GOLD NANOPARTICLES AS THERAPEUTIC AGENT FOR RADIOTHERAPY OF PC3 PROSTATE CANCER CELL LINE

Soares, S.[1-4], Guerreiro, S.G.[3,7,9], Sales, M.G.F. [4,5,11], Correa-Duarte, M.[4,12,13], Fernandes, R.[2,3,10]

INTRODUCTION

- Radiotherapy (RT) is one of the most used approaches in patient's treatment with prostate cancer (PCa).[1]
- Besides the evolution of equipment and technology, this therapy still has some limitations and nanotechnology can help to overcome these problems.[2]
- Over the years, gold nanoparticles (AuNP) have attracted a lot of interest in cancer therapies due their unique properties (figure 1).[3,4]

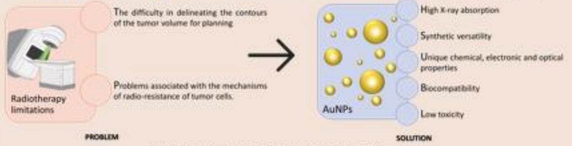

Figure 1 – Potential application of AuNPs to overtake some limitations of RT

MAIN GOAL

The principal goal of this work was compared two different types of AuNPs – spherical ($AuNP_{sp}$) and rods ($AuNP_r$) as potentials radiosensitivity agents in human prostate cancer cell line (PC3) in radiotherapy treatment.

MATERIALS AND METHODS

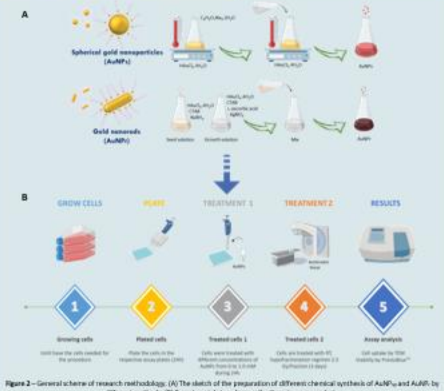

Figure 2 – General scheme of research methodology: (A) The sketch of the preparation of different chemical synthesis of $AuNP_{sp}$ and $AuNP_r$ by different methods; (B) Experimental steps from cell culture to assay analysis.

RESULTS

- **AuNPs characterization**

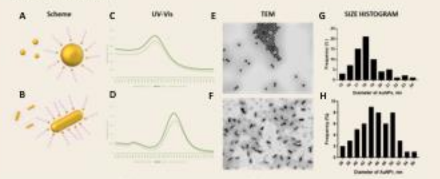

Figure 3 – Scheme of AuNPs with PEG (A, B), UV-Vis spetra with and without PEG (C, D), and Transmission electron microscopy images – TEM [150000x] images of AuNPs with PEG staining with phosphotungstic acid (E,F) and size histogram based TEM images (G,H). The size histogram were obtained by counting over 50 particles.

- **AuNPs uptake in PC3 cell lines**

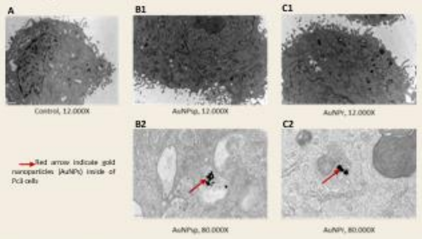

Figure 4 – TEM images of cellular uptake of AuNPs of different shapes in PC3 cells incubated with 10 µM Au[3] concentration. (A) represents PC3 without any treatment; (B1 and C1) represent the overall morphological appearance of PC3 cells when treated with $AuNP_{sp}$ and $AuNP_r$ respectively; (B2 and C2) represent AuNPs taken up by PC3 cells, treated with $AuNP_{sp}$ and $AuNP_r$ respectively. Scale bar: (A, B1, C1) 1µm and (B2, C2) 100nm.

- **Effect of AuNPs in radiosensitivity of PC3 cells**

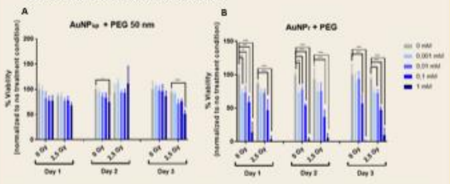

Figure 5 – Effect of AuNPs and ionizing radiation (IR) on the viability of PC3 cell line – A and B represent the viability related with $AuNP_{sp}$ and $AuNP_r$ respectively. The cells were treated with different concentrations (0-1mM) for 24h prior to being exposed to a cumulative dose of 7,5Gy in three fractions of 2,5Gy with 6MV photon beam. Cell viability (%) was measured 24h post-irradiation using the PrestoBlue assay. Results are expressed as the mean ± SD of 3 replicates. Significance of different treatments compared to control of the respective day is represented by black lines shown as * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ and **** $p < 0.0001$.

