The Effect of Exposure to Electromagnetic Waves on Pregnancy

Thesis

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Obstetrics & Gynecology

By

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Abstract:

Introduction:Several studies have looked into the safety of mobile phones in recent years with uncertain results. There is a growing body of evidence that exposure to high density microwaves can cause detrimental effects to the testis and eyes and induce significant biologic changes. The non-thermal effects of microwaves used in mobile phones has been controversial. There is no epidemiologic evidence today showing that occupational or daily life exposures to microwaves do any harm to human reproductive processes, but experimental animal studies have suggested that microwaves can produce intra-uterine effects including teratogenic effects.

Aim of the study:The present study aimed to assess the effect of electromagnetic waves of mobile phones on the fetal heart rate as well as fetal blood flow using the cardiotocography (CTG) monitoring and Doppler ultrasound evaluation.

Methodology:This prospective study included 90 pregnant females, 30 complicated with IUGR with mean gestational age of 34.6±0.85 wks, and 60 with normal pregnancy with gestational age of 36.25± 0.75wks. All patients included in the study were subjected proper full history taking, examination, CTG and Doppler examination.

Results:Results of the current study showeda significant decrease in fetal kicks in group A compared to group B after cell phone use. No significant difference between study groups regarding CTG variability, acceleration and deceleration was observed.

Conclusion:Our results indicated that electromagnetic fields (EMFs) do not cause any demonstrable effects on baseline FHR, acceleration or deceleration. However, our results showed significant lowering of fetal kicks after cell phone use in both IUGR and normal pregnancy groups

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Key words:cardiotocography *(CTG), Doppler,* electromagnetic fields (EMFs), *fetal heart rate (FHR), intra uterine growth restriction (IUGR).*

List of Abbreviations

AC	Abdominal Circumference
ACRBR	Australian Centre for Radiofrequency Bioeffects Research
AEDV	Absence of end diastolic velocity
AFI	Amniotic fluid index
AFV	Amniotic fluid volume
BPD	Biparietal diameter
CAI	Color amplitude imaging
CDE	Color Doppler energy
CTG	Cardiotocogram
CW	Continuous wave
DI	Doppler index
EFW	Estimated fetal weight
ELF	Extremely low-frequency
EMF	Electromagnetic field
FCC	Federal Communications Commission
FGR	Fetal growth restriction
FHR	Fetal heart rate
GA	Gestational age
HC	Head circumference
IARC	International Agency for Research on Cancer
IUGR	Intrauterine Growth Restriction
MCA	Middle cerebral artery
MFS	Maximum frequency shift
MI	Mechanical Index

MW	Microwaves
PI	Pulsatility index
PW	Pulsed wave
REDV	Reversal of end diastolic velocity
RF	Radio frequency
RFR	Radiofrequency radiation
RI	Resistance index
ROM	Ruptured membranes
SAR	Specific Absorption Rate
SCENIHR	European Commission Scientific Committee on Emerging and Newly Identified Health Risks
SGA	Small for gestational age
TCD	Transverse cerebellar diameter
TI	Thermal Index
U/S	Ultrasound
UA	Umbilical artery
2D	Two-dimensional

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Introduction

Microwave ovens, satellites, and radio/TV transmission and mobile phone transmitters /receivers produce electromagnetic waves daily ***(Khan M, 2008).***

As a matter of fact, we are exposed to electromagnetic waves apart from the occupational exposure with a frequency ranging from 300MHz to 300GHz ***(Khan M, 2008).***

In addition, the common use of mobile phones has given rise to concerns about the potential influences of electromagnetic waves on human physiology ***(Valberg PA, Van Deventer TE et al., 2007)***.

Worldwide use of mobile phones had been increased by the end of 2008 to about 4.1 billion; these users involve pregnant women also ***(Valberg PA, Van Deventer TE et al., 2007).***

Several studies have looked into the safety of mobile phones in recent years with uncertain results ***(Valberg PA, Van Deventer TE et al., 2007).***

There is a growing body of evidence that exposure to high density microwaves can cause detrimental effects to the testis and eyes and induce significant biologic changes involving the central nervous system, cardiovascular system, and hematopioetic system through thermal action ***(Valberg PA, Van Deventer TE et al., 2007).***

Meanwhile, the non-thermal effects of 915MHz microwaves used in mobile phones has been controversial ***(Robert E, 1999).***

There is no epidemiologic evidence today showing that occupational or daily life exposures to microwaves do any harm to human.

There's experimental animal studies which have suggested that microwaves can produce intra-uterine effects including teratogenic effects ***(Mazor R, Korenstein-llan A et al.,2008).***

THE AIM OF WORK

The present study aimed to assess the effect of electromagnetic waves of mobile phones on the fetal heart rate as well as fetal blood flow using the CTG monitoring and Doppler ultrasound evaluation.

Electromagnetic Radiation

- **Introduction**

The electromagnetic environment consists of natural radiation and man-made electromagnetic fields thatare produced either intentionally or as by-products of the use of electrical devices and systems***(Alekseev and Ziskin, 2009)***.

The natural electromagnetic environment originates from terrestrial and extraterrestrial sources such aselectrical discharges in the earth's atmosphere and radiation from sun and space. Characteristic of naturalfields is a very broadband spectrum where random high peak transients or bursts arise over the noise-likecontinuum background. This natural background is orders of magnitude below local field levels producedby man-made RF-sources considered here***(Bahr et al., 2006)***.

