

CyberKnife®

Precision Radiosurgery Using Image-Guided Robotics



A Practical Guide for Patients and their Doctors

Painless Treatment for Tumours and Neurosurgical Operations

Treats complex lesions which are otherwise inoperable

There are many CyberKnife centres in the USA but medical costs are very high compared to the rest of the world. There are also many centres across Asia but few have websites giving information in English and even fewer invite contacts by international patients. Europe now has some of the most modern CyberKnife centres in the world and MHL promotes English-speaking CyberKnife centres in Switzerland, Germany and Greece.

As yet though many countries still lack a CyberKnife Centre and for international patients it is hard to establish which centres they should apply to and how to go about it. The different CyberKnife centres are also developing their own treatment protocols and the range of supporting hardware and software is always expanding. As with any service, the best centre for you may not be the nearest one.

Over the past few years MHL has handled a large number of patient enquiries and offers practical guidance on the criteria which centres are likely to adopt when selecting patients. Our dedicated web site www.cyberknifeservice.com guides patients and doctors through the application process and includes an [on-line application form](#).

What patients say about CyberKnife treatment

Valorie, spinal AVM "The CyberKnife provided me the only possibility of leading a normal life without paralysis."

Donald, acoustic neuroma "I looked for an alternative when I was told a 7-hour surgical procedure would result in the loss of balance nerve, and possible damage to the facial nerve. After a 90-minute CyberKnife treatment, my wife and I went out for a glass of wine. It's been 4 years since my treatment and I believe the CyberKnife procedure gave me a second chance at life."

Tomye, recurrent part-optic meningioma "The CyberKnife saved my life without invasive surgery."

Anne, spinal tumour "I credit the CyberKnife technology with helping me stay one step ahead of cancer."

MHL and CyberKnife

Medilux Healthcare Ltd is an independent company with no contractual or financial relationship with Accuray Inc, the manufacturers of CyberKnife. We aim to give an unbiased view of the benefits and limitations of this form of treatment and as treatment protocols are developing all the time, readers should visit www accuray.com for the latest technical information and references.

CyberKnife Radiosurgery - Giving Patients New Hope

What is CyberKnife Radiosurgery?

CyberKnife radiosurgery is a precise, painless, non-invasive radiation treatment that can be an alternative to open surgery in certain cases.

Multiple beams of high-energy radiation are delivered from multiple points and converge precisely at the tumour or lesion inside the body. Each individual beam is insufficient to cause harm, but the convergence of all the beams at the tumour results in the lesion receiving a very high dose of radiation whilst sparing nearby normal tissue.



CyberKnife radiosurgery is so precise that radiation beams can be sculpted to small, complex-shaped tumours near critical structures, such as hearing and vision nerves. This ability to accurately irradiate only the tumour and protect healthy tissue allows the CyberKnife to treat many lesions which may be considered inoperable or untreatable without this radiosurgery system.

How does CyberKnife work?

CyberKnife is a revolutionary new way of performing stereotactic radiosurgery and combines two advanced technologies:

1. The first innovation is a lightweight radiation delivery system mounted on a **multi-jointed robotic arm**. The robotic arm provides unparalleled access to tumours anywhere in the body, reaching areas of the body that are untreatable with other radiosurgery systems and allowing more flexible delivery of radiation for optimum treatment.
2. The second innovation is an **image guidance system**. This advance allows the CyberKnife System to locate the tumour throughout the treatment and correct for small patient movements, which allows radiation to be delivered without the use of stereotactic frame.

What makes CyberKnife so unique?

100% Frameless:

The ability of the CyberKnife to correct for patient movement during treatment spares you from the pain and inconvenience associated with a conventional head frame that must be fixed to the skull with screws. Published studies have shown that the frameless CyberKnife radiosurgery is as accurate – if not more so – than traditional frame-based radiosurgery.

Full Body Capability & Staged Treatment:

The unique design of the CyberKnife system allows it to deliver precise high dose radiation not just to lesions in the brain but to lesions in the spine and other organs throughout the body. In addition, because no frame is required, the CyberKnife system can perform “hypo-fractionated” or staged radiosurgery – where the total radiation dose is divided into smaller doses. This is especially beneficial for treating lesions near sensitive structures and larger tumours, because it better protects surrounding healthy tissue.

Painless Surgery:

The CyberKnife system allows you to be treated without open surgery, so greatly reducing the risk of complications or infections and avoiding the lengthy recovery time which that necessitates. Some centres even treat on an outpatient basis so you do not even stay in a hospital, but in a convenient hotel nearby.