CONCLUSION

- Our results showed that the shape of AuNPs influence the response to RT.
- This is the first study evaluated the effect of shapes of AuNPs as potential radiosensitizing agent in PC3 cells (prostate cancer cells).
- $AuNP_{sp}$ and $AuNP_r$ demonstrated be effective to reduce the cell viability when associated to RT.
- Comparing both nanostructures, $AuNP_r$ demonstrated better results and a higher dose-dependency with and without radiation.

Figure 5 – Representative diagram of the results obtained

ACKNOWLEDGEMENTS

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REFERENCES

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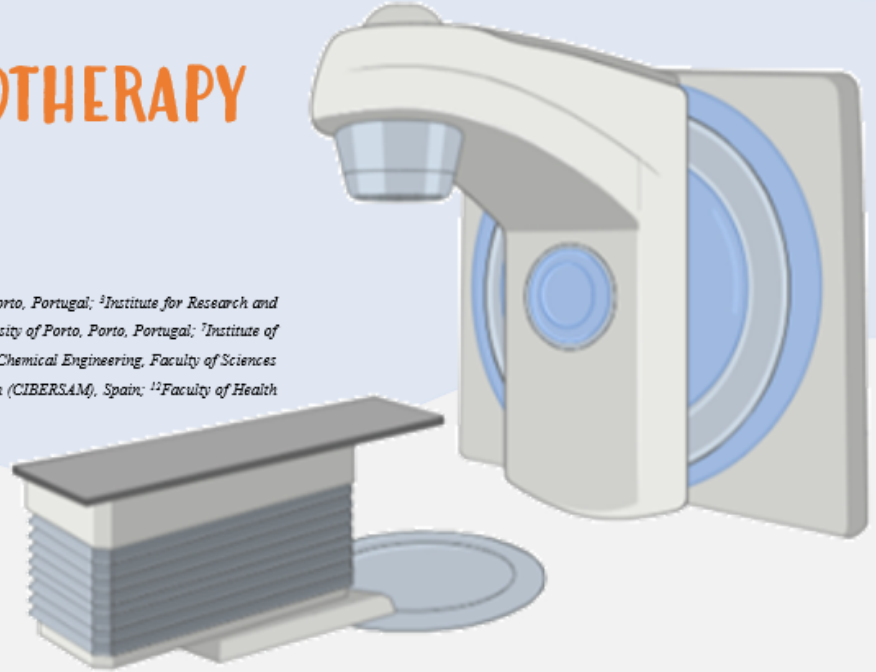
[1]BioMark-CEB/ISEP, Polytechnic of Porto, Porto, Portugal; [2]LaBMI – Laboratory of Medical & Industrial Biotechnology, Porto Research, Technology & Innovation Center (PORTIC), P.PORTO – Polytechnic Institute of Porto, Porto, Portugal; [3]Institute for Research and Innovation in Health (i3S), Porto, Portugal; [4]Faculty of chemistry, University of Vigo, Vigo, Spain; [5]CEB, Centre of Biological Engineering of Minho University, Braga, Portugal; [6]School of Medicine and Biomedical Sciences, University of Porto, Porto, Portugal; [7]Institute of Molecular Pathology and Immunology of the University of Porto-IPATIMUP, Porto, Portugal; [8]Department of Biomedicine, Biochemistry Unit, Faculty of Medicine, University of Porto, Porto, Portugal; [9]Biomark/UC, Department of Chemical Engineering, Faculty of Sciences and Technology, University of Coimbra, Coimbra, Portugal; [10]CINBIO, University of Vigo, 36310 Vigo, Spain; [11]Southern Galicia Institute of Health Research (IISGS), and Biomedical Research Networking Center for Mental Health (CIBERSAM), Spain; [12]Faculty of Health Sciences (FCS) & Hospital Escola Fernando Pessoa (HEFP), University Fernando Pessoa (UFP), Porto, Portugal



