Review Article

Neuropsychiatric Effects of Mobile Phones

M.S. Bhatia, Varun Sharma, Vishal Chhabra
Department of Psychiatry, UCMS & G.T.B. Hospital, Dilshad Garden, Delhi-110095

Introduction

The astronomical growth in the numbers of Cell phone subscribers in India makes it one of the world's fastest growing markets. India is the second largest cell phone consumer market behind China. Globalization is the new mantra. In this age, it is very difficult not to have technology. But with technology, come certain hazards. The only way to beat these is correct and timely information and again, better technology. These fancy devices do keep everybody informed and keep everyone connected but do they really inform us about the health hazards they carry. Sadly or rather alarmingly these harmful effects of cell phones have either been neglected or have not been given due importance over the years.

Background

Mobile phone usage is ubiquitous. Mobile phones may be used as hand-held, hands-free fitted into a car, a 'hands-free kit' (consisting of an ear and mouthpiece connected to a transmitter worn on the belt). The RFR (radio frequency range) emitted from the hand-held telephones is low, about 600 mW average for analogue and 2W peak (125 mW average) for digital phones. Digital and analogue mobile phones also send brief location updates, four or more times an hour, to surrounding mobile phone base stations when not in use. The International Commission on Non-Ionizing Radiation Protection has stated that the localized RFR limit for general public exposure (2 W/kg) will not be exceeded by handsets with duty cycle weighted powers less than 600 raW for 900 MHz fields.[1] This assumes an antenna to head separation of 1.4 cm (ICNIRP 1995). These safety standards, by the way, were developed by electrical engineers, not doctors.

The most basic fact about cell phones and cell towers is that they emit microwave radiation; so do Wi-Fi (wireless Internet) antennas, wireless computers, cordless (portable) phones and their base units, and all other wireless devices. If it's a communication device and it's not attached to the wall by a wire, it's emitting radiation. A cell phone that is on but not in use is also radiating. And, needless to say, cell towers are always radiating.

Why is this a problem, you might ask?

Scientists usually divide the electromagnetic spectrum into "ionizing" and "non-ionizing." Ionizing radiation, which includes x-rays and atomic radiation, causes cancer. Non-ionizing radiation, which includes microwave radiation, is supposed to be safe. This distinction always reminded me of the propaganda in George Orwell's Animal Farm: "Four legs good, two legs bad." "Non-ionizing good, ionizing bad" is as little to be trusted.

Let me give you an example for that. From 1953 to 1976 the Russians irradiated the U.S. embassy in Moscow with a steady 24 hour-a-day bombardment of radio frequency radiation. The embassy staff members experienced loss of ability to think, to concentrate and to sleep. The American ambassador came down with leukemia and had to be replaced. Then the second ambassador came down with leukemia and also had to be replaced. Staff blood samples sent back home for analysis showed DNA damage and a loss of ability to repair it. Staff dysfunctions continued. The irony is, this same technology is now being touted as an aid to public safety.

The Russians knew what they were doing. They had reproduced in the embassy staff the same symptoms they had previously identified under experimental conditions as "Radio Frequency Sickness Syndrome." They had proven that radio frequency radiation - RFR - can be used as a weapon against either a specific target group or against the general population.

The Physics and the Biology of Mobile phones

Do cell phones really emit that much radiation which can be harmful to us? Then here is the answer.

An astronomer once quipped that if Neil Armstrong had taken a cell phone to the Moon in 1969, it would have appeared to be the third most powerful source of microwave radiation in the universe, next only to the Sun and the Milky Way. He was right. Life evolved with negligible levels of microwave radiation. An increasing number of scientists speculate that our own cells, in fact, use the microwave spectrum to communicate with one another, like children whispering in the dark, and that cell phones, like jackhammers, interfere with their signaling. In any case, it is a fact that we are all being bombarded, day in and day out, whether we use a cell phone or not, by an amount of microwave radiation that is some ten million times as strong as the average natural background. And it is also a fact that most of this radiation is due to technology that has been developed since the 1970s.