Better Quality of Life During & After Treatment:

The CyberKnife procedure allows you to resume normal activities immediately after treatment.

Is CyberKnife clinically proven?

The CyberKnife System is based on radiation technology that has been proven for 30 years. Thousands of patients have received CyberKnife treatments worldwide, and many clinical studies with the CyberKnife have been published in medical journals.

CyberKnife is cleared with the US regulatory body FDA to treat tumours and lesions anywhere in the body when radiation treatment is indicated. The principal treatments offered by CyberKnife are listed below.

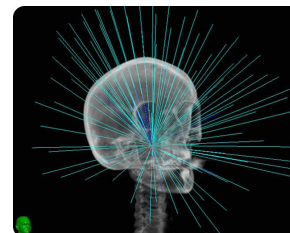
CyberKnife Treatments

Which types of tumours can be treated?

Brain

Acoustic neuroma
Meningeoma
Other Neuromas
Metastases
Gliomas (selected cases)

AVM (arterio-venous malformations)
Trigeminal neuralgia
Haemangioblastomas
Jugular foramen tumours



Eye

Uveal melanoma

Spine

Metastases
Neuromas
Meningeomas

Haemangioblastomas
Tumour pain
MPNST (malignant peripheral nerve sheath tumours)

Spine lesions are treated with the additional Xsight software package, which enables a treatment without the need to place invasive fiducials for spinal tracking.

Body

Lung metastases
Lung cancer (Stage I)
Renal cell cancer (Stage I)

Liver tumours
Pancreas
Prostate

CyberKnife works best on small, discrete, defined tumours. Where the cancer is advanced and diffuse CyberKnife may not be suitable or may only be considered as part of the overall treatment.

Preparatory procedures are required, typically one week before CyberKnife can be used, when markers are implanted which must be allowed to settle.



Which factors would make my case more or less suitable?

We can only give very broad guidelines here and each CyberKnife centre may adopt slightly different criteria in assessment but the following points are likely to be key.

Number of tumours

A treatment protocol has to be set up for each tumour and each tumour requires a large number of separate radiation pulses with tracking in between, so most centres will restrict treatment to a single or perhaps a small number of tumours.

Size of tumour

CyberKnife uses very fine beams of high power radiation, which enable it to adapt to the shape of the tumour and the treated matter is then gradually reabsorbed by the body. As the tumour becomes larger however so the total radiation dose and the time required for treatment increases, as does the quantity of necrotic tissue left for the body to absorb, so CyberKnife Centres are reluctant to treat tumours above a certain size.

Type of tumour

Some tumour types are more amenable to treatment than others and you should not assume that because you do not see your type on the list that it cannot be treated, but we have listed the main treatable conditions. We give further guidance on the Cancer Therapy page of our website www.cyberknifeservice.com and for more technical information you can visit the manufacturer's web site www.cyberknife.com where you will find the most up to date summary of current treatments.

Characteristics of tumour

Because CyberKnife delivers high dosages of radiation to narrowly defined targets it is best suited to situations where the tumour is well delineated from the surrounding healthy tissue.

Location of tumour

This is the great strength of CyberKnife. Dangerous locations and complex shapes, which would bar open surgery may still be open to CyberKnife, so this should not deter your enquiry.

What if I have already had the maximum radiotherapy?

Because CyberKnife is so accurately focussed on the tumour and delivered from such a wide array of angles it can sometimes be used even when you have already had the maximum conventional radiotherapy treatment.

What if my tumour is too large for CyberKnife but the location is too dangerous for surgery?

Obviously any case such as this must be reviewed on its merits but in some cases it may be possible to reduce the tumour mass first by surgery or chemotherapy and then treat the remaining tumour with CyberKnife.

Who will be involved in my treatment?

CyberKnife treatment utilises a team approach, where medical experts collaborate with you as their central focus. Team members may include your surgeon, radiation oncologist, medical oncologist, physicist, and other team members within the hospital.

A Typical Treatment

The following example is for a single treatment session. Some conditions require fractionated treatment over a few days, and different centres may adopt a different approach as to number of treatments required, but the basic principles are the same.

Step 1: Treatment Setup

Making a Mask

A custom soft mask (for head/neck treatments) is formed and used to help minimize movements during the treatment and ensure your comfort. The process is simple and painless.

