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Effect of Progressive Muscle Relaxation Technique on Cancer Related Fatigue in Cancer Patients: A Literature Review

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ABSTRACT

Cancer related fatigue often begins before the cancer is diagnosed, worsens during the course of treatment and may persist for months – even years- after the treatment ends. Currently, studies are more focussed towards managing these physical symptoms using physical therapy, complimentary therapies and alternative therapies such as yoga, mindfulness meditation, and physical therapy including progressive muscle relaxation technique to reduce their adverse symptoms and enhance their quality of life. As this technique is simple to learn, has no negative impact and is feasible to perform anywhere so it is used on a large scale. Hence the aim of the review is to find out the effects of progressive muscle relaxation technique on cancer related fatigue symptoms in patients receiving chemotherapy and radiotherapy.

Keywords: chemotherapy induced fatigue, Jacobson's relaxation, radiation, cancer patient.

INTRODUCTION

Cancer, according to the World Health Organization is a "large group of diseases that can start in almost any organ or tissue of the body when abnormal cells grow uncontrollably".[1] Cancer is a rapidly growing global health hazard. Cancer is the second leading cause of death in world. Although cancer patient's survival have significantly improved, the severe and distressing symptoms induced by cancer and its therapies have substantial impacts on the physical and mental health of most cancer patients.[2] Some of the short and long term side effects of anticancer therapy include fatigue, appetite loss, nausea, vomiting, concentration issues , hearing loss and worsening neurological problems.[3] Cancer survivors experience higher level of fatigue than the general population.[1]The prevalence of fatigue associated with cancer type varied from 26.2% in patients with gynaecological cancer to 56.3% in studies that included mixed types of cancer , according to subgroup analysis. The highest documented prevalence of fatigue (60.6%) was found in individuals with late cancer stages. 62% of patients had fatigue throughout therapy, compared to 51% in patients receiving multimodal treatment.[4] Cancer related fatigue often begins before the cancer is diagnosed, worsens during the course of treatment and may persist for months – even years- after the treatment ends. Untreated

cancer related fatigue can negatively affect a person's physical and emotional well-being and quality of life[5]. Quality of life is a degree to which an individual is healthy, comfortable and able to participate in daily life events. Effective management of symptoms arising from anti-cancer therapies will surely help in relieving the suffering from dreaded cancer and improve the quality of life either.[6]

Cancer patients are increasingly advised to receive complementary and alternative therapies such as yoga, mindfulness meditation, and physical therapy including progressive muscle relaxation technique to reduce their adverse symptoms and enhance their quality of life[3]. Progressive Muscle Relaxation Technique (PMRT) uses breathing exercises in addition to systematic contraction and relaxation of muscles to relieve tension[2,3] As PMRT is simple to learn, has no negative impact and is feasible to perform anywhere so it is used on a large scale[3].Hence the aim of the literature review is to evaluate the effect of Progressive Muscle Relaxation Technique on fatigue in cancer patients receiving chemotherapy and radiotherapy.

RELATIONSHIP BETWEEN FATIGUE AND CANCER

Patient's quality of life is significantly impacted by Cancer Related Fatigue, which is widespread. Thus, it's critical to comprehend the pathophysiology of Cancer Related Fatigue in order to develop useful strategies for prevention and treatment.[7] Promising new theories have been put up concerning the pathophysiology of cancer related fatigue, including the ones about pro-inflammatory response, serotonin, anaemia, vagal- afferent activation and adenosine triphosphate.[8]

Similar to characteristics commonly referred to as "sickness behaviour'', cancer related fatigue frequently co-occurs with symptoms such as pain, sleeplessness, lethargy, disturbed mood and cognitive impairment. An adequate amount of evidence supports the hypothesis that inflammation plays a role in cancer related fatigue, and sickness behaviour is an adaptive response to inflammation. Through the central nervous system's cytokine signalling, cancer and its treatment can trigger the peripheral pro-inflammatory cytokine network and causes cancer related fatigue symptoms. Following the end of chemotherapy, neuro-inflammation has been proposed as a potential cause for chronic cancer related fatigue.[9]

Indirect or direct formation of cancer related fatigue is associated with dysregulation of the Hypothalamic Pituitary Adrenal (HPA) axis, which is linked to immune system and inflammatory response activation. Cytokines that are sent into the central nervous system as a result of cancer and/or its treatments have the ability to activate the HPA axis. Controlling the release of cortisol during stressful situations is one of the HPA axis's functions. In order to shield the body from excessive immune system activation and to reduce tissue damage brought on by inflammation, cortisol can limit the synthesis of cytokines. In breast cancer survivors, physical exhaustion has been linked to dysregulation of blood cortisol levels. Sleep deprivation and circadian rhythm disturbance have also been linked to altered cortisol levels. In breast cancer survivors, flattened circadian rhythms and disrupted sleep following chemotherapy have been linked to cancer related fatigue.[9]

