NANOMEDICINE & CANCER THERAPY

Liposomal Doxorubicin Combined with Radiotherapy for Targeted Cancer Treatment

Enhancing Tumor Radiosensitization While Minimizing Systemic Toxicity

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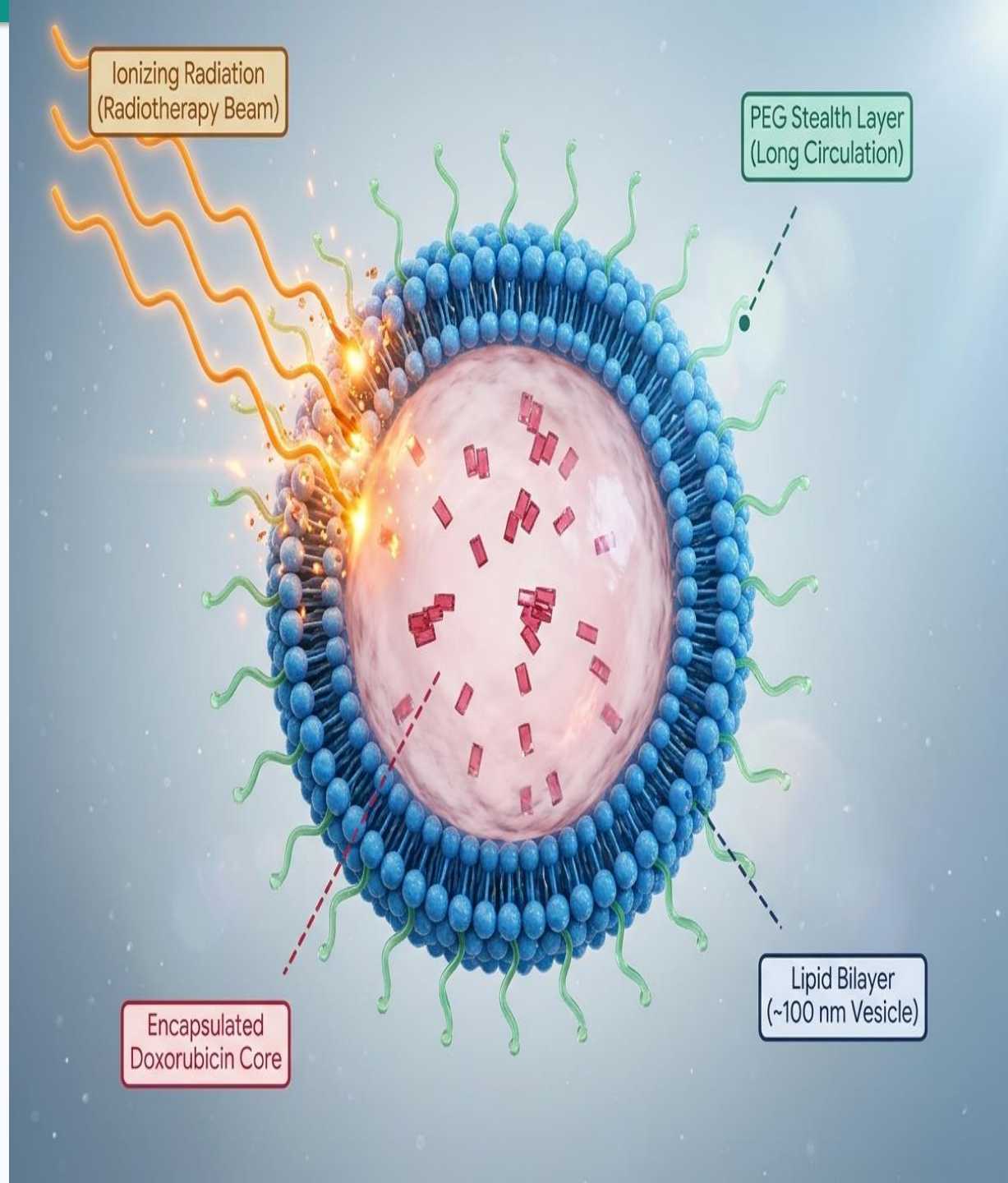
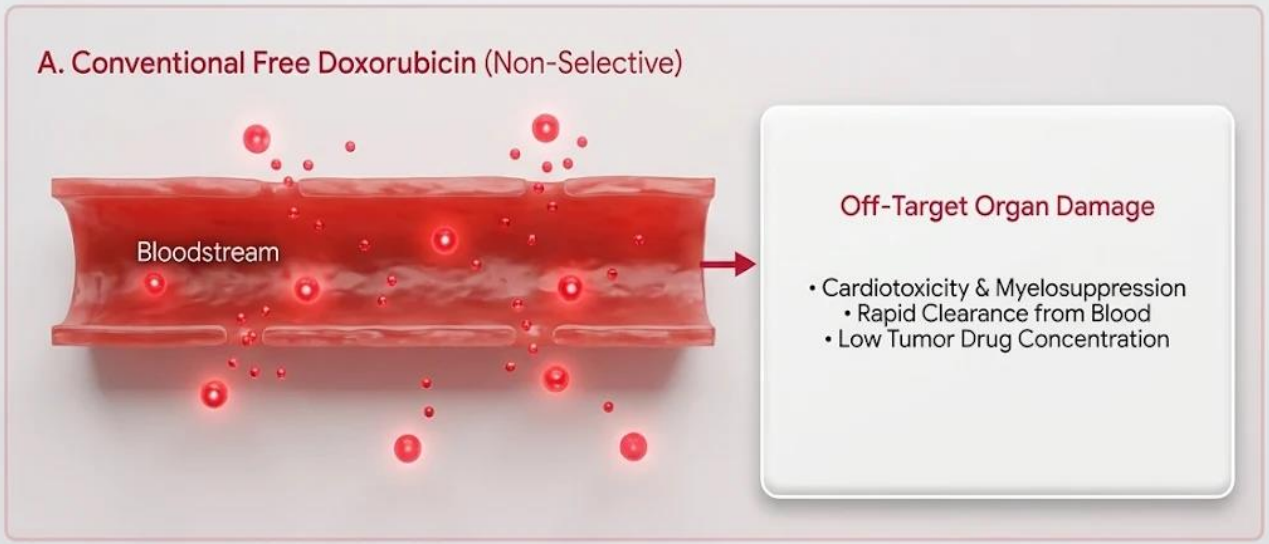
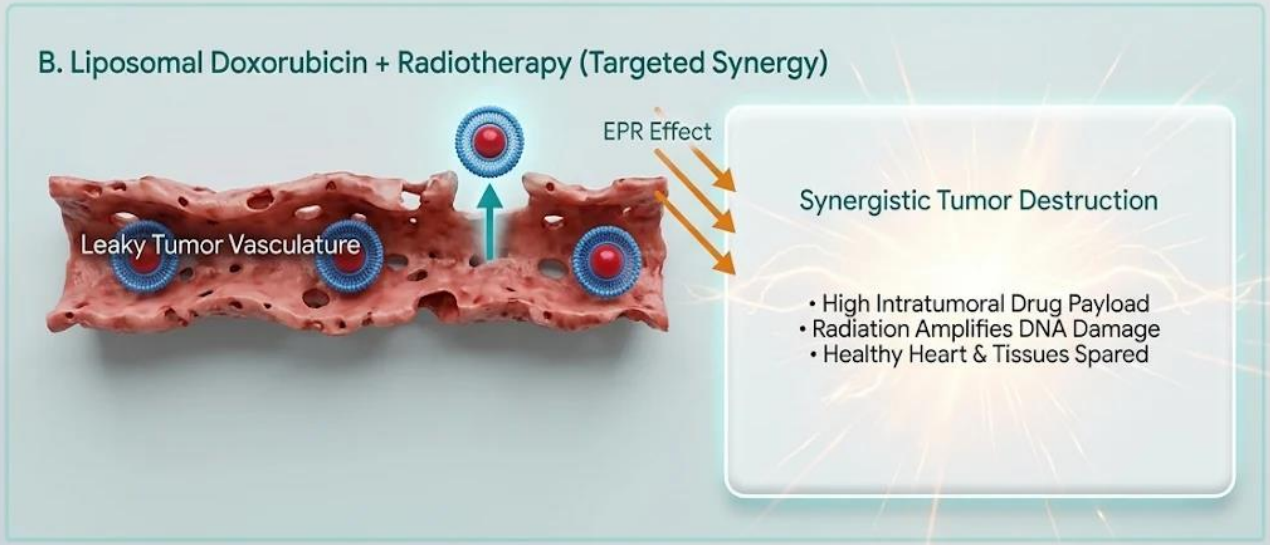


