The Outcome of Cell-phone Radiofrequency on Human Head and Neck Cancer cells

*Yaman M. AlAhmad[1], Mohammed Aljaber[1], Mohamed Bossa[1], Huseyin Yalcin[2] & Ala-Eddin Al Moustafa[1,2,3]**

[1]College of Medicine & [2]Biomedical Research Centre of Qatar University, Doha, Qatar; [3]Oncology Dept., McGill University, MTL, Canada

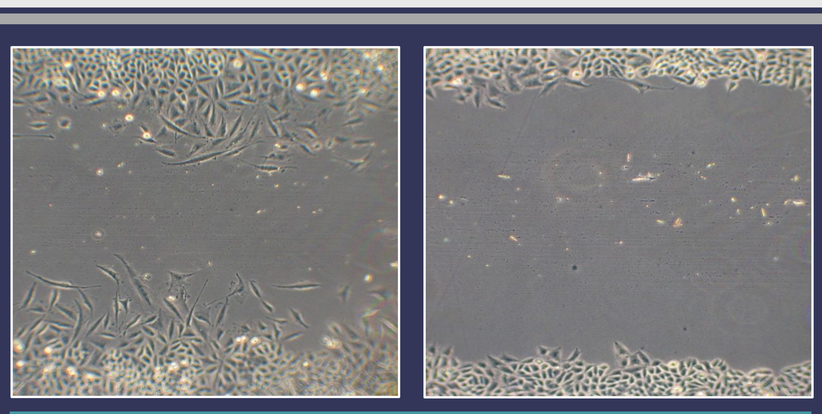
**E-mail: aalmoustafa@qu.edu.qa*

Abstract

Cell-phone is the most widespread technology globally including the Middle-East. Cell-phones transmit and receive radio waves that make the communication possible. However, it has been suggested that cell-phone radiofrequency (RF) use may increase the risk of human brain and probably HN cancers (1, 2). However, the outcome of cell phone RF on head and neck (HN) cancer progression and metastasis has not been explored yet. Thus, we examined the effect of cell-phone RF on cell motility and invasion of two human oral cancer cell lines, SCC9 and FaDu; meanwhile, we explored the outcome of cell-phone RF on angiogenesis using the chorioallantoic membrane (CAM) of the chicken embryo as a model.

Herein, we report that cell-phone RF enhances cell motility and invasion of SCC9 and FaDu cells; this is accompanied by a down-regulation of E-cadherin, which is a major key controller of cell invasion and metastasis (3). On the other hand, we noted that cell-phone RF promotes angiogenesis of the CAM of the chicken embryo at ten days of incubation; it is well-documented that angiogenesis is an important element of cancer progression (4). Regarding the mechanism of cell-phone RF on angiogenesis and cell invasion, we found that cell-phone RF activates Erk1/Erk2 in our cell models which could be the main pathway behind these two important events. Our data suggest that cell-phone RF enhances HN cancer progression by stimulating cell invasion and angiogenesis via Erk1/Erk2.

Objective: *The aim of this study is to investigate the outcome of cell-phone RF on human HN cancer progression and initiation using human HN cancer and normal oral epithelial cell lines as well as CAM models*



Exposed Control

FIGURE 1 *Human HN cancer cells were exposed to cell phone RF on the left. Compared to control (unexposed) human cancer cells on the right.*

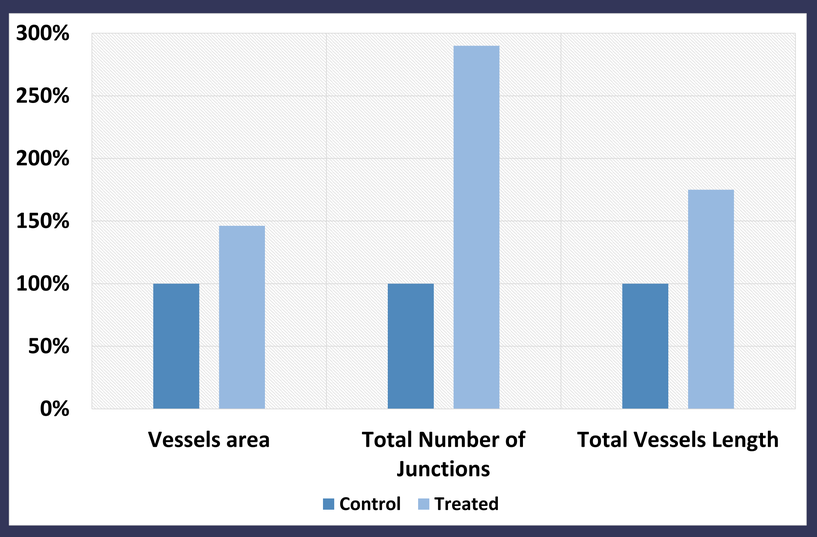
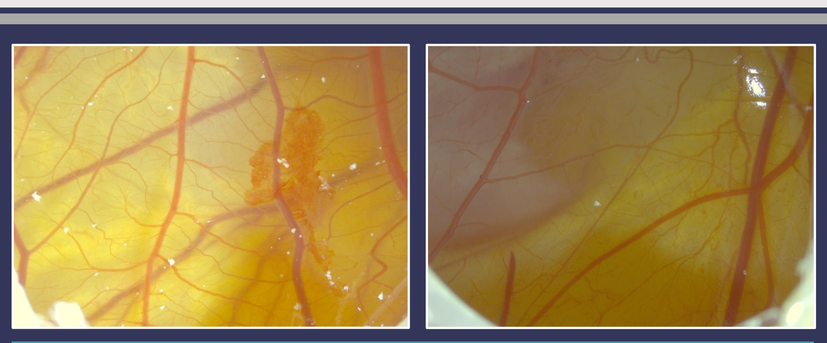
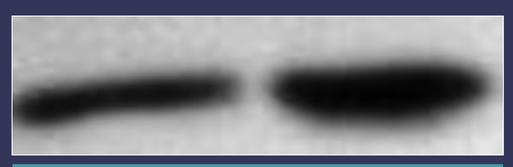


