



HAL
open science

Reduction of radiotoxicity by ultra-high dose rate protontherapy

Gaëlle Saade, Eva Bogaerts, Sophie Chiavassa, Guillaume Blain, Grégory Delpon, Manon Evin, Youssef Ghannam, Ferid Haddad, Karin Haustermans, Charbel Koumeir, et al.

► **To cite this version:**

Gaëlle Saade, Eva Bogaerts, Sophie Chiavassa, Guillaume Blain, Grégory Delpon, et al.. Reduction of radiotoxicity by ultra-high dose rate protontherapy. 2nd Flash Radiotherapy and Particle Therapy Conference (FRPT 2022), Nov 2022, Barcelona, Spain. . hal-03886326

HAL Id: hal-03886326

<https://imt-atlantique.hal.science/hal-03886326>

Submitted on 6 Dec 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

#139 REDUCTION OF RADIOTOXICITY BY ULTRA-HIGH DOSE RATE PROTON THERAPY

Gaëlle Saade¹, Eva Bogaerts², Sophie Chiavassa^{3,4}, Guillaume Blain³, Grégory Delpon^{3,4}, Manon Evin^{4,5}, Youssef Ghannam⁴, Ferid Haddad^{3,5}, Karin Haustermans², Charbel Koumeir^{3,5}, Ellina Macaveva^{2,6}, Lydia Maigne⁷, Quentin Mouchard³, Noël Servagent³, Edmond Sterpin^{2,6}, Stéphane Supiot^{1,4} and Vincent Potiron^{1,4}
 1 Nantes Université, CNRS, US2B, UMR 6286, F-44000 Nantes, France, 2 Department of Oncology, KU Leuven, 3000 Leuven, Belgium, 3 IMT Atlantique, Nantes Université, CNRS/IN2P3, Subatech, Nantes, France, 4 Institut de Cancérologie de l'Ouest, Saint-Herblain, France, 5 GIP ARRONAX, Saint-Herblain, France, 6 Institut de Recherche Expérimentale et Clinique (IREC), Université catholique de Louvain, 1200 Woluwé-Saint-Lambert, Belgium, 7 Université Clermont Auvergne, CNRS/IN2P3, LPC, 63000 Clermont-Ferrand, France

1- Introduction

■ Electron beams are widely used for Ultra-High Dose Rate Radiotherapy (UHDR-RT) studies.

■ The novelty of UHDR-RT using protons still requires a lot of knowledge of the parameters involved in its response.

■ **Protons** : -Spread a little along the trajectory.
 -Have a precise targeting.

What are the requirements that allow obtaining a protective effect using proton UHDR-RT ?

2- Materials and Methods

■ Zebrafish embryos



No experimental authorization is required Statistical power Fast beam structure investigations