As far as cell phones themselves are concerned, if you put one up to your head you are damaging your brain in a number of different ways. First, think of a microwave oven. A cell phone, like a microwave oven and unlike a hot shower, heats you from the inside out, not from the outside in. And there are no sensory nerve endings in the brain to warn you of a rise in temperature because we did not evolve with microwave radiation, and this never happens in nature. Worse, the structure of the head and brain is so complex and non-uniform that "hot spots" are produced, where heating can be tens or hundreds of times what it is nearby. Hot spots can occur both close to the surface of the skull and deep within the brain, and also on a molecular level.

Neuro-psychiatric sequelae

There have been a number of scientific reports concerning the possible relationship between exposure to radio frequency fields (RF) during mobile phone use and reported harmful effects ascribed to regular cell phone usage[2,3,4] such as

- Headaches, Dizziness, Nausea
- Memory loss, Mood swings (rage), Sleep disorders
- Fatigue, Loss of concentration, Lack of coordination
- Pain in hands or arms, Skin sensations

Hocking reported about Disturbing symptoms from the use of mobile telephones in his paper[5]. He reported some patient account in his paper as:-

1. 'It has been noted that by using the mobile phone in the transmit mode, the side of the head closest to the phone heats up and at different periods of time persistent migraines appear.'
2. 'I have noticed persistent strong headaches for a period of 4 days; worsening after using the mobile phone for extended periods of time (approx. 10-15 minutes, 4-5 times a day). These headaches have been occurring on the left side of my head, adjacent to phone and aerial.'
3. 'I've also noticed migraines to the side of the head which sort of goes away on the weekend, when we don't use the mobile phone. But it persists during the weeks since we had the phones.'

He concluded the paper with intent to characterize the syndrome of symptoms associated with mobile phone usage. The symptoms are felt in the temporal, auricular, or occipital areas and were often described as a dull or burning pain. The unpleasant sensations may begin within minutes of beginning a call or come on with usage during the day. The symptoms may cease within the hour after a call or last till bedtime. Some cases have symptoms suggestive of intra-cranial effects on vision, inner ear and cognitive function. Symptoms do not occur with ordinary handset usage. Symptoms may occur around the waist when the mobile phone is worn on the belt.

The occurrence of 'headaches' was noted in the laboratory setting with similar exposures 30 years ago. Frey[6] has described how in the course of an experiment he and his volunteers developed headaches during exposure to the side of the head from 1.3 GHz radar-pulsed RFR at 400|iW/cm2 averaged power. (The estimated energy from a mobile phone is similar). Reports of cranial symptoms are now being reported from Sweden, the UK, the USA and New Zealand.[6]

Many of these cases are characterized by symptoms of dizziness, disorientation, nausea, headache, and transient confusion. Such symptoms might be expected to arise from unilateral stimulation of the vestibular apparatus. This could occur from the direct action of the radio waves on the endolymph or the hair cells in the semicircular

canals or from convection currents set up in the external auditory meatus from the heat of the mobile phone. Most patients complain of a sensation of heating round the ear, often accompanied by reddening of the skin. Blanks *et al*[7] have shown that there is significant variability in the precise orientation of the semicircular canals, which may result in a predilection to greater thermal stimulation in some people. Because mobile telephones tend to be used in noisy situations, the user holds the instrument much more tightly to the ear than he does a normal phone. In the opinion of the author[6] there is good theoretical and clinical evidence to support the hypothesis that some people, perhaps 5% to 8% of mobile phone users, have transient symptoms of vestibular disturbance associated with their use. It is not only during the day time that mobile phones have an adverse impact on the quality of living. The harmful effects of the day time exposure to radiofrequency are even more marked during the sleep. Lack of proper sleep, fatigue, and tiredness, are common. Regular cell phone users are more prone to feel drained and have lack of energy during early morning. Some people get up in the middle of night just to check on there cell phones thus reducing the duration of uninterrupted sleep. The main health risk is less time in the deeper stages of sleep that can help the body recuperate. It is suggested that regular late night mobile use by teenagers may even lead to mood and personality changes and problems like ADHD.[8]

The term **ringxiety** coined by David Laramie has already been discussed about in the previous issue of this journal under newer psychiatric diagnostic entities. *Ringxiety* also known as fauxcellarm or phantom phone rings is a type of audio illusion which is increasing in incidence with each passing day. A person suffering from ringxiety describes a nagging sense of hearing mobile phone ringing of feel it vibrating when actually is not.