All tissues, but skeletal muscle most especially, may experience long- term side effects from impaired energy metabolism (adenosine triphosphate (ATP) production) resulting from cachexia or damage to the sarcoplasmic reticulum and/ or mitochondria following chemotherapy or radiotherapy. Peripheral fatigue risk may rise as a result of this impact on skeletal muscle.[9]

Vascular endothelial growth factor (VEGF) level is linked to treatment-induced weariness, according to the growth factor hypothesis. As an independent predictor of worse survival and an angiogenic cytokine with significant significance to cancer, VEGF stimulates the development of new

blood vessels required for tumour growth and metastasis. Elevated levels of soluble intracellular adhesion molecule-1 and VEGF were found to be associated with a significant decrease in quality of life and greater fatigue in breast cancer patients receiving chemotherapy.[8]

According to a theory, dysregulation of serotonin could explain Cancer related fatigue by increasing brain serotonin (5-hydroxytryptemine[5-HT]) levels in specific brain regions and upregulating specific 5-HT receptors. These changes could be brought on by cancer or treatment -related side effects. This may result in altered HPA -axis function, reductions in somatomotor drive, and a feeling of diminished physical labor capability. There is mounting evidence, mostly from research on chronic fatigue syndrome and exercise- induced exhaustion, that 5-HT metabolism and neurotransmission play a part in the development of central tiredness. Elevated plasma levels of free tryptophan have been seen in people with chronic fatigue syndrome, which may result in elevated central 5-HT levels. It has been demonstrated in multiple human investigations that using selective serotonin reuptake inhibitors decrease one's ability to exercise. Other studies, however, have demonstrated that central 5-HT concentrations have little effect on cancer related fatigue.[8]

Patient suffering from the accompanying problems of fatigue, dyspnoea, palpitations, dizziness, and impaired cognitive function are significantly affected by related anaemia. Even if body makes an effort to make up for the effects of a reduction in red blood cells, anaemia leads to decrease in the amount of oxygen delivered to tissue. One of the possible causes of fatigue associated with anaemia or haemoglobin malfunction is hypoxia-related decrease in organ functioning. Randomized trials in cancer patients and elderly people with chronic anaemia have shown a direct correlation between improvements in fatigue and quality of life and increase in haemoglobin.[8]

LITERATURE SEARCH

A total of 5 articles were selected for this review article. Literature search was performed from 2015 to 2024 by using database including SCOPUS, PubMed, Google Scholar & Web of Science. Keywords such as PMR, fatigue, complementary treatment, chemotherapy were utilised. Boolean terms such as AND, OR and NOT were used.

Progressive Muscle Relaxation Technique

Edmond Jacobson was the original developer of Progressive muscle relaxation technique, a scientifically validated technique allowing people to enter a deep state of relaxation.[3] There is substantial correlation between the relaxation of muscle group tautness and the association with the autonomic nervous systems, suggesting one probable mechanism for reduction of fatigue. Correlation between central nervous system and peripheral nervous system occurs when muscles relax, which activates the parasympathetic nervous system and lowers muscle tone. Progressive muscle relaxation functions on the basis of Neuromuscular hypertension. This has been discovered to be the cause of a variety of unfavourable expressive psychological feelings as well as musculoskeletal disorders with a psychological foundation. When doing progressive muscle relaxation technique, it induces relaxation and aids in the reduction of stress and depression which in turn improves the quality of life.[10]

DISCUSSION

Progressive Muscle Relaxation incorporates systematic tightening and relaxing of body muscle groups as well as breathing exercises to relieve unnecessary stress.[3] Muscles are contracted and held for a few seconds before being relaxed, progressing from foot up to face. A pre and post-experimental study by Varsha Huddar et.al., compared the effects of progressive relaxation technique (PRT) and Benson's technique on anxiety and fatigue in cancer survivors. Their study comprised of 42 subjects with cancer related anxiety and

fatigue. Subjects were randomly allotted to 2 groups, where one group received progressive relaxation technique & other group with Benson's technique for 5 days. The results demonstrated that PRT lowers fatigue more effectively than Benson's technique in cancer survivors.[1]

A quasi experimental study was conducted in Delhi, India by Manisha Bhatia et.al., to assess the effectiveness of Progressive Muscle Relaxation Therapy on Physical Symptoms among Cancer Patients receiving Chemotherapy. Total 40 GI cancer patients were enrolled with 20 patients in each experimental and comparison groups by lottery method. The results concluded that PMRT was effective in improving the physical symptoms of insomnia and fatigue in cancer patients receiving chemotherapy.[10]

