Information Brochure for Patients
Hyperthermia

Department of Radiation Oncology and Radiotherapy
Charité - Universitätsmedizin Berlin
Campus Virchow-Klinikum
Dear Patients,

Cancer patients are treated at the Charité - Universitätsmedizin Berlin using classical radiotherapy and chemotherapy with the addition of hyperthermia for more than two decades. Next to surgery, radio- and chemotherapy, this modality evolves continuously by the implementation of an increasing number of phase II and III clinical trials. The genuine cytotoxicity of chemo- and radiotherapy can be effectively enhanced by means of hyperthermia. Consequently, an improved local tumor control, prevention of distant disease, better quality of life, and once in a while also a complete cure can be achieved. The Charité Comprehensive Cancer Center supported by the German Cancer Aid has generated a platform of multidisciplinary tumor boards in order to discuss all cancer cases on an individual basis and in some instances implementing hyperthermia as an additional modality in the multimodal fight against cancer.

At the Department of Radiation Oncology and Radiotherapy, all patients receive state-of-the-art cancer treatment. Basic tumor research and clinical studies with translational elements aim at a further improvement of existing treatment methods, increase the chances of cure and reduce side effects of treatment. The interdisciplinary tumor boards enable us to provide an optimized, multimodal tumor treatment tailored to the needs of the individual patient.

Kind regards,

Volker Budach, MD, PhD
Chair of the Dept. of Radiation Oncology and Radiotherapy
Campus Virchow-Klinikum and Campus Benjamin Franklin
Hyperthermia: Method

What does hyperthermia treatment involve?
The word hyperthermia is derived from Greek and means overheating. With hyperthermia treatment, the tumor area is heated to a temperature of up to 43°C (109°F) over a period of about one hour.

How does hyperthermia work?
It has been known for some time that cancer cells are more sensitive to heat than healthy cells and, consequently, the targeted application of heat can by itself cause many cancer cells to die. At the same time, so-called heat shock proteins are generated in tumor tissue. These proteins result in activation of the immune system against cancer cells with the formation of killer cells which can attack and destroy the tumor. An additional effect is a heat accumulation in the central tumor regions due to poor blood circulation and thereby direct destruction of tumor cells. Given the lack of oxygen in these areas, the tumor cells here are normally particularly well protected and resistant against chemo- and radiotherapy. On the other hand, in the well-vascularized and oxygen perfused peripheral tumor regions, temperatures in excess of 43°C (109°F), which are capable of destroying cells, cannot be achieved. However, the general increase in temperature sensitizes these regions to simultaneous chemo- and also radiotherapy. For this reason, at the Charité we do not use hyperthermia as a single therapeutic modality but always in combination with either chemotherapy or radiotherapy or both.

What types of hyperthermia are used at the university department of radiation oncology?
We use regional deep hyperthermia for deep-seated tumors in the pelvis, abdomen and limbs. Patients are positioned in a so-called ring applicator with several integrated antennae which generate high-frequency electromagnetic waves. The antennae, which are arranged in a ring shape, can be controlled separately via a multi-channel amplifier system using special software. Like this, the waves can be focused directly on the selected tumor area for heating. Local superficial hyperthermia is used for tumors which are just beneath the skin, e.g. recurrent breast cancer.

What role does temperature measurement play?
Temperature measurement is vital in order to perform the treatment in a controlled manner. Temperatures between 42°C and 43°C (108°F - 109°F) are ideal. To avoid damaging the surrounding healthy tissue, this upper limit should not be exceeded. This is the reason that at the Charité the classic method of high-precision temperature measurement with high-resistance temperature sensors (thermistors) in the tumor and normal tissue is used.

Hyperthermia: Applications

For which patients is hyperthermia an option?
At the Department of Radiation Oncology and Radiotherapy, Charité, Campus Virchow-Klinikum, hyperthermia is used for the following tumor types:
- Anal cancer
  - Locally advanced or recurrent anal cancer
- Bladder cancer
  - Initial treatment of locally advanced bladder cancer
- Breast cancer
  - Inoperable local recurrence at the chest wall or macroscopic residual tumor following surgery
- Cervical cancer
  - Locally advanced cervical cancer or local recurrence with previous chemoradiation
- Pancreatic cancer
  - Cancer of the pancreas, following R1/R2-surgery in combination with chemotherapy
- Prostate cancer
  - Biochemical recurrence following prostate removal
- Soft tissue sarcoma (abdomen, pelvis, limbs)
  - Postoperative R1/R2 situations, which cannot be salvaged by an additional surgical intervention
  - Neoadjuvant in order to reduce tumor size and thereby preserve functionality
  - In a palliative situation in order to stop tumor progression