Why Combine Liposomal Doxorubicin with Radiotherapy?

Clinical Challenge & Nanocarrier Rationale

- **Limited Selectivity:** Conventional chemotherapy damages healthy organs (especially the heart) due to non-specific distribution.
- **Liposomal Nanocarriers:** Biocompatible lipid vesicles encapsulate doxorubicin to protect the drug in circulation.
- **Tumor Accumulation:** Liposomes alter pharmacokinetics to increase drug buildup inside solid tumors.
- **Synergistic Combination:** Pairing liposomal doxorubicin with radiotherapy boosts tumor control while lowering systemic toxicity.





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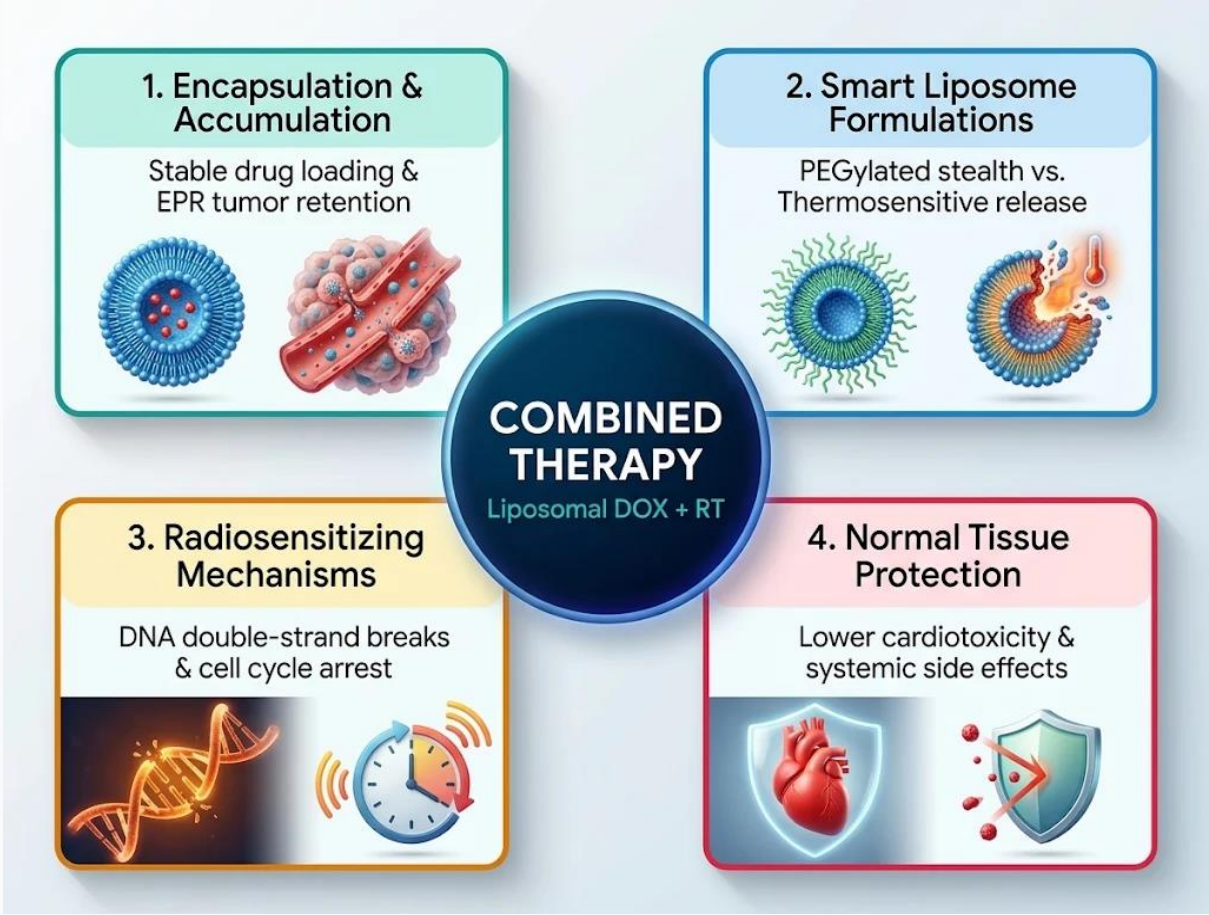
Aim & Scope of the Study