FIGURE 3: *Quantification of angiogenesis of cell-phone RF-exposed embryo. AngioTool softwar was used in this analysis. It is clear from this figure that cell-phone RF increases blood vessel development by around 40-50% after treatment for 4 days in comparison with the control embryos.*



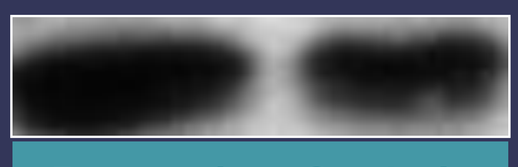
Exposed-embryo Control

FIGURE 2: *Outcome of cell-phone RF on the CAM of chicken embryo of ten days. We note that cell-phone RF stimulates angiogenesis of the CAM of the embryo.*



Exposed Control

FIGURE 4 : *Western blot analysis of E-cadherin expression in FaDu cells exposed to cell phone RF. We note that E-cadherin is down-regulated in cell-phone-exposed cells in comparison with control cells*



Exposed Control

FIGURE 5: *Cell-phone RF enhances Erk1/Erk2 activation of FaDu cells. Cells were exposed to cell phone RF 3 times per day for a duration of 10 min for 3 days.*

Results

1. ***We found that cell-phone RF stimulates cell motility of FaDu and SCC9 cell lines after three days of treatment with cell-phone RF (Figure 1). However, our preliminary data regarding NOE cells showed that cell-phone RF inhibit the proliferation of human normal oral epithelial cells.***
2. ***Our data revealed that cell phone RF enhances angiogenesis in around 80% of treated-embryos in comparison with control embryos after four days of treatment (Figure 2 and 3).***
3. ***We also report that cell-phone RF induces a down-regulation of E-cadherin in FaDu and SCC9 exposed cell lines in comparison with control cells (Figure 4).***
4. ***Finally, we found that cell-phone RF induces Erk1/Erk2 phosphorylation of FaDu and SCC9 exposed cells in comparison with their matched control cells (Figure 5)***

Methodology

Two human oral squamous carcinoma cells, FaDu and SCC9, were used in this investigation; in addition to two human normal oral epithelial (NOE) cell lines (4) which was used as control.

The CAM of the chicken embryo of 6 days of incubation is used to explore the effect of cell-phone on angiogenesis.

In this study a regular cell-phone was used. Cell lines and embryo were exposed to cell-phone RF for a duration of 10 minutes three times per day for three to four days.

Cell wounding assay also was used to assess cell motility under the effect of cell-phone RF.

Western blot analysis and Monoclonal antibodies were used to investigate the expression of E-cadherin and Erk1/Erk2 phosphorylation in our cell-phone RF-exposed cell lines.

Conclusion

In this study, we demonstrate, for the first time, that cell-phone RF can:

Enhance cell motility of human HN cancer cells.

Down-regulate E-cadherin, which is a major tumor invasion suppresser gene.

stimulates angiogenesis of the chicken embryo CAM.

Regarding the molecular pathways of cell phone RF on cell motility and the down-regulation of E-cadherin in HN cancer cells, our preliminary data showed that Erk1/Erk2 phosphorylation could be the main pathways behind these effects. Finally, we believe that more studies are necessary to confirm these important data.

References

1- Al Moustafa et al., 2015. Springer. DOI 10.1007/978-94-017-7380-5_6.
2- Levis et al,. 2011. Environ Health, 17; 10:59.
4- Al Moustafa et al., 2004. Oncogene. 2004 Jan 15; 23(2):350-8.
3- Krishna Priya et al., 2016. Int J Cancer. 2016 Mar 2.0

Acknowledgements

College of Medicine, Qatar University.
Biomedical research center, Qatar University.