Fiducial Placement

CyberKnife treatments for body (non-head) lesions may require a short outpatient procedure to implant several small metal markers (fiducials) near the tumour, in order to track its position throughout the treatment. The CyberKnife centres that we represent use the more modern additional software however, which enables them to treat spinal tumours without implanting fiducials.

Imaging

A T-scan is performed. Your surgeon and radiation oncologist use the scan to identify the exact size, shape and location of the tumour along with the surrounding vital structures to be avoided.

Step 2: Treatment Planning

The CT data is downloaded to the CyberKnife treatment-planning computer where physicians will use advanced software to customise the number, intensity and direction of radiation beams for the robot to send to the target. You do not need to be present during this step.

Step 3: Treatment Delivery

Arriving

Wear comfortable clothing and no jewellery. Try to relax, knowing that this will be a painless procedure.

Positioning

You will be asked to lie on the treatment table and be fitted with the custom mask or body mould made earlier during the set-up process. Generally, no sedation or anaesthesia is required because the treatment is painless.

Painless Treatment

During treatment, you will need to lie still. You will be awake throughout the entire procedure, which typically lasts 30-90 minutes depending on the complexity of your tumour. The image guidance system periodically takes x-ray images and compares them to data from the CT scan to ensure that the radiation is targeted accurately to the tumour.

Completion

If you are undergoing single-session radiosurgery treatment, your treatment is complete and you can usually leave the hospital and resume normal activity immediately. If your physician prescribes a "hypo-fractionated" or staged treatment, this will usually be spread over a few consecutive days.



Follow-up

As with any radiosurgery or radiation therapy, follow-up imaging and consultation is required to monitor progress, ideally on a six-monthly basis. This may require a return to the CyberKnife centre but it is usually sufficient to send MRI control scans and neurological follow up results on a CD or to discuss these with you local Consultant.

How do I obtain treatment?

Each CyberKnife centre has its own approach to reviewing cases and to treating patients and this can make it a confusing process for both patients and doctors. From our own experience, some centres do not seem to welcome international enquiries and simply ignore requests for information whilst others respond well. Media publicity tends to result in waves of applications with quieter spells in between, so you are part of such a surge of enquiries your submission must be clear and adequately supported for a CyberKnife centre in another country to take it up.



If patients then send the same incomplete information to several centres this merely causes annoyance to the centres, resulting in long delays and poor responses. This acts to nobody's advantage, so we provide patients and doctors with practical guidance as to the information that all centres are likely to require. We can also suggest which centres are most likely to welcome international enquiries and we encourage patients to tell us of their experience with different Centres.

We do not advise patients as to which Centre to use but we do represent certain Centres and can give more detailed guidance as to the conditions for which they are currently accepting enquiries, their application procedures, their current availability and prices.

Starting a new enquiry

You will need to visit our web site www.cyberknifeservice.com. This is our dedicated web site for CyberKnife patients worldwide and will answer most of your questions. If you have read this and feel that your case could be suitable for CyberKnife then please complete the Online Enquiry Form which you will find there. You will be asked for details of recent scans which are available but do not send them until they have been requested.

If you have supplied sufficient information for us to submit your enquiry to your selected Centre we will do this and advise you of their response, usually within a few days. If we cannot submit your enquiry for any reason or more information is needed we will tell you by e-mail. If scans are called for we will tell you how to upload them directly by internet or post them on a CD.

If your case is accepted for treatment we will hand over direct contact between the Centre and you or your doctor. We do not charge patients for CyberKnife treatment enquiries made through us.

NOTE: Medilux Healthcare Ltd can advise patients, doctors or health insurers in general terms whether CyberKnife is likely to be of assistance for a stated condition and give an indication of cost, but we do not examine or diagnose patients, nor can we commit any CyberKnife Centres to any diagnosis, outcome or costing or enter into any formal or informal agreement on their behalf. We will not enter into contractual arrangements with any party regarding their or their patient's treatment at any Centre, nor will we be in any way liable for the success, failure or other outcome of such treatment.

Where can I obtain further information?

You will find more details on the conditions which CyberKnife can treat and the actual treatment procedures on our web site www.cyberknifeservice.com. You will also find links to additional resources, including the manufacturer's web sites for technical resources and patient support where the latest treatment protocols are outlined and to the CyberKnife Society.

Contact details

Please note that we operate by internet and e-mail. Our personnel travel extensively for training and research purposes and we have to be able to forward information quickly and effectively to different CyberKnife Centres so we cannot handle postal or telephone enquiries.

