



Apollo Hospitals
touching lives GROUP

**ASIA PACIFIC'S MOST ADVANCED
CYBERKNIFE[®] ROBOTIC RADIOSURGERY SYSTEM
IS NOW AT APOLLO SPECIALITY CANCER HOSPITAL**



What is CyberKnife® ?

The CyberKnife® is a state-of-the-art, radiotherapy equipment for robotic radiosurgery that allows radiation oncologists to treat pathologies painlessly, without the need for an operation.

CyberKnife® uses pencil beams of radiation which can be directed at any part of the body, from any direction with the help of a robotic arm. The system tracks the tumour's position, detects any movement of the tumour or patient, and automatically corrects its positioning. It then targets the tumour with multiple beams of high-energy radiation, destroying abnormal tissue without damaging surrounding areas.

The treatment is so accurate that it's now possible to treat tumours previously thought to be inoperable. Although the results of treatment do not always show immediately, in most cases, the procedure will initially stop the growth of tumours, before gradually reducing their size.

As there is no open surgery, the risk complications normally associated with an operation are eliminated, as is the need for a long recovery time. This makes treatment suitable even for those who are not well enough to cope with surgery. Most patients leave the hospital the same day.

How does the CyberKnife® system work?

CyberKnife® gives patients new hopes for treatment of tumours previously diagnosed as inoperable or untreatable. As mentioned earlier, the CyberKnife® uses pencil beams of radiation, that can be directed at any part of the body from any direction, via a robotic arm. The vast array of different angles/trajectories from which pencil beams of radiation converge upon the tumour lead to a high cumulative dose of radiation dose at the convergence point (the target/tumour), and yet a very fast 'fall-off' of dose towards the periphery of the carefully mapped target. The surrounding normal tissues/organs only receive a small fraction of the high central dose of therapy.



Whilst the tumour may be destroyed by an efficiently high dose of radiation therapy, conventional radiotherapy cannot usually deliver the required dose on a tumour without also delivering a high dose of radiation on the surrounding organs. CyberKnife® often overcomes this problem by its capability to reach the target area with pinpoint accuracy.

CyberKnife® system consists of an advanced lightweight linear accelerator (LINAC) - this device is used to produce high energy 'tumour' beams of radiation.

There is a robot, that can make the linear accelerator point from a wide variety of angles. It's this centralized computer controlled movement of the system that's also called as the 'Brain' of the machine

A pair of X-ray cameras are able to obtain frequent pictures of the patient during the treatment session. The computer uses this information to target the radiation beam with sub-millimeter accuracy.

The use of the robot in the CyberKnife® System is vital in delivering radiation beams accurately whilst monitoring patient's movement during the treatment. Any change in the position of the patient is detected by the cameras and then the robot adjusts its position to allow re-targeting of the linear accelerator before delivering the radiation beam. Use of the robot ensures that there is no need to manually reposition the patient during treatment as a result of movement, thereby slowing down the treatment process.

How is the CyberKnife® system different from other radiation delivery systems?

Standard stereotactic radiosurgery techniques rely on a rigid frame fixed to the patient's skull for head immobilization. There are other systems for extra-cranial Stereotactic Radiation. These systems are most often uncomfortable. If the target moves with the breathing of the patient, they often require breath holding techniques, which may be difficult for some patients. Frame-based systems mean there are limited angles that the radiation can be delivered through.

The CyberKnife® System offers maneuverability and versatility that other systems cannot offer, therefore now making it possible to treat tumours anywhere in the body, especially the brain, spine, liver, lung, pancreas and prostate.

The combination of image guidance cameras and the very latest computer technology ensures that the CyberKnife® System is able to overcome the limitations of older frame-based radiosurgery systems, such as the Gamma Knife and LINAC based X-Knife.

What is CyberKnife® with Synchrony?

The Synchrony system is an additional, enhanced system that works along side the CyberKnife® System. According to Accuray (the manufacturer of CyberKnife®), the Synchrony system is the first technology in the world capable of delivering radiosurgery to tumours affected by the respiratory cycle. This includes tumours of the lungs, liver, kidney and pancreas.

Synchrony uses a complex system of cameras, motion tracking software, fibre-optic sensing technology, infrared emitters and a special tight-fitting elastic patient garment. As a patient undergoes CyberKnife® treatment the synchrony system continually identifies patient breathing movement in conjunction with the internally placed fiducial markers and then updates the treatment delivery of the radiation beams. It means that the CyberKnife® system is always able to track the tumour in real time, thus allowing maximum radiation delivery and minimum risk of damage to surrounding healthy tissue.