Primary Aim

- To evaluate the potential of liposomal doxorubicin combined with radiotherapy for improving cancer treatment outcomes.

Key Scope Areas

- **Encapsulation & Delivery:** Drug loading efficiency and tumor-site accumulation.
- **Radiosensitization:** Molecular mechanisms amplifying radiation-induced cell death.
- **Liposomal Formulations:** Comparing PEGylated stealth vs. thermosensitive carriers.
- **Safety Profile:** Potential reduction of healthy-tissue and cardiac damage.



Liposomal Preparation and Drug Loading

01

STEP 1: Liposome Formation

Phospholipids + Cholesterol + PEG
self-assemble into ~100 nm stealth vesicles



02

STEP 2: Active Drug Loading

Ammonium sulfate / pH gradient locks
Doxorubicin inside core (no leakage)



03

STEP 3: Targeted Tumor Delivery

EPR accumulation via leaky tumor vessels
& surface ligand/antibody binding



04

STEP 4: Controlled Release + RT

Sustained intratumoral release kills cancer
cells while sparing healthy heart tissue



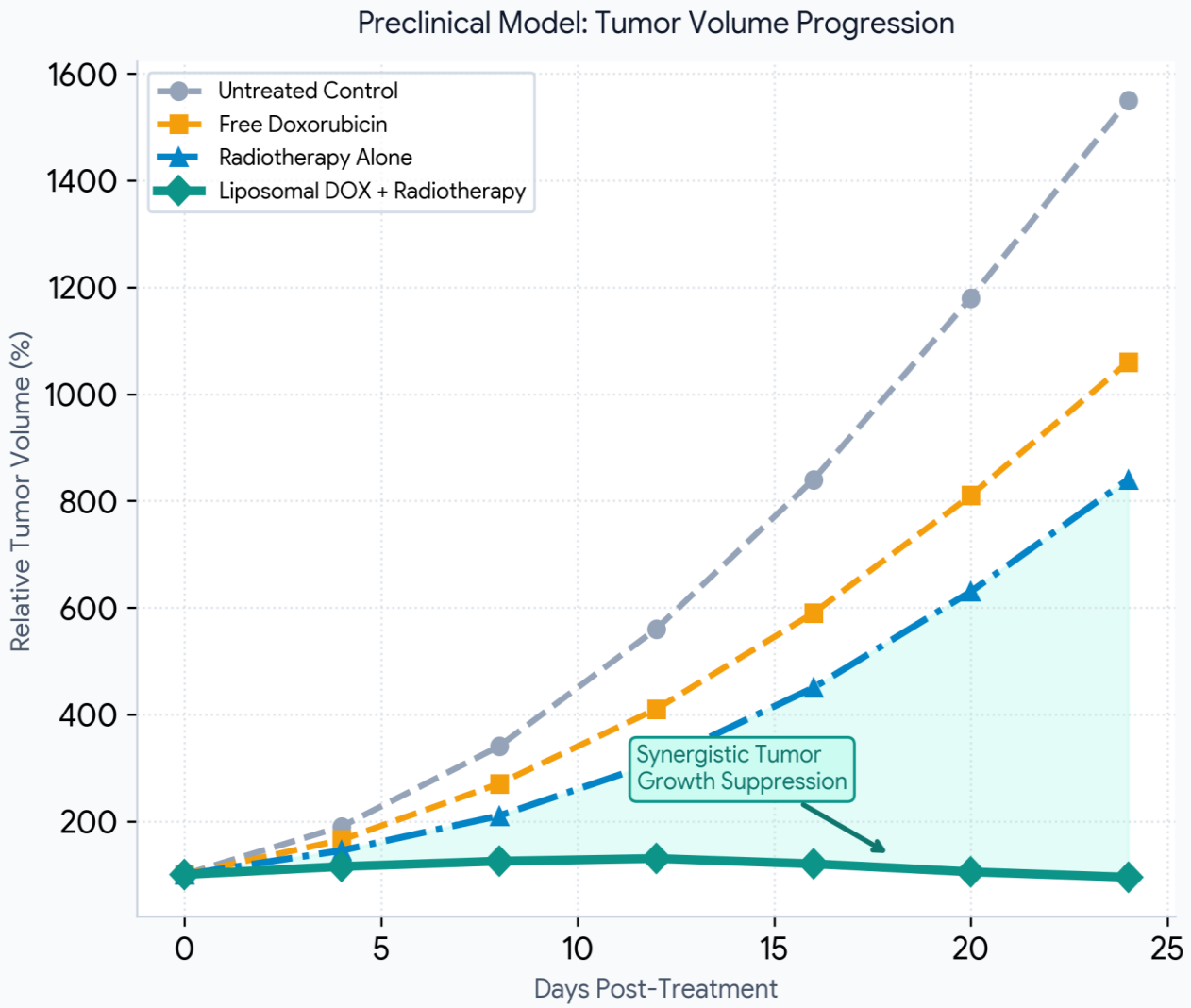
Key Results: Synergistic Antitumor Activity

Three Core Preclinical Findings

- **1. Improved Accumulation:** PEGylated liposomes prolong circulation and enhance intratumoral drug buildup.
- **2. Triggered Local Release:** Thermosensitive liposomes release doxorubicin rapidly under localized heating (hyperthermia).
