

Testicular Cancer in Teenage Boys: Is Cell Phone Radiation a Risk Factor for Young Boys Who Wear their Cell Phone on a Belt or in a Front Pocket? Cindy Sage

Re: The increasing toll of adolescent cancer incidence in the US

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This highly informative paper on increasing teen cancer rates omits a potential risk factor for testicular cancer.

The authors report that testicular and thyroid cancers are the most rapidly increasing cancers among teens, yet the known risk factors for these cancers do not seem to offer explanation for their marked increase. Although ELF and RF are not 'known risk factors', they are certainly possible risk factors for testicular cancer. It seems reasonable for the authors to consider the rather substantial evidence for adverse effects of ELF and RF from cell phone radiation and other wireless RF exposures on testicular morphology and function where the evidence for pathological changes indicates another possible risk factor for testicular cancer.

Both extremely low frequency (ELF-EMF) and radiofrequency radiation (RF) at environmentally relevant exposure levels are classified now by IARC as Possible Human Carcinogens (IARC, 2013). Dick Clapp was an early leader in acknowledging the possible carcinogenic consequences of electromagnetic fields (Coogan et al, 1996; Clapp, Howe and Jacobs, 2005). In 2005, Clapp judged the potential risks for cancer related to electromagnetic fields sufficient to warrant precautionary action, particularly for childhood leukemia (Clapp et al, 2005).

Overall, the evidence from various laboratories studying male fertility and reproduction effects over the last ten years is important enough raise questions about possible public health consequences (including cancer) of chronic, long-term exposure to mobile phone use, when carried on the body close to the reproductive organs. It is important to recognize environmental-level exposures from cell phone radiation (and the extremely low frequency magnetic field component from battery switching of the phone) are already widely reported to cause significant, deleterious effects on sperm, and testicular morphology consistent with development of testicular cancer. Several dozen studies from various international laboratories have replicated adverse effects on sperm quality, motility and pathology in men who use and particularly those who wear a cell phone, PDA or pager on their belt or in a pocket (Agarwal et al, 2008; Agarwal et al, 2009; Wdowiak et al, 2007; De Iuliis et al, 2009; Fejes et al, 2005; Aitken et al, 2005; Kesari et al, 2010, 2011, 2012, Behari and Rajamani, 2012). Other studies conclude that usage of cell phones, exposure to cell phone radiation, or storage of a mobile phone close to the testes of human males affect sperm counts, motility, viability, morphology and degeneration of the testes (Aitken et al, 2005; Agarwal et al, 2009; Eroglu et al, 2006). Use of electronic household items and cell phones are reported to decrease fertility potential in men by inducing pathological changes in sperm and testes morphology (Eroglu et al. 2006). Avendano et al (2012) reported a 4 hour to a wireless internet –connected laptop resulted in a significant decrease in progressive sperm motility and an increase in DNA fragmentation and keeping a laptop connected wirelessly to the internet on the lap near the testes may result in decreased male fertility. Animal studies have demonstrated oxidative and DNA damage, pathological changes in the testes of animals, decreased sperm motility and viability, and other measures of deleterious damage to the male germ line (Yan et al, 2007; Otitoloju et al, 2010; Salama et al, 2008; Behari et al, 2006; Kumar et al, 2010, 2011). Hong et al (2005) reported that 50 Hz EMFs (0.2 mT or 6.4 mT, exposed for a period of 4 weeks) may have the potential to induce DNA strand breakage in testicular cells and sperm chromatin

condensation in mice. MF-ELF exposure levels of several hundred milligauss can occur during cell phone battery switching when emails or texts are being received (Sage et al, 2007). French et al (2000) reported that repeated exposure to mobile phone radiation acts as a repetitive stress leading to continuous expression of heat shock proteins (HSP) in exposed cells and tissues, which in turn affects their normal regulation, and cancer results. Repeated exposure to cell phone radiation results in chronic expression of HSPs that can lead to induction of cancer. This hypothesis provides the possibility of a direct association between mobile phone use and cancer. Human sperm are damaged by cell phone radiation at very low intensities (0.00034 – 0.07 $\mu\text{W}/\text{cm}^2$). Exposure levels are similar to those resulting from wearing a cell phone on the belt, or in the pants pocket, or using a wireless laptop computer on the lap, in proximity to the testes.

The testes, like the brain, gut and placenta all have barriers protecting them from blood toxins. Several studies have established that cell phone radiofrequency radiation can cause pathological leakage and disruption of the blood-brain barrier (Salford et al, 2003, Salford et al, 2012). By analogy, testicular deterioration from leakage of the testes-blood barrier caused by cell phone radiation may contribute to testicular cancer (Herbert and Sage, 2013).

Given the extensive scientific evidence already published on this topic, it is not surprising that testicular cancer has become epidemiologically visible. Non-ionizing radiation should be one of the key environmental exposures added to the list of possible risk factors for the increase in testicular cancer in boys. It is largely a preventable exposure, particularly in teens who are still under the guidance of their parents and can be educated not to wear a cell phone on a belt, or carried in a front pocket. The authors may find the references below to be helpful.

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