Photobiomodulation can delay tumor progression in breast cancer bearing-mice

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Abstract: Cancer is a worldwide health problem and new therapeutic strategies are necessary. Photobiomodulation is a noninvasive and cost-effective therapy, but its use in cancer cells is still controversial. In this study, we explore the effects of PBM on breast tumor bearing-mice.
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1. Introduction

Cancer is a worldwide heath problem and photobiomodulation (PBM) has gained great prominence in heath areas due to search for less invasive therapies. PBM has been reported to modulate inflammatory process, relieve pain and accelerate wound healing [1,2]. In fact, PBM has also proved to be effective in cancer treatment side effects such as oral mucositis, radiodermitis and lymphedema[3-5], due to the better understanding of mechanisms involved and dosimetric parameters. However, its use is still controversial to treat cancer since a few studies report that PBM is able to proliferate tumor cells in vitro[6,7]. Thus, in this work we evaluate the effects of PBM on breast tumor bearing-mice.

2- Materials and Methods

Six BALB/c female mice (6 weeks- 20 g) were inoculated into mammary fat pad with $2x10^6$-breast cancer cells 4T1 transfected with luciferase (4T1-Luc). After two weeks, when the tumor volume was about 100 mm^3, the mice were divided into control and PBM group. The animals of the PBM group were exposed to a single session of red laser (λ= 660 nm) with output power of 40 mW, fluence of 150 J/cm² and energy of 6 J. Tumor volume was measured by a caliper every 7 days during 4 weeks and tumor progression was analyzed through luciferase detection by bioimaging during 14 days. Prior to imaging, mice for both groups received 150 µg/mL luciferin, intraperitoneally. The anti-fatigue effect of PBM was assessed by a forced swimming test with a weight equivalent to10 % of body mass attached to the mouse-tail. The swimming period was considered the time spent floating and moving until exhaustion, with possible drowning. When the mice were unable to remain on the water surface, they were considered with fatigue. Animal survival was also observed during the experimental period. All data were submitted to unpaired t-test and numerical values are presented as mean ± SEM. Statistically significant differences were considered when $p < 0.05$.

3. Results

PBM group presented similar behavior to control group in the first 14 days after laser exposure (Fig.1a). However, on the days 21 and 28, PBM group showed lower tumor volume than control group, although no statistically significant differences were detected between groups. On the other hand, at days 7 and 14 post-treatment, a significantly smaller tumor area was noticed by bioluminescence in PBM group (Fig.1b). Besides, the PBM group showed a better performance in forced-swimming test compared to control group (74.4 ± 0.6 versus 38.0 ± 3.0 s, respectively) on the 14^{th} day (fig. 1c). All data together led to an increase in animal survival. In fact, mice of control group died within 54 days of cell inoculation. In contrast, PBM group survived until 85 days following tumor.

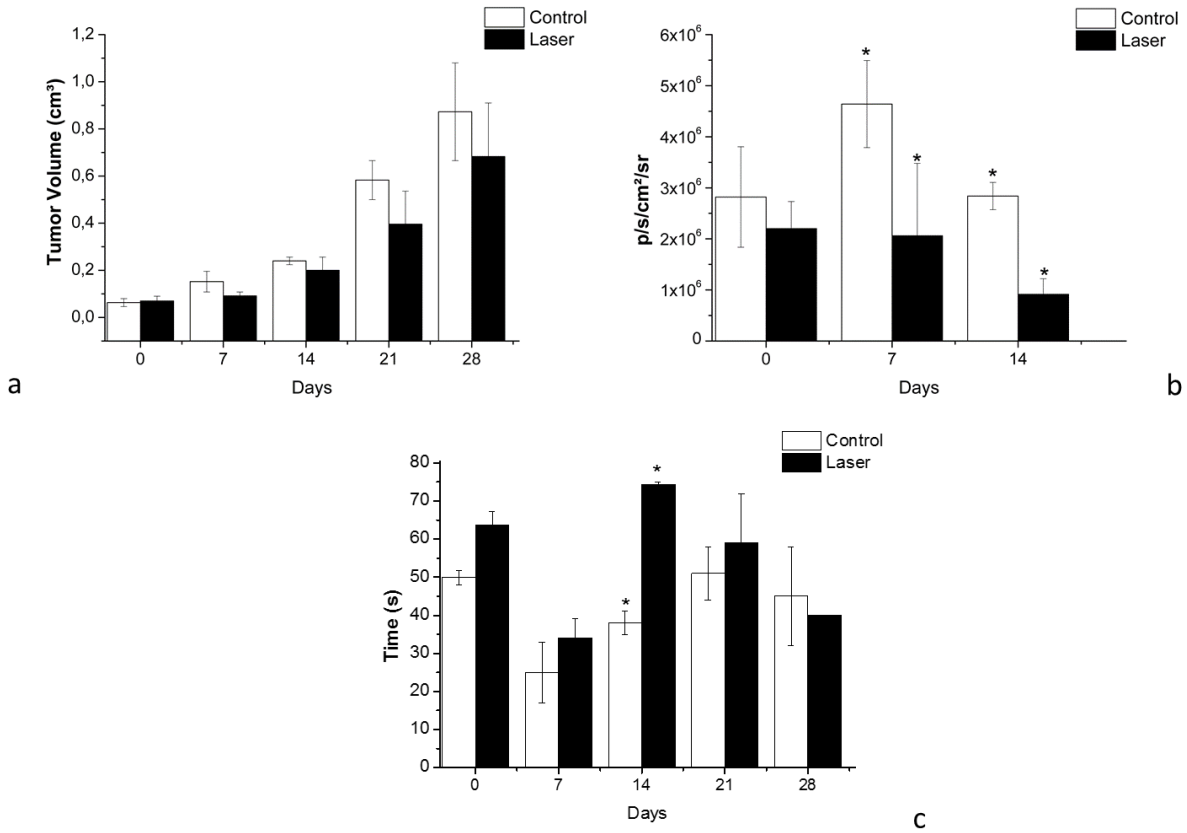

Figure 1- Mean values ± SE of tumor volume (a) tumor area by bioimaging (b) and forced-swimming test (c) of BALB/c mice.

3- Conclusions

Under the parameters used in this study, PBM can delay tumor progression, prolong swimming time and increase life expectancy of breast tumor-bearing mice.

4. References

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