EFFECTS OF MAGNETIC FIELD ON CANCER CELL LINE

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ABSTRACT

Cancer is life taken diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. The various methods like chemotherapy, radiotherapy, use of medicinal plants and chemical drugs have been successfully employed for the treatment of this disease. Although, these methods can control the cell division or spreading of disease but the side effect of these methods are also well explored. Use of magnet in the treatment of various diseases like Asthma, diabetes, eye problem, headaches, injuries, overweight, migraines, liver disorder, kidney problems, insomnia, hypertension from ancient time has been well reported but the effect of magnetic field on cancer cell line has not well explored. The present review helps in exploring the possibilities of magnetic therapy in cancers treatments.

KEYWORDS

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Magnet
Magnetic Fields
Electric Fields

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1 Introduction

In Western culture about 2,000 years ago magnet name was introduced with the rediscovery of lodestone from mountainous Magnesia region of Greece. Magnet a piece with property of attracting iron and other similar materials can be a life line for human generation. Magnet can cure many lives taken diseases including cancer. Aristotle (300 B. C) was the first who used the magnet for healing purposes. Use of magnet in treatment of disease was also reported in 100 AD, it was by a Greek physician Pliny for treating eye diseases. Similarly, Roman physician Galen used magnate for the treatment of colon infection in 3rd century. From this time onwards people stated using magnet for treating various disease like Asthma, diabetes, eye problem, headaches, injuries, overweight, migraines, liver disorder, kidney problems, insomnia and hypertension. Information about the use of magnet by Chinese was also reported, they treated wounds with magnetic power which stopped pain and accelerate healing. By that time they did not know purpose of using magnet, but in 1530 Paracelsus demonstrated the used of different poles of magnet that is north and south for different healing diseases. William Gilbert was the pioneer researchers of this field (Payne 1997).

1.1 Magnet revolution on 20th Century

Albert Davis (1936) used magnetic poles on rats, mice and other animals for investigating its effects on biological organisms, he extended his work on plants and seed also. This magnificent works shows the effect of north and south poles and according to this North Pole stimulated the activities of the cell while South Pole has suppressive effect on the cell. Similarly, Davis concluded that negative pole have fruitful effects on human body and with that of positive pole showed stressful effect. Persistent exposure of positive pole, hinders body metabolic function, decreases oxygen supply in body, produces acidity and encourages replication of latent microorganisms, it will also increase pain because of interference in body (Jordon et al., 1999). With that time people came to know about the role of magnates in the curing of arthritis, if South Pole used for several months it gives relief in pain also inhibits the expansion of pain. Magnetic treatment not only was helpful in curing arthritis but was also useful to heal sprains and broken bones. Scar tissues formation can be reduced and healing time was also speed up with magnetic treatment process. 1,712 patients with different ailments pertaining to circulatory disorder, inflammation, joints and organ disorders, fractures and acute injuries were examined with pulsed magnetic fields by Marcus Weber (1992), the result of this study showed a fabulous affects on responded. Approximately 60% responded found good or very good results without any side. This electromagnetic therapy gives healthy body for the mankind. Many researchers reported the antitumefr activities when the combindely provided of DC/AC and Magnetic fields (Novikov et al., 1996, 2005; Novikova et al., 1998; Novikov, 2004).