E-mail: enquiries@cyberknifeservice.com

Internet: www.cyberknifeservice.com

For details of other non-invasive technologies visit www.mhlmedical.com or www.mhlhealth.com

Managing Director: Phillip Stacey

Chairman and Technical Director: Steven Warren

Registered business address: Medilux Healthcare Ltd., 20 Marnock House, Kingswood Road, Tunbridge Wells, Kent, TN2 4XP, United Kingdom

The European CyberKnife Centre Munich, Germany



The European CyberKnife Centre (ECZM) is a private, independent treatment centre adjacent to and co-operating with the University Hospital. Whilst the Centre offers the full range of CyberKnife treatments for local patients, it specialises in tumours of the brain, spine and lung and in neurosurgical disorders.



ECZM is an outpatient-only facility and is pleased to arrange suitable hotel accommodation and transfers on request. In this Centre most treatments are given in a single 'fraction', that is there is just one treatment session, following which the patient can return home or go about his or her business.

Since ECZM currently operates the only CyberKnife in Germany and the attending Neurosurgeons are highly regarded in their field, it is one of the busiest CyberKnife Centres in the world. It opened in July 2005 and within its first year of operation was named the leading CyberKnife Centre in the world for brain and spinal tumours.

Body tumours requiring placement of fiducials require more time and coordination than brain and spinal tumours and some also require coordination with outside specialists, so as this centre has become busier they have been forced to restrict such treatments to local patients where this coordination is more easily arranged, in order to enable the surgeons to treat more patients.

We have worked with ECZM since early in 2006 however and because of our close relations we are still able to secure access to this prestigious centre for patients with the following conditions:

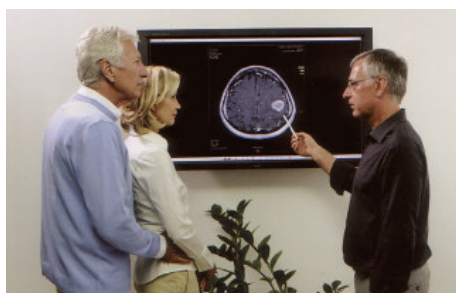
Brain: Acoustic neuroma, Meningeoma, Other Neuromas, Metastases, AVM (arterio-venous malformations), Trigeminal neuralgia, Haemangioblastomas, Jugular foramen tumours

Eye: Uveal melanoma

Spine: Metastases, Neuromas, Meningeomas, Haemangioblastomas, Tumour pain, MPNST (malignant peripheral nerve sheath tumours)

Lung: peripheral lung tumours

At certain times and for particular conditions we can refer further cases to Munich, which we will notify to patients as the situation arises.



ECZM offers fixed priced packages so we are usually able to advise likely costs with some certainty. Exact prices will be confirmed by the Centre and must be settled before treatment. In certain cases an additional scan will be required with the advanced scanner at the adjacent University Hospital in order to assist with programming the CyberKnife and we recommend patients to allow up to an additional €1,000 in case this is required.

ECZM is an outpatient-only facility so there are normally no hospitalisation charges to pay and of course no anaesthesia is required as this is a painless, non-invasive procedure.

The surgeons and staff at ECZM speak good English and a wide range of European languages besides German. You can communicate freely with them during treatment and can even bring your favourite CD to help you relax during treatment.

You can find further details on the European CyberKnife Centre, including photographs of the Centre, the neurosurgeons and the equipment on our web site www.cyberknifeservice.com.

You will also find downloadable travel guides for patients in the UK and Ireland, North or South/Central America, Australasia and Southern Africa.

International visitors

Germany is part of the European Union and no visa is required for EU citizens. The national currency is the Euro. Citizens of the EU, Switzerland, Norway or Iceland may be eligible for state funding under the E112 referral scheme. This must be arranged at home through their own doctor before treatment is given.



Iatropolis Tomography Centre

Athens, Greece



Iatropolis is a multi-function scanning and surgery centre which has recently established one of the latest generation CyberKnife installations, together with supporting software to enable it to perform the full range of CyberKnife radiosurgical interventions.

More than 750 patients have been treated with CyberKnife here to date and the Centre is equipped with the most modern scanners. These include a Siemens Trio 3 Tesla MRI scanner, the only one in Greece, a Siemens Definition 128-slice CT scanner with a full range of diagnostic units.

Iatropolis is located in the Northern outskirts of Athens and patients are accommodated within the Centre. The English speaking personnel are accustomed to international patients and transfers from and to the airport are included.