The majority of CyberKnife® centres around the world use Synchrony technology in conjunction with the CyberKnife® robot. Centres which only treat intracranial tumours do not need respiratory tracking and therefore may use CyberKnife® without the Synchrony system.



Benefits of CyberKnife®

- Alternative to conventional open surgery
- Pain-free
- Non-invasive
- Can be generally done as an Out-Patient procedure
- No anesthetic required
- No recovery time
- No blood loss
- Lesions/tumours that have previously had the maximum dose of standard radiation can be treated
- Lower risks than with conventional surgery
- Treatment of lesions/tumours previously inoperable by surgery or standard radiation
- Can often achieve comparable or better outcomes than conventional surgery
- The ability to give stronger, more accurate doses of radiation directly to the tumour means that the number of treatment doses can be shortened.
- The risk of radiation damage to normal surrounding healthy tissues is minimized greatly
- Increased patient comfort due to the elimination of the invasive head frame
- Immediate return to normal activity.

CyberKnife® indications

- Lesions adjacent to radiosensitive structures
- Complex-shaped lesions
- Previously irradiated lesions precluding further external beam irradiation
- Recurrent surgical lesions after surgery
- Lesions requiring difficult surgical approaches
- Patients who are too frail for surgery or refuse surgery

What are the conditions that CyberKnife® can treat?

All patients considered for radiotherapy are potential candidates for CyberKnife® also. Research is still going on all the other conditions that can be considered for CyberKnife® treatment. However the most common conditions treatable are:

- **Astrocytoma, glioma, glioblastoma multiforme, oligodendroglioma**

CyberKnife® offers superior conformance to tumour shape, which is important especially for recurrence. CyberKnife® can also irradiate the tumour bed to delay recurrence.



- **Brain metastases**

Radiosurgery may be equal to surgery for single metastases and better for multiple metastases. Advanced imaging allows CyberKnife® to treat those that are widely dispersed.

- **Spinal tumours**

CyberKnife® is regularly used to treat spinal metastases. It may also serve as a treatment for many primary spinal tumours.

Conditions:

SKULL BASE

- Meningioma
- Parasellar Meningioma
- Pituitary Adenoma
- Schwannoma

HEAD & NECK

- Nasopharynx tumours
- Misc. Skull Base tumours
- Recurrent Cancers

LUNG / THORACIC

- Primary, Metastatic or Recurrent Cancer

LIVER

- Primary & Metastatic Cancer

PANCREAS

- Primary or Recurrent Cancer

MELANOMA

- Primary, Metastatic or Recurrent Cancer

INTRACRANIAL

- Acoustic Neuroma
- Trigeminal Neuralgia
- Astrocytomas
- Hemangioblastomas
- Craniopharyngiomas
- Metastasis
- AVM

SPINE

- Benign tumours (chordomas, neurofibromas etc).
- Primary, Metastatic or Recurrent Cancer of the spinal cord
- Benign tumours of the bony spine

KIDNEY

- Primary or Recurrent Cancer

PROSTATE

- Primary or Recurrent Cancer

RECURRENT DISEASE

- Brain, Skeleton, & Soft Tissue

- **Pituitary adenoma**

CyberKnife's® staged treatments may help avoid the risk of visual loss and other side effects associated with single-session radiosurgery. Its superior conformance minimizes irradiation of normal tissue, including the optic chiasm and hypothalamus.

- **Hemangioblastoma**

CyberKnife® noninvasively ablates the tumour nodule, usually in one session, even in hard-to-reach areas. This is especially beneficial for Von Hippel Lindau disease patients who can become disabled by multiple surgeries.

- **Skull base tumours**

The proximity of these tumours to vital nerve and vascular structures makes them surgically problematic.

- **Chordoma**

While chordomas are relatively radioresistant and close to vital structures, they were frequently labeled as untreatable. Superior conformance and staged sessions permit higher doses therefore. CyberKnife® should be considered as a primary treatment option, the treatment of choice by now.

- **Meningioma**

For smaller meningiomas, radiosurgery is an ideal therapy. CyberKnife® is especially safe for meningiomas adjacent to critical structures because it can be delivered in fractions.

- **Neurofibroma & schwannoma**

While these tumours' resistance to radiation makes conventional radiotherapy an option only when surgery is not, CyberKnife's® conformance makes it an effective alternative to radiation therapy and surgery for selected patients.



- **Acoustic neuroma**

Studies show that CyberKnife® treatment in stages offers the highest rates ever achieved for hearing and facial-nerve preservation.

