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Could DNA damage be a useful biomarker of diagnosis and prognostic in human breast and colorectal cancer?

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Breast and colorectal cancers are the two most common and deadly cancers worldwide. Mechanisms underlying the increasing number of sporadic cases of these cancers are not fully understood, but environmental exposure and lifestyle have been implicated. Among causes of cancer development, genomic instability plays a major role due to constant endogenous and exogenous aggressions to cells that cause mutations when the damage is not repaired. Recently, understanding the mechanisms that drive DNA instability in cancer cells has become an increasingly important area of research, as it has the potential to contribute to the development of new diagnostic tools for cancer. Although controversial, DNA damage is more commonly associated with carcinogenesis, and it has been considered by some authors as a potential biomarker for cancer diagnosis and prognosis. To clarify this issue, we assessed basal levels of DNA damage, in peripheral blood lymphocytes of 58 breast and 27 colorectal cancer patients and a control group of 11 healthy individuals, using the simple comet assay. This work was approved by the local ethic committee and each patient gave a written consent. Most of the studied cancer cases (95.7%) are not hereditary and may be associated with sporadic cases. Results showed that DNA strand breaks levels of all cancer patients are higher when compared to healthy individuals (t-test for independent samples, P=0.001), and are independent of age, gender, and lifestyle, such as smoking and drinking habits, suggesting that high levels of DNA damage are associated with cancer. Particularly, we observed that breast cancer patients in stage III of the disease have a significantly increased level of DNA damage than individuals in stages I and II of the disease (one-way ANOVA, P=0.02), revealing that there was a positive linkage between DNA damage level and the disease stage. In turn, results from colorectal cancer patients did not allow the same conclusions to be drawn, since most patients were stage II. Additionally, results suggest that colorectal cancer patients with a worse prognosis tend to have higher levels of basal DNA damage at diagnosis.

Altogether, these findings support the potential value of DNA damage assessment as a useful biomarker for diagnosis and prognosis in these cancer patients. However, DNA damage is not sufficient for a cancer diagnosis since many factors can contribute to DNA damage and further tests are required for a definitive diagnosis.

Keywords:
Cancer, breast, colorectal, DNA damage, biomarker.