You can find further details and travel guides for patients in the UK, Ireland, North and South/Central America, Australasia or Southern Africa on our dedicated web site www.cyberknifeservice.com.



Applying for treatment at Iatropolis



Patients or doctors should visit our website www.cyberknifeservice.com. If you think your condition might be suitable then please complete the online enquiry form. If the case looks suitable in principle, scans will then be called for.

These can be uploaded directly to Iatropolis and details of how to do this will be provided as soon as the Centre advises that they are needed. Alternatively they may be posted to Iatropolis on a CD.

Cases are reviewed twice-weekly by the scientific team (neurosurgeon, radiotherapist-oncologist and radiophysicist) and if any further information is required we will inform you. If your case still looks promising after scans have been reviewed we will put you in contact with the appropriate doctor at Iatropolis, who will take the matter forward from there.

Please note that CyberKnife radiosurgery is a very precise form of treatment and is tailored to the exact size and shape of the target. This requires recent, high quality scans in order to build the correct treatment programme.

Case review at Iatropolis

Some cases can be assessed sufficiently by documentation and scans submitted as above and the patient can then visit Athens for treatment. Others require a more detailed review and personal examination, which will necessitate the patient making a visit to Athens and having a further scan on site if required.

There is a charge for this service, but if CyberKnife intervention is indicated and the patient returns promptly for treatment, before another scan is required, it will be credited against the total cost.



Placement of fiducials

Some treatments (but not brain or spine) require placement of small metal fiducials as markers to guide the CyberKnife and these must then be allowed to settle for about a week before treatment can be given. This is a normal part of the CyberKnife treatment process and you should remain in Greece for this period. A 'compulsory holiday' in Greece is preferable to conventional hospital surgery however!

International visitors

Greece is part of the European Union and no visa is required for EU citizens. The national currency is the Euro.

Although citizens of the EU, Switzerland, Norway or Iceland may in principle be eligible for state funding under the E112 referral scheme, Iatropolis has advised us that they do not accept patients under this scheme due to the lengthy bureaucratic procedures involved.

Radiotherapie Hirslanden

Zurich, Switzerland



The Hirslanden Group is Switzerland's largest private hospital group with 13 clinics around the country. CyberKnife treatments are carried out by Radiotherapie Hirslanden AG in conjunction with Oncology, Urology and other departments at the Klinik Hirslanden, the Group's flagship hospital in Zurich.



Klinik Hirslanden is a major, full service hospital with scanning, individual intensive care units and a wide range of medical specialities on site.

These include **Trilogy®** advanced radiotherapy, **da Vinci®** robotic surgery and the latest technology in other areas such as cardiac care.

Treatments

Hirslanden provides CyberKnife treatments for the brain, spine, prostate, pancreas, liver and lung. They collaborate closely with the CyberKnife centre in Nice (France), established by the French National Cancer Institute, and the two centres are working together to extend treatments to further areas of the body.

The decision on whether to treat is made after a complete evaluation of the patient. This includes consideration of the type of disease, size and number of tumours, localization and the age and general condition of the patient. If Radiotherapie Hirslanden consider that an alternative form of treatment or a combination of treatments would be more suitable for your case they will advise you accordingly.



If conventional radiotherapy is indicated this is usually available within three days of application so you are assured of prompt treatment once your case is accepted.

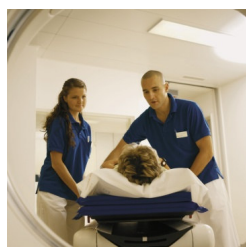
Applying for treatment at Hirslanden

Patients or doctors should visit our website www.cyberknifeservice.com. To have your condition reviewed then please complete the online enquiry form. If the case looks suitable in principle, scans will then be called for.

When you submit your enquiry you will be able to download an information sheet giving details of how to upload scans directly to Hirslanden. They will send you the appropriate password for their system if appropriate, or alternatively you may post your scans on a CD and they will give you the necessary details at the time.

Cases will be reviewed by their CyberKnife team and once your application has been submitted all correspondence will be between you (or your doctor) and Radiotherapie Hirslanden.

Case review at Hirslanden



Where individual cases require personal, on-site assessment Hirslanden offers a fixed price review package. This includes airport transfers, accommodation for one night at a local hotel, a CT scan, an examination and a consultation.

If you proceed promptly to CyberKnife treatment, i.e. before a new scan becomes necessary, approximately half of this fee will be credited against your treatment cost.