- **Intracranial AVMs**

With CyberKnife®, we can treat locations that can't be safely approached with microsurgery or endovascular therapy. Selected AVMs have an 80% chance of disappearing after a single treatment session. CyberKnife® can also be used in conjunction with other therapies to remove remnants.

- **Spinal AVMs**

CyberKnife® is the first and the only system to offer radiosurgical treatment of spinal AVMs. It provides the same or even more accuracy and success as for intracranial AVMs.

- **Trigeminal neuralgia**

Unlike invasive therapies and conventional radiotherapy, CyberKnife® is painless, frameless, less risky and therefore more easily repeated to treat recurrence. It can be used in functional Neurology like Trigeminal neuralgia.

Head & Neck

Early Head & Neck cancers

As a sole modality in early head & neck cancer when surgery is not contemplated and long duration of conventional radiotherapy is time consuming. Also used as a boost to Residual disease in locally advanced head & neck cancers.

Recurrent Head & Neck cancers

CyberKnife® is increasingly being used for head and neck tumours, particularly recurrent cancers of limited size. Control of symptoms such as active bleeding or impending nerve compression is often achievable

Cancer of the Nasal Fossae, and inoperable Otolaryngologic tumours involving critical structures may be the reason a tumour is considered unresectable or only marginally resectable. With significantly less irradiation of surrounding tissues, CyberKnife® can even treat tumours untreatable or already treated with conventional radiotherapy.

Chest

CyberKnife® is a sole modality in early lung cancer when surgery is not contemplated and long duration of conventional radiotherapy is not convenient. CyberKnife® treatment seems to be even more successful than conventional radiotherapy.

Metastatic Lung cancer

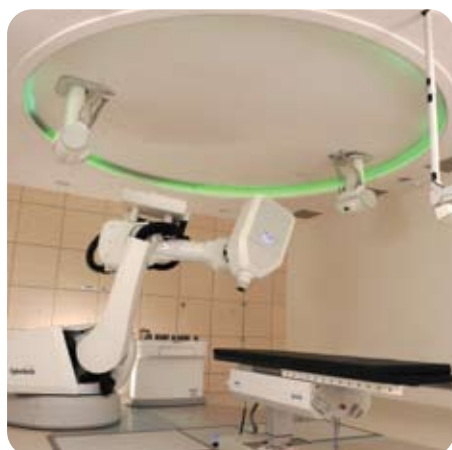
The lungs are unfortunately a common site of secondary spread (known as metastatic disease, or metastases) for a wide variety of primary cancers, including colorectal cancer, upper gastrointestinal cancers, kidney cancer, sarcomas (primary soft tissue or bone cancers) and pediatric cancers.

Advanced Lung cancer

The primary treatment for more advanced lung cancer patients (stage III) usually consists of chemotherapy and radiotherapy, CyberKnife® treatment may increase the disease-free survival. Research on this is still going on though.

Recurrent Disease

It is not unusual for lung cancer to relapse following attempted curative treatment. For these recurrent cancers, CyberKnife® radiosurgery offers a new treatment alternative to patients, who have traditionally had very few remaining options, and may be considered in selected patients for symptom relief, in some cases translating to additional long-term disease-free survival.



Gastrointestinal Tract

It is not unusual for these patients to relapse following attempted curative treatment. For these recurrent cancers, CyberKnife® radiosurgery offers a new treatment alternative to patients, who have traditionally had very few remaining options, and may be considered in selected patients for symptom relief, in some cases translating to additional long-term disease-free survival.

Liver cancer

While surgical resection remains the best treatment for operable primary liver cancer (hepatocellular carcinoma, cholangiocarcinoma), in the event of multiplicity, CyberKnife® is an option worth considering. Sparing adequate remaining liver function may be achievable with this modality of stereotactic radiosurgery, particularly in patients with some degree of cirrhosis.

Metastatic liver : If not easily resectable, are treatable with CyberKnife®.

Pancreatic cancer

The CyberKnife® System has been used to treat pancreatic cancer in patients who are poor surgical candidates, those who refuse surgery and in patients for whom surgery or other treatments have failed. Two clinical studies from Stanford University have shown the growth of pancreatic tumours in patients with advanced disease has been controlled by CyberKnife® radiosurgery.

Urology

Kidney cancer

For malignancies arising because of a single kidney, radio surgery offers a non surgical treatment

Prostate cancer

The challenge that doctors face in treating prostate tumours with radiation therapy is that the prostate moves unpredictably as air passes through the rectum and as the bladder fills. Minimizing any large movements of the prostate can help reduce unnecessary irradiation of surrounding healthy tissue.