- **3. Enhanced Radiosensitization:** Doxorubicin amplifies radiation-induced DNA damage and lowers cancer-cell survival.

Overall Preclinical Finding

- Combining liposomal doxorubicin with radiotherapy significantly improves tumor-growth control across experimental models.



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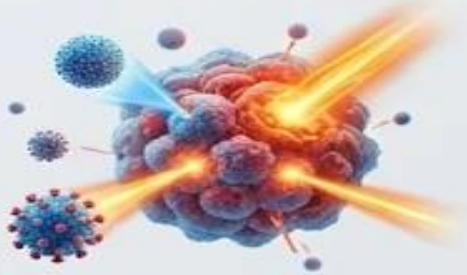
Conclusions & Clinical Implications

Summary & Future Outlook

- **Targeted Nanomedicine**
  Safer, targeted alternative



- **Chemo-Radiotherapy Synergy**
  Enhanced tumor eradication



- **Complementary Formulations**
  Sustained circulation



Stealth coat Thermosensitive

- **Clinical Impact**
  Improved survival, heart protected



Complementary Liposomal Platforms for Chemo-Radiotherapy

PEGylated "Stealth" Liposomes



- Evades clearance
- Prolonged blood half-life
- Passive EPR tumor buildup
- Ideal for sustained release

Thermosensitive Liposomes (TSL)



- Heat-triggered release
- Paired with hyperthermia
- Rapid intratumoral drug burst
- Maximizes radiosensitization

CLINICAL & TRANSLATIONAL OUTCOME





- Higher Therapeutic Index
- Enhanced Tumor Control
- Reduced Cardiotoxicity

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