Results from one recent study done in 2007 study[9] suggest that suggest that RF exposure under conditions similar to cell phone usage is associated with adverse effects on sleep quality within certain sleep stages. The strengths of this study compared to earlier studies was the longer exposure time during worst conditions and a wider range of outcome variables, including self-reported, neuro-endocrine, and neuro-physiological variables.. Considering all other possible confounders, the authors still concluded that there is a statistical association between RF exposure and specific self-reported and Neuro-physiological variables, pertinent to possible effects from mobile phone-generated RF exposure. Future analysis of the study as well as further studies were advised to clearly assess various biological, neuro-physiological, and cognitive outcome measures, e.g., spatial memory, performance, and EEG data.

Mobile operators and governments have claimed cell phones don't emit enough microwaves harm people, but sensitive Koreans are feeling their negative effects. According to a survey by Rep. Suh Hae-suk at the governing Uri Party, 10.9 percent of 1,034 respondents said that they felt physical disorders due to cell phone usage.[10]

Physical damages

Apart from neuro-psychiatric and subjective symptoms ascribed to cell phone usage, some startling associations have been made to regular usage of this telecommunication wonder which are really scary. While industry sponsored studies have failed to show a clear link between cell phone usage and brain tumors (there are other effects which have been ignored by industry studies), independent scientific studies[11] show that the radiation from hand held mobile phones do pose serious health risks and can increase the incidence of brain tumors. Microwave signals travel through human tissue, glass, metal and plastic. Human tissue also absorbs microwave radiation. The effects of even minute levels of microwave radiation have been shown to:

- Open the blood-brain barrier to viruses and toxins
- Heat head, brain tissue & disrupt brain activity
- Reverse cell membrane polarity
- Alter brain waves & alter brain chemistry Alter the brain's electrical activity during sleep
- Cause memory loss and mental confusion
- Cause headaches and induce extreme fatigue
- Damage nerves in the scalp
- Cause blood cells to leak hemoglobin
- Create joint pain, muscle spasms and

tremors
- Create burning sensation and rash on the skin
- Induce ringing! in the ears, impair sense of smell
- Precipitate cataracts, retina damage and eye cancer
- Reduce the number and efficiency of white blood cells
- Stimulate asthma by producing histamine in mast cells
- Cause digestive problems and raise bad cholesterol levels
- Stress the endocrine system, especially pancreas, thyroid, ovaries, testes
- Damage DNA

The effects of the radiation can produce a wide range of physical symptoms. Some symptoms may take years to show up. Some of the effects can be short-term while other effects can be long-term or permanent. Opening the blood-brain barrier allows toxins into the brain that cause a wide range of ailments - many of which are currently unknown or poorly understood.

Irrefutable evidences

Since 1988, researchers in the laboratory of a Swedish neurosurgeon, Leif Salford, have been running variations on this simple experiment: they expose young laboratory rats to either a cell phone or other source of microwave radiation, and later they sacrifice the animals and look for albumin in their brain tissue. Albumin is a protein that is a normal component of blood but that does not normally cross the blood-brain barrier. The presence of albumin in brain tissue is always a sign that blood vessels have been damaged and that the brain has lost some of its protection. Here is what these researchers have found, consistently for 18 years: Microwave radiation, at doses equal to a cell phone's emissions, causes albumin to be found in brain tissue. A one-time exposure to an ordinary cell phone for just two minutes causes albumin to leak into the brain. In one set of experiments, reducing the exposure level by a factor of 1,000 actually increased the damage to the blood-brain barrier, showing that this is not a dose-response effect and that reducing the power will not make wireless technology safer. And finally, in research[12] published in June 2003, a single two-hour exposure to a cell phone, just once during its lifetime, permanently damaged the blood-brain barrier and, on autopsy 50 days later, was found to have damaged or destroyed up to 2 percent of an animal's brain cells, including cells in areas of the brain concerned with learning, memory and movement. Reducing the exposure level by a factor of 10 or 100, thereby duplicating the effect of wearing a headset, moving a cell phone further from your body, or standing next to somebody else's phone, did not appreciably change the results! Even at the lowest exposure, half the animals had a moderate to high number of damaged neurons.