The CyberKnife® Robotic Radiosurgery System is able to overcome this challenge by continuously identifying the exact location of the prostate tumour throughout the course of the treatment. During CyberKnife® treatment, a patient can lie still while the doctor zeroes in on a moving target – the prostate – and irradiates it without harming surrounding areas. As a result, the procedure is more comfortable for patients, radiation is delivered more accurately and treatments can be completed in one to five days.

Treatment Process

CyberKnife® treatments involve a team approach in which several experts participate. Before execution of the irradiation process, the patient has to undergo a substantial preparation process

Step 1: **Patient consultation**

Physician and patient meet to determine the CyberKnife® System treatment objectives.

Step 2: **Patient preparation**

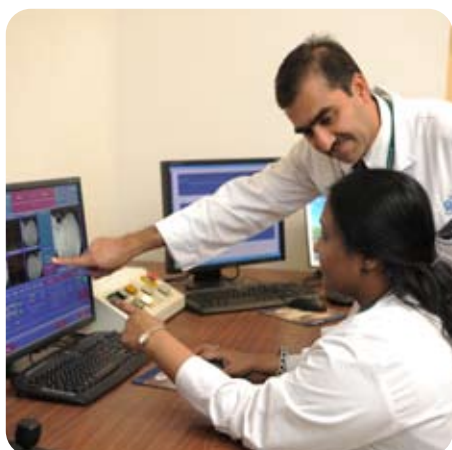
CyberKnife® is a completely frameless treatment system.

Fiducial Placement

Patient's undergoing CyberKnife® treatment for a prostate or some other site body (non-head) lesion, may require a short outpatient procedure to implant several small metal markers (fiducials) near the tumour to enable the CyberKnife® System to track tumour position throughout treatment. Lesions in the head do not require this step.

Making a Mask or Body Mold

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



Step 3: **Image acquisition**

Prior to the procedure, a CT scan is performed. The scan is used to identify the exact size, shape and location of the tumour along with the surrounding vital structures to be avoided. Additional scans like MRI, PET CT/angiography may also be done if necessary.

Step 4: **Planning**

The image is then digitally transferred to the CyberKnife® System's workstation, where the treatment planning begins. Here, a qualified team uses the CyberKnife® software to generate a treatment plan. Planning of the treatment is one of the most critical and time-consuming process where all the specialists participate (Radiation Oncologist, Clinician, Physicist, and the radiologist will all participate). The machine itself is under regular quality control, under the care of specially trained physicists. An individual plan of dose delivery will be generated which will maximize the treatment efficacy and minimize the risks involved.

The treatment plan will undergo a dosimetrical verification test.

**Step 5:
Treatment**

Once the treatment plan is developed, the CyberKnife® procedure is set to begin. The CyberKnife® System's computer-controlled robot will slowly move around the patient, to the various locations from which it will deliver radiation to the tumour.

Each treatment session will last between 30 and 90 minutes, depending on the type of tumour being treated.

If treatment is being delivered in stages the patient will need to return for additional treatments over several days. In majority of cases, patients can resume their previous activities after the completion of the CyberKnife® treatment. However the consultant will give the final advice regarding this.



Follow-up

People after the CyberKnife® treatment will have to undergo follow-up monitoring without fail. The team works out an appropriate set of follow-up tests to provide the patient with more realistic and objective answers

Follow-up imaging, generally performed with a combination of CT, MRI and/or PET scanning, is usually performed in the months following treatment to assess the tumour's response to the delivered radiation.





Apollo Speciality Cancer Hospital

Apollo Speciality Cancer Hospital is set apart by the comprehensive cancer care it delivers. Here, the nation's the best healthcare professionals work with a coordinated multi-disciplinary approach, supported by the latest technology.

Apollo imparts cancer treatment through a Tumour board which comprises a panel of competent Medical, Surgical and Radiation Oncologists together with diagnostic consultants who discuss referred cases and jointly decide on the best line of treatment for the patient.

Apollo also supports patients, helping them improve their quality of life post-treatment with the help of medical counselors, speech therapists, dieticians and other professionals, appropriate to the individual case.

Apollo Speciality Cancer Hospital is equipped with facilities on par with the best in the world. The most modern technology and equipment, in addition to highly skilled healthcare professionals deliver comprehensive care for the entire range of diseases. Apollo Speciality Cancer Hospital has the cutting-edge equipments for advanced procedures bringing world-class healthcare closer to you.





Apollo Speciality Cancer Hospital
touching lives CHENNAI

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