■ Irradiation at 28 hpf

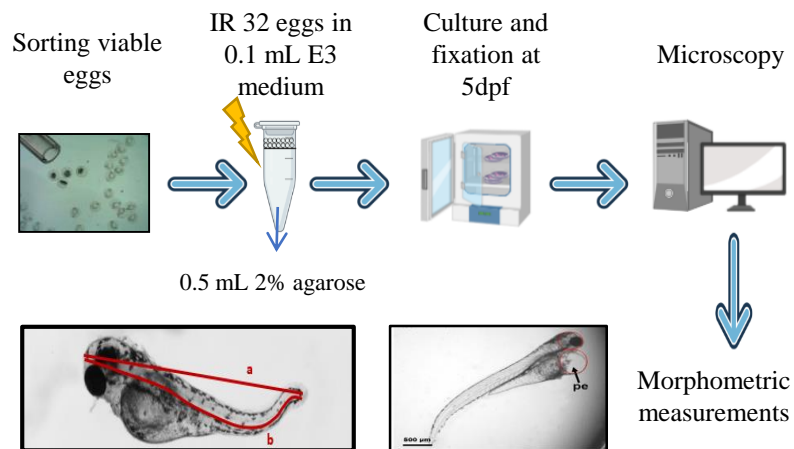
Plateau of 68 MeV protons



Conventional dose-rate
12 Gy/min

Ultra-high dose-rate
8-9 kGy/sec

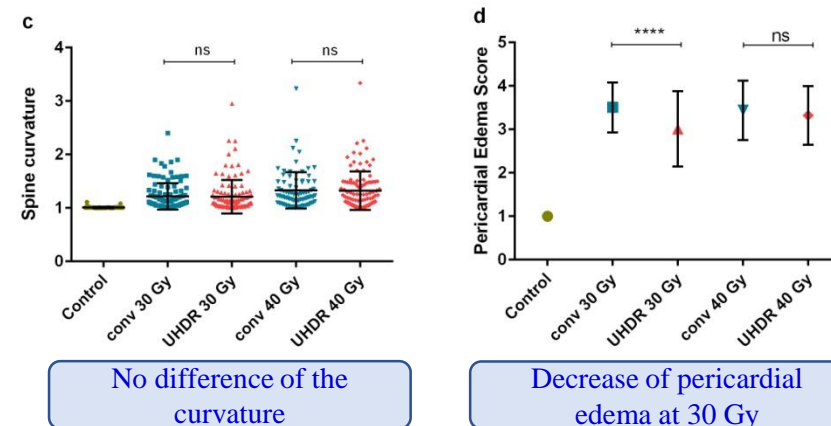
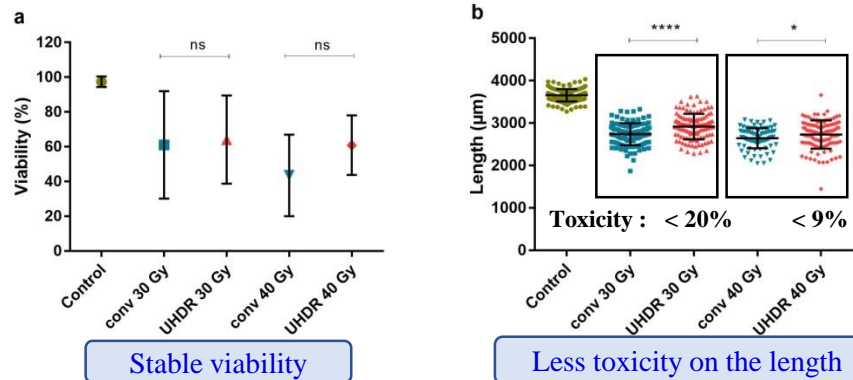
■ Protocol



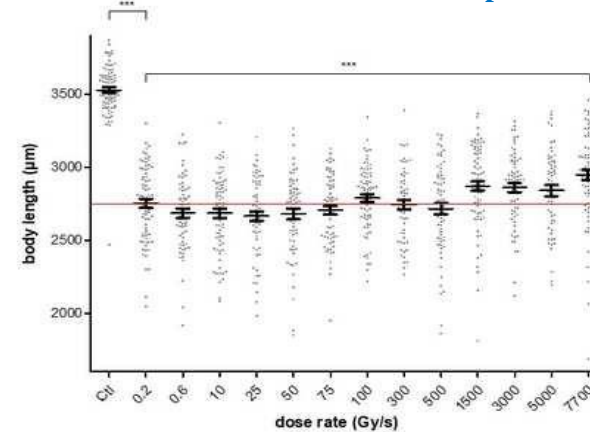
a: Distance (from head to tail)
 b: Length of the body
 b/a: Curvature of the tail
 Scoring pericardial edema

3-Results

■ Effect of proton UHDR-RT on the morphology of zebrafish embryos vs conv RT :



■ Effect of the mean dose-rate on the protection of zebrafish embryos :



Significant protection at 7700 Gy/s.

4- Conclusion

■ A protection in body length after proton UHDR-RT was demonstrated with the zebrafish embryonic model.
 ■ This model allows to study rapidly several parameters allowing a better understanding of proton UHDR-RT.