

# Clinical translation of FLASH therapy

Project

*Professor Jean Bourhis, Chairman of Radiation Oncology, CHUV*

## Introduction

About 30-40% of all people will develop a cancer during their lifetime, and cancer is the second cause of death worldwide. Surgery, chemotherapy, immunotherapy, and radiotherapy are used to cure and manage the disease. However, approximately 30-40% of all cancers are multi-resistant to all forms of therapy, a situation that defines an unmet clinical need for more efficient and better tolerated treatments. Radiotherapy is one of the most important pillars of cancer treatment and, in this context, FLASH therapy, a new form of radiotherapy, is a very promising approach to improve the curability of tumors that are resistant to conventional treatments.

## FLASH therapy: a ground breaking discovery

Over the past decade, technological advances have transformed radiation therapy (RT) into a precise and powerful treatment for cancer patients. Nevertheless, the treatment of radiation-resistant tumors is still restricted by the dose-limiting normal tissue complications, which is why FLASH-RT is emerging in this field. This treatment is characterized by a paradigm-shifting method of delivering doses of radiation in milliseconds, rather than the minutes required in conventional radiotherapy. In pre-clinical studies, this extremely short overall time induced a reproducible and remarkable protection of the normal healthy tissues from the hazardous effect of radiation, while the efficacy on tumors was preserved. This observation generated an enormous interest in oncology, opening new avenues for more effective and less toxic radiotherapy.

## FLASH therapy pioneered at Lausanne University Hospital (CHUV)

The FLASH therapy was initially developed at the CHUV, which first published an outstanding differential effect between tumors and normal tissues in 2014. Later, these results were confirmed in several renowned academic centers worldwide. More recently, the treatment of a first patient presenting a multi-resistant skin cancer was performed at CHUV, resulting in the complete disappearance of the tumor with nearly no side effects.

Based on its pioneer role, its unique expertise and international leadership with respect to FLASH therapy, the CHUV is now engaged in an intensive research program for rapid clinical testing of this remarkable observation in cancer patients. This is a comprehensive program from bench to bedside, based on a unique platform including fundamental and medical physics, FLASH-biology and clinical expertise which will support this clinical transfer. In terms of the clinical translation, the main challenge is to solve the technical issues related to the production of the FLASH beams required to treat the tumor at the appropriate depth within the tissue.

Currently, a clinical prototype for treating patients with FLASH therapy is not available anywhere in the world. The CHUV is at the forefront of these developments, and is ready to test three clinical prototypes within the coming years. These will enable the treatment of tumors in FLASH conditions at various depths within the tissues - a world premiere.