Where CyberKnife radiosurgery is not indicated Hirslanden may still be able to offer other treatment.

Placement of fiducials

Some treatments (but not brain or spine) require placement of small metal fiducials as markers to guide the CyberKnife and these must then be allowed to settle for about a week before treatment can be given. This is a normal part of the CyberKnife treatment process and you should remain in Switzerland for this period. A 'compulsory holiday' in Switzerland is preferable to open surgery in a hospital however!

International visitors

Switzerland is part of the European Economic Area (EEA) so no visa is required for EU citizens. If you or an accompanying relative require a visa to visit Switzerland please ensure that you obtain this in good time before treatment. The national currency of Switzerland is the Swiss Franc

Healthcare Global (HCG) Bangalore, India



HealthCare Global Enterprises Ltd. is South Asia's largest cancer care provider with a network of centres across India.



In 1989 Dr. Ajai Kumar (pictured below right with Dr John Adler, the CyberKnife inventor) along with four other oncologists started the first comprehensive cancer centre in India, the Bangalore Institute of Oncology (BIO).

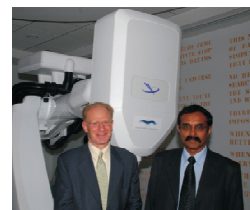
This offers a full suite of oncology services. To cater for growing demand, the BIO Specialty Centre was added, with 60 medical oncology beds, a tertiary care ICU, a bone marrow transplant unit and a PET-CT unit.

In 2002, Health Care Global Enterprises was founded, including the Curie Centre of Oncology and today, HCG Enterprises is a successful doctor-led initiative, with over 150 doctors being partners.

Treatment at HCG Bangalore

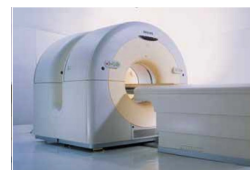
In February 2009 HCG opened its new CyberKnife Centre in Bangalore, which is now available to international patients through our on-line enquiry service.

HCG CyberKnife specialists collaborate with the patient to devise a treatment that best suits the patient's needs. The team may include Radiation Oncologists, Speciality Surgeons, Radiologists, Medical Physicists and Diagnostic and Therapy Technologists.



The Centre also offers medical and surgical oncology, brachytherapy and radiotherapy using the Siemens Artiste™ image guided system. Often referred to as radiotherapy with 'CT-on-rails', this takes real-time CT images and compares them with the CT image used in pre-treatment planning to track the tumour and deliver more accurate radiation doses, depending on the patient's condition.

Other facilities include a state of the art PET CT scanner to assess tumour aggressiveness, to monitor success of therapy, for early detection of any recurrent tumours, to provide a whole-body survey for cancer that may have spread, to identify benign and malignant growths and for radio-guided surgery and radiotherapy. It is also used for heart disease and associated surgery planning and for brain disorders, such as early diagnosis of Alzheimer's Disease.



HCG's medical cyclotron facility, the only such facility in India, provides very high quality isotope production to meet US FDA and EU standards. The cyclotron and laboratory will produce a variety of PET-Tracers (radioactive molecules), used for diagnosis of various illnesses.

Applying for treatment at HCG

Patients or doctors enquiring for CyberKnife treatment should visit our website www.cyberknifeservice.com. To have your condition reviewed then please complete the online enquiry form. All enquiries to HCG through this form will also be considered for the full range of treatment modalities offered by HCG and you can enquire to up the three CyberKnife centres in the same application. If the case looks suitable in principle, scans will then be called for.

For other enquiries to HCG you can complete the on-line form on our web site www.mhlclinics.com or e-mail hcg@mediluxhealth.net and your enquiry will be forwarded automatically.

Please note that MHL cannot advise on individual cases and HCG will communicate with you or your doctor directly about possible treatment, scheduling and costs.

Treatment costs

CyberKnife treatment in Bangalore is less expensive than in European centres, especially when other treatments are required with it. All cases are considered individually and once your case has been assessed by the team at Bangalore they will advise you what costs you can expect for your specific treatment.

International visitors

Visitors from some countries will require a visa to enter India but HCG will provide assistance with this and can arrange hotels and airport transfers for patients and accompanying relatives. They can also arrange full holiday packages, which may be useful if you have to wait for fiducials to settle before CyberKnife treatment or wish to extend your stay in India. After treatment and return home, HCG continues to follow up with patients to ensure continuity of care.