One can argue that only lab rats were affected. How come something safely tested on rats is considered safe for humans but some results clearly showing harmful effects on them are not given due importance? A guess from your side is as good as mine!

America's Allan Frey, during the 1970s, was the first of many to demonstrate that low-level microwave radiation damages the blood-brain barrier.[13] Similar mechanisms protect the eye (the blood-vitreous barrier) and the fetus (the placental barrier), and the work of Frey and others indicates that microwave radiation damages those barriers also.[14] The implication:

No pregnant woman should ever be using a cell phone.

Brain cancer rates in USA have increased by 25% since 1975. In 2001, 185,000 Americans were diagnosed with some form of brain cancer. A grade four brain tumor can grow from the size of a grape to tennis ball size in just 4 months. Brain tumors are almost always fatal and most people die within 6-12 months after diagnosis. Although no specific causation has been reported but isn't it interesting to note that RFR have increased during this period remarkably & these radiations are known factors for brain cancer. An epidemiology study conducted by Dr. Lennart Hardell found a higher incidence of brain tumors on the sides of heads used by mobile-phone subscribers to make and receive calls. The study was published in the August, 2002 issue of the European Journal of Cancer Prevention.

Other organs that have been shown to be especially susceptible to radio waves include the lungs, nervous system, heart, eyes, testes and

thyroid gland. Diseases that have increased remarkably in the last couple of decades, and that there is good reason to connect with the massive increase in radiation in our environment, include *asthma, sleep disorders, anxiety disorders, attention deficit disorder, autism, multiple sclerosis, ALS, Alzheimer's disease, epilepsy, fibromyalgia, chronic fatiguen syndrome, cataracts, hypo-thyroidism, diabetes, malignant melanoma, testicular cancer, and heart attacks and strokes in young people.*

In 1993, the telecom industry committed $25 million dollars for a series of research projects designed to prove that cell phones are safe. The studies proved just the opposite! They proved that federal microwave exposure standards are dangerously inadequate. Cell damage and tumors can be easily induced in the lab at about one third of the FCC's exposure guidelines.

Despite damning evidence, the FDA still prevaricates: "There is no reason to conclude that there are health risks posed by cell phones to consumers." Meantime, the telecom industry has been pressing to increase by more than 10 times the allowable human exposure to cell phone radiation !

Luckily, Dr. George Carlo headed up the industry's study project. He presents the shocking facts in his book, Cell Phones: Invisible Hazards in the Wireless Age: An Insider's Alarming Discoveries About Cancer and Genetic Damage (Carroll and Graf, 2001). A summary of Dr. Carlo's book is this: Cell phones are hot, adequate protective regulations are naught, and humans are being "fried" so that the deceitful telecom industry can rake it in! It's dirty business as usual, and the longer the industry can con the public, the more billions it collects.

Parents in some European nations are now warned to *keep children away from cell phones*. A University of Utah researcher found the younger the child; the more radiation is absorbed by the brain. Spanish researchers have shown that cell phones can alter electrical activity of a child's brain for hours, causing drastic mood changes and possible behavior and learning disabilities. Scientists fear that cell phone radiation could damage human embryos. Pregnant women are advised to be wary.