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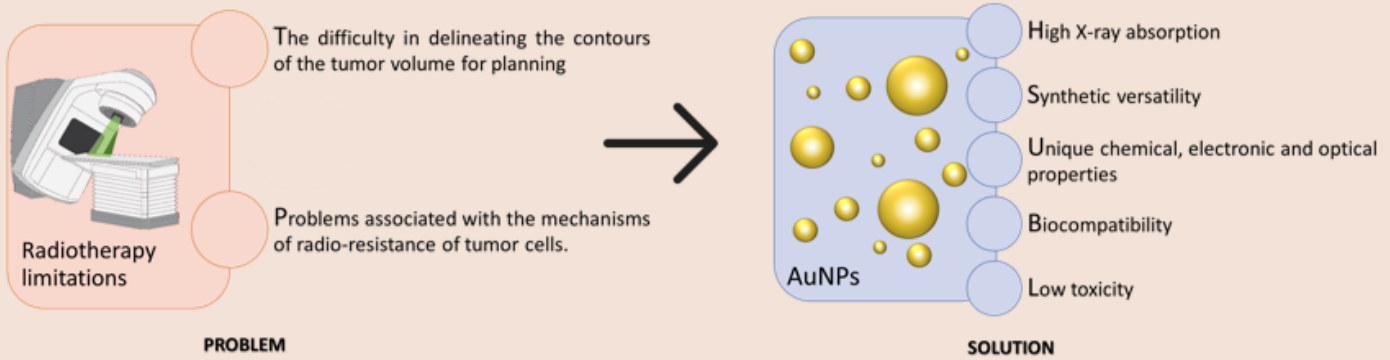

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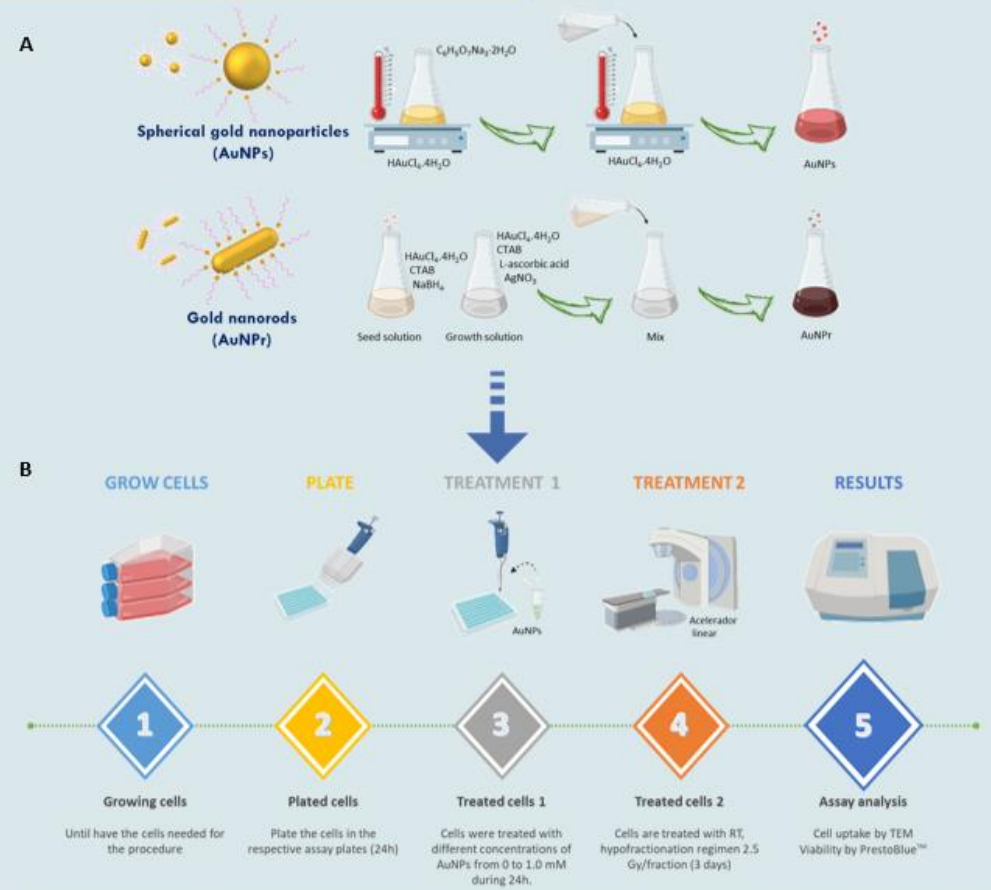

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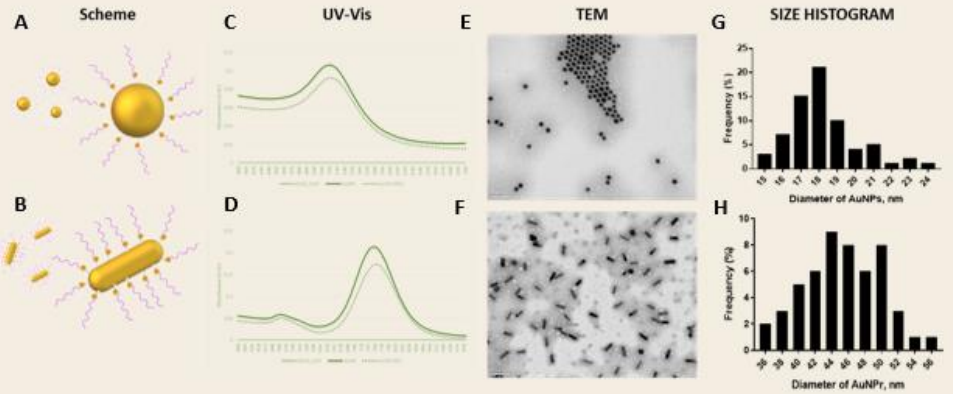