When is hyperthermia not recommended?
Absolute contraindications are metal implants such as prostheses and stents because, under certain circumstances, they can get very hot and cause severe burns or necrosis. Moreover, hyperthermia treatment should not be executed on patients with serious heart failures, as the application of heat can be strenuous for the cardiovascular system. Further contraindications are pregnancy and cardiac pacemakers, since the electromagnetic waves used for heating can cause some malfunction.
Hyperthermia: Treatment

How is hyperthermia treatment performed?
In preparation for hyperthermia, the first step is to calculate the temperature distribution. In order to tailor treatment to the individual patient, in our department we use various computer-aided planning systems, including Sigma-Hyperplan. On the basis of this planning, the tumor can be heated precisely, while ensuring maximum protection for the surrounding healthy tissue. Before treatment begins, measuring probes are inserted into the tumor focus or positioned as close as possible to the cancer focus in order to monitor the temperature during treatment. The temperature in tumors which are located directly under the skin can be established by measuring the temperature on the skin surface. For deep seated cancer foci, we use natural body orifices such as the rectum, urethra and vagina for the placement of the temperature probes. In some cases it may prove necessary to insert an invasive probe under local anesthesia. Following this preparatory phase, the patient is positioned in a ring applicator for regional deep hyperthermia. Antennae located in the applicator emanate electromagnetic waves and thus generate heat in the body in a similar way to a microwave oven. We use the modern system BSD 2000 3D with a series of ring applicators (SIGMA-Eye, SIGMA-60, SIGMA-40, SIGMA-30). This allows us to offer treatments to a wide range of patients, from adults to infants. The therapy session starts after a heating-up period of the tumor of approximately 30 minutes followed by one hour of treatment. The accompanying chemo-/radiotherapy should be performed in close temporal context.

Are patients on their own during treatment?
Our patients are continuously supervised by a team of experts. The correct temperature and technical parameters are monitored throughout the entire treatment by medical physicists in the control room. In addition, doctors monitor the patient’s cardiovascular functions during hyperthermia treatments, while a nurse looks after the patient’s physical and emotional well-being. The team maintains continuous visual contact with the patient, which means that feedback can be given at any time. On request, relatives can also be present during treatment or relaxing music can be provided.

What intervals are recommended for hyperthermia sessions?
The frequency of treatment depends on the specific diagnosis and is decided on a case-by-case basis. At the Charité, hyperthermia is normally applied either once or twice weekly during oncological treatment (radio- and/or chemotherapy).

Are there any side effects of hyperthermia?
In most cases no significant side effects are observed. Skin erythema and edema due to overheating and water retention in the tissue are rarely seen. Necrosis of fatty tissue, which normally heals without any complications, is even more seldom. In pelvic or abdominal tumors, the pressure from the water bag (known as a water bolus) required to connect the electromagnetic waves of the applicator to the patient may be disturbing. The water bolus is, however, removed immediately after treatment.
What quality criteria are applied to hyperthermia at the Charité?

Treatment is performed based on the quality requirements and guidelines of the European Society for Hyperthermic Oncology (ESHO) and the Interdisciplinary Hyperthermia Working Group (IAH) of the German Cancer Society (DKG). Our expert hyperthermia team comprises radiation oncologists, physicists and engineers, nursing staff and radiology assistants with years of experience in the field of hyperthermia. At the Charité, the high quality requirements specified by the ESHO guidelines are fully met. For example, the documentation of all relevant treatment parameters is computer-controlled and the accuracy of the temperature display is checked daily. Furthermore, the hyperthermia treatments are documented and evaluated within a framework of clinical studies.

Is hyperthermia also a focus of scientific investigations?

Important international and national studies with control groups have impressively confirmed the efficacy of hyperthermia in combination with radio- and/or chemotherapy for some diseases. The cancer foci disappeared entirely in some cases. In other cases, the use of hyperthermia allowed the patient’s life to be prolonged (compared to patients who received standard therapy without hyperthermia). Despite the very promising experimental and clinical results to date, more research into hyperthermia is required.

Where can you find more detailed information on hyperthermia?

You can find reliable information online from the following institutions:

Charité webpage
http://radioonkologie.charite.de/

Interdisciplinary Hyperthermia Working Group (IAH)
www.hyperthermie.org

German Cancer Society (DKG):
www.krebsgesellschaft.de/db_hyperthermie,10845.html
How to find our department:

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