2 Magnet on cancers cells

Cancer is a result of uneven synchronization between cell division and cell death which is known as apoptosis resulting in formation of carcinogenesis. To cure cancer much attention has given on the regulation of apoptosis because if apoptosis is balance that will lead to normal cell growth. (Fang et al., 1998; Silva et al., 1996, Saxena et al., 2013). Malignant tumour in a host can be pretentious by using bio-electromagnetic phenomena. People who live near power transmission lines are very close to be effected by leukaemia. (Poole, 1991; Chen, 1997). Frequency of ~50 Hz, near power transmission cables is to found of fluctuating electromagnetic fields, this frequency reaches human physiology frequency of ~1Hz, this low frequency can be known as static magnetic field. Different frequency of magnetic field also plays different effects on biological body, Chang et al. (1985) reported that pulsed magnetic field which is 0.8T , 22ms, 1Hz hamper the growth of S-180 sarcoma in mice, with that same magnetic fields was been applied to treat patients which helps patients to cure certain disease in their middle and late-stage. ELF pulsed gradient magnetic field on S-180 sarcoma in mice not only slowdown, but also enhance its oncolytic power of host immune cells (Zhang et al., 1995 & 1997) Nd-Fe-B permanent magnet with 0.4T was used in early days to cure cancer cases (Zhou, 1994). Apoptosis in cancer cells with the effect of ELF pulsed gradients magnetic field can prompt its effects with blocking of development of neovascularisation which is required for tumour supply (Zhang et al., 2002). When magnetic field was applied on sarcoma cells the mean weight of the treated mice upturn after 5 days of the experiments with that of control (cancer cells without magnetic field) which showed that treated mice were higher in weight than the untreated one and this improvement have a positive correlation with the days of exposure and weight. Treated sarcoma mice showed smaller and harder, this tissue can be unproblematic to be cut off from the adjoining tissue present, but the control sample was larger and spongy and was difficult to be separated from surrounded tissues. This magnetic effects showed its power on endothelial cells also, treated mice tumours blood vessel swollen up to obstruct the vessels of blood if might be possible that a part effected with cancer might have occlude sufficient supply of nutrition and oxygen (Zhang et al., 2000; Zhang et al., 2002).

Cadossi et al. (1991) upsurge the bone marrow toxicity of cyclophosphamide of mice by low frequency pulsing electromagnetic field. Carboplatin (Sandler et al., 2006) an anti-cancerous drug which act on cancer cell line A - 431 and HT - 29 escalates up its effects when PMF (pulsed magnetic field)
with 0.525 mT average magnetic field was exposed for 1 hour. Another anti-cancerous drug cisplatin didn’t showed any response PMF, drug Daunomycin which is also an anti-cancerous was effective only for HT-29 (Hannan et al., 1994)

2.1 Cancer Cells

Magnet treatment effects magnify the response of the body cells by increasing metabolism of body which enhances mitochondria and RER activities. N/P ratio (Main et al., 1997) magnetic effects showed results in decreasing N/P ratio with round nuclei which is showing that cells are at the juncture to be cure, this result is different with that of cancers cells as nuclei of cancer cells are not uniform (Zhang et al., 1997). This accomplish that magnetic field lessens down ‘degree of malignancy’ of cancers cells and hinders its brisk and heteromorphic growth. Cancer cells which were treated with magnet delivered some of the morphological characteristics with that of programmed cell death (PCD). Apoptotic bodies which were wad with cellular membrane debris, emerge were dissolved by macrophages and lymphocytes. With the effect of magnetic field like phagocytes and lymphocytes which are immune cells and are responsible to digest cancer cell by surrounding it were protuberantly seen around sarcoma cells (Sabo et al., 2002).

2.2 Macromolecules

Mitosis and DNA replication of sarcoma cells can be deter with help of magnetic which is monitored because of decrease in DNA content, done with Feulgen staining (Zhang et al., 1997). With this phases of sarcoma cells also decrease down (Zhang et al., 1995).

2.3 Leukemic cells

Static Magnetic field also showed its effect on human leukemic cells line HL-60 when exposed for 1 Tesla for 72 hrs, which retarded the metabolic activities of cells (Sabo et al., 2002). Similarly, Markov (2000) reported that low frequency electric filed temper biological bodies, but similar frequency magnetic field can penetrate into human body and showing effective results. In 1984 Ardito et al., concluded that 4.1% diminution in proliferative rate, when static magnetic field of 0.074T for around 48 hours was in conducted on human lymphocytes cells. If human cancers cells and mouse effected with cancers cells go through 11.6 Tesla of static magnetic field for 1h it showed 10% survival fraction (Tata et al., 1994).

Magnet therapy, magnetotherapy or magtherapy is unconventional medicine which comprises with static magnet fields. It was claim that if evident body part is exposed by permanent magnet it’s showed advantageous effects on health (Tofani et al., 2002). Haemoglobin is repulsive in magnetic field because of its diamagnetic property. The magnets used, are many orders of magnitude too weak to have any measurable effect on blood flow (Stick et al., 1991). As we all know that every magnet consist of two poles that is north and south pole, these poles might be known as positive and negative respectively. These negative and positive poles have diverse effects on animals and human body cells. Our body yield a imperceptible magnetic fields with is engender by body chemical reaction which takes place in cells and impulse produce by body nervous system. An electromagnetic field (EMF) unruffled of magnetic and electric field both. Presence of magnetic field is anticipated because of the movement of charged particles and electric filed is due to presence of charged particles.

