding tissue is spared from damage.

### **What are the advantages of the Cyberknife technique?**

The M6-generation Cyberknife combines the highest level of accuracy and flexibility. The beam is shaped by means of different beam limiting devices (round, variable iris and multileaf collimators). We select the appropriate system for the size, location and position of the tumour. This allows us to achieve even better quality with shorter treatment times – to the advantage of the patient.

# CONTACT

**European Cyberknife Center Munich**

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Germany

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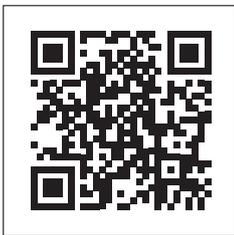
[info@cyber-knife.net](mailto:info@cyber-knife.net)

**Opening times**

The secretary's office can be contacted

Monday to Friday 7.30 a.m. – 8 p.m.

Saturday, Sunday 9 a.m. – 6 p.m.



[www.cyber-knife.net](http://www.cyber-knife.net)

CYBERKNIFE

European Cyberknife Center Munich

MEDICAL EXPERIENCE BASED  
ON 6.000 COURSES OF  
TREATMENT SINCE 2005