P Jaya et al., conducted a randomised single-blind controlled trial on 50 patients to find out the effect of progressive muscle relaxation therapy on fatigue and psychological distress of cancer patients during radiotherapy. They divided the participants into two groups, with one group receiving PMRT and other group undergoing conventional treatment. Both interventions lasted for 3 weeks and consisted for 20 minutes of supervised training thrice a week. Fatigue system inventory and hospital anxiety and depression scale used as an outcome measures. The statistical results showed that PMRT and conventional treatment were similarly efficacious in reducing fatigue and psychological distress related to cancer patients who were hospitalized undergoing radiotherapy.[11]

Zehra Gok Metin et.al., conducted an assessor blinded, three arm, randomized controlled trial to investigate the effects of progressive muscle relaxation (PMR) and mindfulness meditation (MM) on fatigue, coping styles and quality of life in patients with early breast cancer patients receiving adjuvant paclitaxel. A total of 90 participants were randomly assigned to either a 12 week of PMR, MM interventions and control group. The intervention groups continued PMR or MM for 20-min every day for a total of 12 weeks. The CG received only a single time attention- matched education (15 min) on breast cancer before the start of the paclitaxel regimen. Data collection tools included the Patient Information Form, Brief Fatigue Inventory (BFI), Brief COPE, and Functional Living Index -Cancer (FLIC). Data were collected at baseline, week 12, and week 14. It was concluded that Progressive muscle relaxation and mindfulness meditation are effective interventions that if initiated concurrently with the adjuvant paclitaxel demonstrate similar effects on fatigue and coping styles.[12]

Charalambous A et al., also provided strength to progressive muscle relaxation technique for improving the cancer related symptoms by conducting a prospective randomized controlled trial, investing the effects of combined guided imagery and PMR technique reported a significant decrement in fatigue severity among breast and prostate cancer patients receiving chemotherapy.[13]

The possible mechanism behind the improvement in cancer related fatigue after PMR technique includes relaxation that involves energy restoration in the body and reduction of autonomic arousal.[13] In this technique after isometric contraction, muscles will undergo relaxation which in turn leads to activation of the parasympathetic system and results in reduced muscle tone, and hence there is a correlation between central nervous system and peripheral nervous system.[10] Summary of the studies showing effects of PMR in cancer patients. [Table – 1]

Author	Year	Study Type	Study Population	Intervention	Study Findings	Conclusions
Huddar V et al.,[1]	2023	Experimental Study	Cancer survivors	Progressive relaxation technique vs. Benson's relaxation technique	Progressive relaxation showed a significant reduction in both anxiety and fatigue compared to Benson's technique ($p < 0.05$). Fatigue was particularly reduced in survivors who used progressive relaxation.	Progressive muscle relaxation is more effective in reducing fatigue and anxiety compared to Benson's technique.
Bhatia M et al.,[10]	2020	Quasi experimental study	GI Cancer patients undergoing chemotherapy	Progressive muscle relaxation therapy	A significant reduction in physical symptoms, including fatigue, was observed after the intervention (p-value = 0.03). The therapy was well-received by participants and reported to alleviate distress.	Progressive muscle relaxation therapy is effective in alleviating physical symptoms such as fatigue in cancer patients undergoing chemotherapy.
Jaya P et al.,[11]	2020	Randomized Controlled Trial	Cancer patients (Breast & head and neck) undergoing radiotherapy	Progressive muscle relaxation therapy	Fatigue levels decreased significantly ($p < 0.05$) and psychological distress was reduced after the intervention. But no significant differences were found between the groups.	Progressive muscle relaxation therapy reduces fatigue and psychological distress in cancer patients during radiotherapy.
Gok Metin Z et al.,[12]	2019	Randomized Controlled Trial	Early breast cancer patients	Progressive muscle relaxation, mindfulness meditation, and control group	Progressive muscle relaxation significantly reduced fatigue (p-value = 0.02) compared to control. Mindfulness meditation	Progressive muscle relaxation & mindfulness meditation equally improves fatigue in early breast cancer patients.

					showed similar effects on fatigue.	
Charalambous A et al.,[13]	2016	Randomized Controlled Trial	Cancer patients (breast/ prostate) receiving chemotherapy	Guided imagery + progressive muscle relaxation	Both interventions led to significant improvements in fatigue and symptom management ($p < 0.01$), with progressive muscle relaxation showing slightly better results.	Progressive muscle relaxation, combined with guided imagery, is effective in managing fatigue and symptoms in chemotherapy patients.

Table-1: PMR studies in Cancer patients receiving chemotherapy and radiotherapy.

CONCLUSION

The approach of progressive muscle relaxation technique has gained popularity in palliative care. This technique is mostly used to relax the muscles and improve the quality of life. It has proven to be effective for improving the cancer treatment related fatigue. It can be useful in different types of cancer patients undergoing chemotherapy and radiotherapy.

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