3° Πανελλήνιο Συνέδριο
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Ακτινολογίας

Carbon Ion Radiotherapy: Current Status and Future Perspectives

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Οργάνωση

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Εισαγωγή

Introduction

- Carbon Ion Radiotherapy (CIRT) is an advanced form of particle radiotherapy.
- It combines high dosimetric precision with enhanced biological effectiveness.
- It offers significant advantages over photon radiotherapy and Proton Beam Therapy (PBT).

Purpose

- To critically review current scientific evidence on CIRT, focusing on its radiobiological advantages, clinical applications, and safety parameters.
- To evaluate the potential benefits of CIRT in addressing therapeutic challenges and shaping future perspectives.

Μέθοδοι & Υλικά

Literature search & study selection

- Literature search conducted using Scopus, PubMed, and Google Scholar databases.
- Evidence sources included systematic reviews, meta-analyses, and original research articles on CIRT.
- Key topics of investigation and source selection criteria:
  - Physical and radiobiological properties of carbon ions
  - Clinical application, efficacy, and treatment-related toxicity
  - Normal-tissue sparing and treatment safety
  - Comparison of CIRT with Proton Beam Therapy (PBT) and photon radiotherapy

Αποτελέσματα

Bragg peak

Precise dose delivery - healthy tissue spared, lower toxicity

High LET / RBE

Effective against hypoxic and radioresistant tumors

Hypofractionation

Shorter courses - feasible even in a single session

	Photons	Protons (PBT)	Carbon ions (CIRT)
Bragg peak	No	Yes	Yes
LET / RBE	Low	Low	High
Healthy-tissue sparing	Moderate	High	High
Hypoxic / radioresistant tumors	Limited	Limited	Highly effective
Center availability	Wide	Moderate	Limited

Συμπεράσματα

Key findings

- CIRT offers superior biological effectiveness and precise dose delivery, especially for radioresistant and hypoxic tumors.
- Both CIRT and PBT achieve excellent clinical outcomes with reduced toxicity.

Limitations & outlook

- CIRT limitations: high cost, sensitivity to anatomical changes, and biological / clinical uncertainties.
- Further comparative studies and broader accessibility are needed to define each modality’s optimal clinical role.

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