It was also found that magnet showed no effects on cell growth rate (Eiselein et al., 1961; Hall et al., 1964; Halpern and Greene, 1964; Greene and Halpern, 1966; Iwasaki et al., 1978; Chandra and Stefani, 1979; Frazier and Andrews, 1979; Short et al., 1992). No changes was noticed in growth rate for two cell lines culture ,when 47 Tesla of static magnetic field was applied for 72 hours human fibroblastoma (DMD-A) and human melanoma (PS1273) (Short et al., 1992). Not all cells under the effects of magnet show uniform reduction in growth rate or we can say that there is no pattern of magnetic effects, this results varied from 19% for the melanoma cells to 40% for the Raji cells when exposed to 7 Tesla. When magnetic field was applied on HTB63 (melanoma), HTB77 IP3 (ovarian carcinoma), CCL 86 (lymphoma, Raji cells) the percentage reduction in cell growth was noticed in different phase of cell cycle. In HTB63 cell growth was reduced to 67% as the normal growth without magnet was 64.4% in G1 phase, in G2 phase there was no changes in growth, but in S phase percentage fall to 20.4 % as compared to 23.0% with normal growth. In G1 phase of HTB77IP3 cell was reduces to 53.6% which was noted to 65.4% in normal growth, there was no change in G2 growth rate which was 1% in both cases. S phase of HTB cells growth rate showed increases in percentage from 33.7% to 45.4%. In CCI 86 cells 52.5% growth rate changes to 49.1% with magnetic sample in G1 state, G2 also showed downfall from 3.1% to 2.8% and in S state from 50.8% to 48.1% fall (Raylman et al., 1996). To determine breaks in double-stand DNA persuade in cellular DNA by agents such as ionizing radiation magnetic field was used to examined by pulsed- field gel electrophoresis on Raji cells by applying 7Tesla (Elia et al., 1991; Story et al., 1993).

MTT assay test is directly proportionate with the measurement of metabolic activity which shows cell number (Mosmann et al., 1983) as decrease in metabolic activity affiliated decrease in cell number count. Metabolic activity of human leukemic cell line HL-60 showed prominent effect by SMF. Many researches had been done with the non-thermal collaboration with electromagnetic field with that of cells. (Blank et al., 1997; Weaver et al., 1999). If murine immune cells was exposed to 0.025-0.15T SMF it showed its effects by slowing down macrophages phagocytosis and boost up apoptotic death of thymocytes (Flipo et al., 1998). Antineoplastic drugs (Piazza et al., 1995) in collaboration with magnetic field showed greater result than that of these drugs without SMF. When HL-60 cells with SMF of 1-T, time of 72 hours and alliance with antineoplastic drugs with their different
concentration was examined, its metabolic activities were tested with MTT test. In the absence of magnetic field, a metabolic activity of cells reduces down significantly when mixtures of different antineoplastic drugs with different concentration were applied. A cytotoxic effect of Antineoplastic drugs is to be enhancing with SMF (Sabo et al., 2002).

Magnetic effect was visualised on mice affected with tumour cell, its growth and progression was examined with luminescence. Viable cell enumeration of extracted cells is possible against an indigenous background population by visual detection of luminescent colonies (Grant et al., 1991). The mice which were not exposed to magnet were known as NCG group showed huge tumour. NCG mice was compared with week 4 with that of week 1, outcome of that was 500 times fold increase in tumour growth. Mice were clutch under groups of G60, G180, G360 and NCG to evaluate magnetic field influence in week 1 to week 4. These groups were made according to the time of exposure of magnetic field to tumour growth. G60 group means 60 minutes magnetic field from week 1 to week 4 showed robust increase of 900 times with that of week 1. G180 group showed 200 times increase in tumour growth from week 1 to week 4. G360 group means magnetic field with 360 minutes exposal resulted into only 44 times growth which is very less as compared to that of G60 and G180. Ascitic form of EAC (Ehrlich ascites carcinoma) was known to be more sensitive if week magnetic field is applied on it with the solid form of this type of tumour (Novikov et al., 2008).

Magnetism can be used for cancer cells treatment as it showed its marvellous results with its exposure. Its effect with the time changes but its results can be revelled only if we know that the cells are converted to cancer cells. Magnet can be a milestone in human treatment to different diseases.

References