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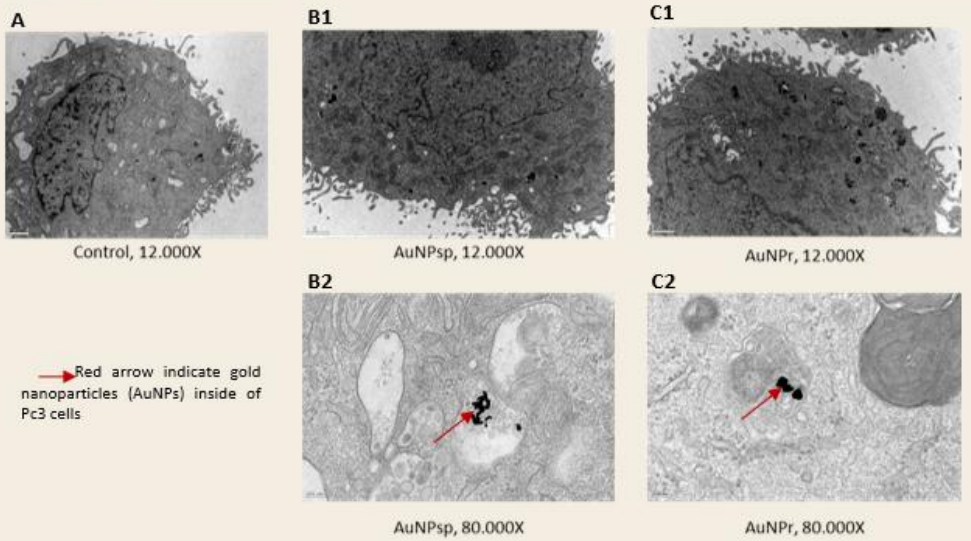

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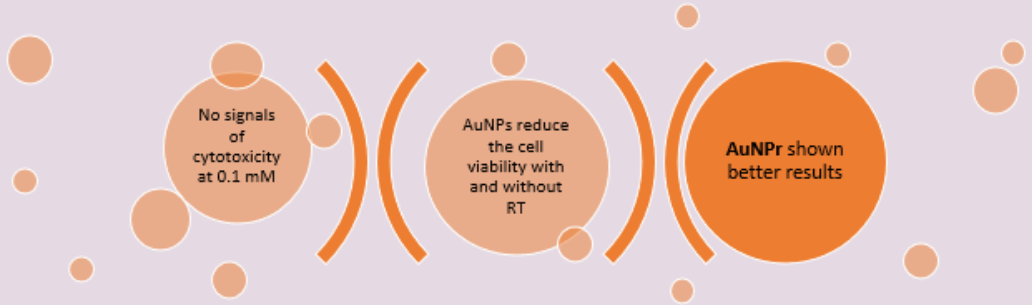

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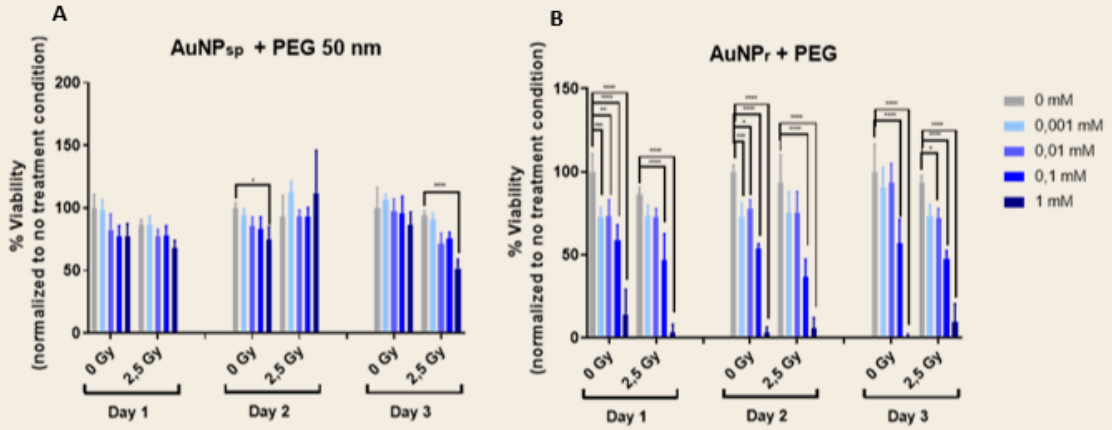

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