Driving and Talking – A Big No No

A cell phone must greatly increase its field strength to maintain communications within the metallic cage of an auto. Thus, the effect of microwave radiation inside a vehicle is especially intense. Volkswagen of Europe has warned that cell phone usage inside a car can be "injurious to health due to the extremely high electromagnetic! Fields generated."

Insurance studies in England showed that an average driver talking on a cell is actually more impaired in function and reaction time than a drunk. Finland's Radiation and Nuclear Safety Authority reports that one hour of exposure to mobile phone radiation can cause human cells to shrink. Researchers believe this is due to increased protein activity, an indicator of cell damage. What an unstable world needs now is a global population afflicted with incredible shrinking brains!

Some researchers claim that holding a mobile phone between the raised shoulder and the ear could have a damaging effect on muscles, bones, tendons and discs. These problems would apply equally to a cordless phone or a landline phone as to a mobile phone and are the effect of bad posture.

One writer has put the harmful effects of RFR's and cell phones in perspective similar to that of tobacco usage 30 years ago. He has predicted similar epidemiological effects with global population being affected and world wide measures being required to curb the side effects.

More and more Evidence after evidence can be provided damming the RFR's and the cell phones but more appalling is the way the consumers have been kept in dark about these issues. Interestingly all the references quoted here and the material used to write this article is in public domain. So, why is this cover up? Again I will say your guess is as good as mine!!

Is all lost? Should all cell phones be thrown away in darkest corners of deep sea? Aren't they a necessity and part of life? So what to do? First of all cell phone users have right to information and cell phone usage should be an informed choice. Also adequate safety measures must be taken as given by :

The WHO (World Health Organisation) Rules

1. Cell phones should be used for emergen-

cies, and not for long conversations.

2. A small chip-like cell phone microwave radiation protection device is available, which has the ability to absorb electromagnetic energy waves from your mobile phone. It helps in reducing the potential harmful effects of these emissions to the human body.
3. Using a mobile headset is a good idea, you don't have to hold phones next to your ears all the time.
4. Mobile phone users should limit their exposure to harmful radio frequencies by cutting the length of calls.
5. Hands-free devices cut exposure by keeping the instrument away from the head and body.
6. Driving cum mobile phone talking should be banned.
7. Mobile phones should not be used in Intensive Care Units of hospitals as they can pose a danger to patients by interfering with the working of pacemakers and defibrillators.
8. People with hearing aids should not use mobile phones.
9. Base stations, which have low powered antennae on their terrace to communicate with cell phones, should not be located near children's schools and playgrounds

Nomophobia : Almost everyone can identify with stress arising out of death, loss, separation or shifting house. But can anyone identify with stress arising out of not being in mobile contact. The term "Nomophobia" is an abbreviation of No Mobile Phobia. It is believed to be a new manifestation of the disorder known as "fear of missing out".

Fear of being out of mobile phone contact affects over 13 million people across the UK. A study conducted by YouGov revealed that nearly 53% of mobile phone users (58% men and 48% women) in Britain tend to get anxious or panic or phobic when they lose their mobile phone, run out of battery or credit, or have no network coverage. Over 20% accept that they never switched off their mobile phones – with one in ten citing the reason as job requirements, 9% said that having their phone switched off made them anxious and 55% giving the reason as keeping in touch with friends, family and colleagues.

In our opinion, the pathological dependence on mobile also fulfills the criteria of so called "Mobile or Cell Dependence Syndrome" resembiling substance Dependence Disorder, producing predominantly 'Psychological Dependence'. Mobile phone use can be considered as one of the socialized form of addiction or dependence.

The possible areas of research on 'mobile addiction' relate to Host (psychological profile, physical and psychological impact and adverse sequelae, withdrawal syndromes), Agent (Type, Mode, Time and Duration of daily use, Addiction potential) and Environment (Company, Family, Society and Laws affecting use). The other areas which need detailed exploration is Sexting (sending messages with sexual connotations representing foreplay), spread of nosocomial infections (as mobile phones are never washed or cleaned) and effects of mobile phones radiations on pregnancy and children.

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