The everyday use of devices and systems emitting radiofrequency (RF) electromagnetic fields is continuously increasing. Sources generating high levels ofelectromagnetic fields are typically found in medical applications and at certain workplaces***(Buccella et al., 2007)***.

Cellular mobile communication networks cause on average low levels of electromagnetic fields in areasaccessible to the general public. Handsets and cell phones, however, might cause significantly higherpeak levels of exposure during use***(Calabrese et al., 2006)***.

Electromagnetic radiation can be classified into two types: ionizing radiation and non-ionizing radiation, based on its capability of ionizing atoms and breaking chemical bonds. Ultraviolet and higher frequencies, such as X-rays or gamma rays are ionizing, and these pose

their own special hazards. By far the most common health hazard of radiation is sunburn, which causes over one million new skin cancers annually***(Alekseev and Ziskin, 2009)***.

The non-ionizing radiation could be divided in terms of frequency to extremely low-frequency (ELF), radio frequency (RF) and microwaves (MW) frequencies (fig.1)***(Krawczyk et al., 2008)***.

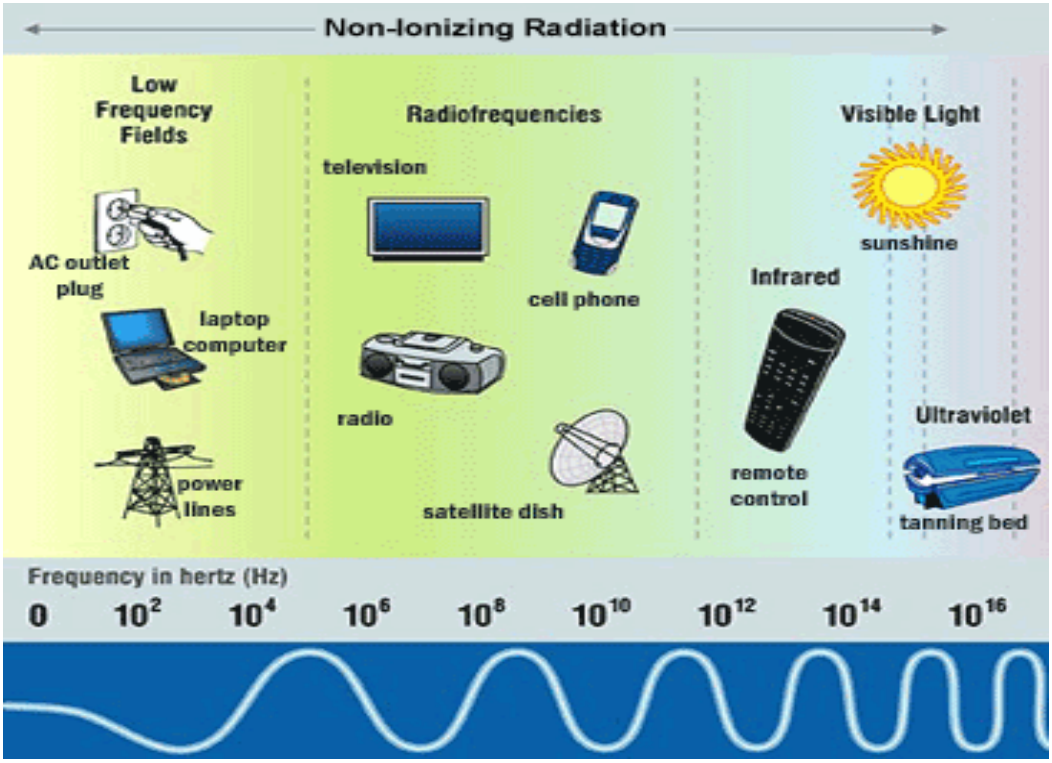

Figure (1): Types of non-ionizing radiation *(Harper and Buress, 2008)*

ELF radiation has very long wave lengths (on the order of a million meters or more) and frequencies in the range of 100 Hertz or cycles per second or less. While, radio frequencies have wave lengths of between 1 and 100 meters and frequencies in the range of 3 kHz to 300 MHz. However, the MWs have wavelengths ranging from as long as one meter to as short as one millimeter, or equivalently, with frequencies between 300 MHz and 300 GHz ***(Pozar, 1993)***.

Microwaves are good for transmitting information from one place to another, because microwave energy can penetrate haze, light rain and snow, clouds, and smoke. The MW is electromagnetic field (EMF), can be considered as a combination between an electric field and a magnetic field. The electrical part is produced by a voltage gradient and is measured in volts/meter. The magnetic part is generated by any flow of current and is measured in Tesla***(Krawczyk et al., 2008)***.

The quantity used to measure how much EMF radiation is actually absorbed by the body is called the ***Specific Absorption Rate (SAR).*** The SAR is usually *expressed in units of watts per kilogram (W/lcg) or milliwatts per gram (mW/g)****(Harper and Buress, 2008)***.

Radiation can affect the body in many ways, and the health effects may not become apparent for many years. Theseeffects range from mild symptoms, such as skin reddening, to serious effects such as cancer and death. These effects are dependent upon the amount of radiation absorbed by the body (the dose), the type of radiation, whether or not the exposure was internal or external, and the length of exposed time ***(Haddow et al., 2008)***.

The body attempts to repair the radiation damage, but sometimes the damage is too severe or widespread. Lapses may also occur in the body's natural repair process in its attempt to compensate for the damage caused by radiation ***(NCRP, 2007)***.

- **Measurement**

Both narrow-band (frequency selective) and broad-band instruments can be used for assessing exposureto RF fields. In selecting instrumentation it is necessary to consider a number of key factors that