



Deep Neck Flexor Endurance In Head And Neck Cancer Patients And Normal Individuals - An Observational Study.

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Abstract:

BACKGROUND: Head and neck cancer (HNC) encompasses a diverse group of malignancies affecting the oral cavity, pharynx, larynx, and other anatomical regions within the head and neck. Head and neck cancer (HNC) typically refers to malignant tumours arising from mucosal lining of upper aerodigestive tract, and encompasses primary sites within oral cavity, larynx and pharynx.

AIM & OBJECTIVE: The aim of this study was to compare the deep neck flexor endurance in patients with head and neck cancer versus normal individuals. The objective was to find out the difference in deep neck flexor endurance among head and neck cancer patients versus normal individuals.

METHODS: The observational study was conducted at a tertiary care hospital. The study population included patients with head and neck cancer and normal individuals. Group A consisted of head and neck cancer patients, while Group B comprised normal individuals. The study spanned a duration of three months, utilizing purposive sampling to select a sample size of 64 patients, with 32 in each group. The primary outcome measure was the deep neck flexor endurance test.

RESULTS: Data was analyzed by using instat version 3.0 . Between group analysis was done for deep neck flexor endurance (u value = 1024 , p value = <0.0001) using non parametric test .The result of the study showed that extremely significant difference was found which reflects normal individuals having more endurance than patients with HNC

CONCLUSION: The Study concluded that Head and Neck Cancer patients had reduced Deep Neck Flexor endurance as compared to normal individuals.

Keywords - Head and neck cancer, deep neck flexors, Craniocervical flexion test.

I. INTRODUCTION

Head and neck cancer (HNC) encompasses a diverse group of malignancies affecting the oral cavity, pharynx, larynx, and other anatomical regions within the head and neck. Head and neck cancer (HNC) typically refers to malignant tumours arising from mucosal lining of upper aerodigestive tract, and encompasses primary sites within oral cavity, larynx and pharynx. Tobacco and alcohol use are the best established risk factors and HNC accounted for about 26% of all cancer cases in males and 8% in females. The risk of developing HNC was 1 in 33 for males and 1 in 107 for females.⁽¹⁾ HNCs are associated with several challenges in their management, related to the direct involvement by these tumours of key anatomical areas with vital functions as speech, breathing, chewing and swallowing. Moreover, cosmesis can also be affected. Most commonly the American Joint Committee on cancer T (Primary tumours) N (Nodal disease) M (Distant metastasis) classification system (TNM System) is used for staging tumours of Head and Neck. Treatment modalities, including surgery, radiation, and chemotherapy can significantly impact the musculoskeletal system, particularly the neck muscles. Among these, the deep neck flexors (DNFs) play a crucial role in stabilizing the cervical spine and maintaining proper head posture. Dysfunction or weakness in these muscles can lead to postural abnormalities, pain, and reduced quality of life⁽²⁾.

The Deep Neck Flexor Endurance Test (DNFET) is a reliable clinical tool used to assess the endurance of these muscles. It involves the patients maintaining a specific head and neck position while lying supine, and the time they can sustain this position is recorded. Previous studies have demonstrated the utility of the DNFET in various populations, including those with chronic neck pain and athletes. Craniocervical flexion (CCF) is achieved with the longus capitis and longus colli, which are the deep cervical flexor (DCF) muscles in the atlanto-occipital joint and C1-C2 upper cervical segments. They are the key postural muscles located in the anterior part of the neck and support cervical lordosis. Craniocervical flexor endurance training (CCFET) is a low-level endurance training of the DCF muscles that begins when the person is able to achieve the correct CCF.⁽²⁾

However, there is limited research focusing on DNF endurance in patients with HNC. Considering the substantial impact of cancer treatments on neck musculature, it is hypothesized that patients with HNC may exhibit reduced DNF endurance compared to healthy individuals. Understanding these differences is critical for developing targeted rehabilitation strategies to improve outcomes in this population.¹

This study aims to compare the DNF endurance between patients with HNC and healthy controls. By identifying the extent of DNF impairment in HNC patients, healthcare providers can better tailor interventions to address these specific deficits. The findings of this study will contribute to the growing body of literature on the musculoskeletal impacts of HNC and guide clinical practices in oncology rehabilitation.

This comparative analysis is essential not only for enhancing patient care but also for improving the overall understanding of how head and neck cancer and its treatments affect neck muscle function. Through this research, we aim to bridge the gap in knowledge and provide a foundation for future studies focusing on rehabilitation and quality of life improvements for HNC patients.

The need for this study arises from the significant impact of head and neck cancer (HNC) treatments on the musculoskeletal system, particularly the deep neck flexors (DNFs). Current literature lacks comprehensive data on DNF endurance in HNC patients, despite the known post-treatment complications such as neck pain and postural issues. Assessing and comparing DNF endurance between HNC patients and healthy individuals will highlight the extent of muscular impairment caused by cancer treatments. This understanding is crucial for developing targeted rehabilitation programs to improve cervical spine stability, alleviate pain, and enhance the quality of life for HNC survivors. Ultimately, this study aims to fill a critical gap in oncological and musculoskeletal research, guiding better clinical practices in oncology rehabilitation.

The aim of this study was to compare the deep neck flexor endurance in patients with head and neck cancer versus normal individuals. The objective was to find out the difference in deep neck flexor endurance among head and neck cancer patients versus normal individuals. The alternate hypothesis states that there was a significant difference in the deep neck flexor endurance in patients with head and neck cancer versus normal individuals. Conversely, the null hypothesis posits that there was no significant difference in the deep neck flexor endurance in patients with head and neck cancer versus normal individuals.

II. METHODOLOGY

The observational study was conducted at a tertiary care hospital. The study population included patients with head and neck cancer and normal individuals. Group A consisted of head and neck cancer patients, while Group B comprised normal individuals. The study spanned a duration of three months, utilizing purposive sampling to select a sample size of 64 participants, with 32 in each group. The primary outcome measure was the deep neck flexor endurance test.

The inclusion criteria for the study were as follows: both male and female patients above 18 years of age who had undergone surgical treatment for head and neck cancer, including anterior neck dissection and complete modified neck dissection, with Tumour, Node, Metastasis (TNM) staging of 1-3. Patients need to have the ability to understand and follow instructions, have no prior participation in similar interventions, and be willing to participate in the study.

The exclusion criteria ruled out patients with structural instability and osteoporotic changes of the cervical spine, any neurological deficits, bone tumors, vertigo, or a history of trauma or fracture in the cervical spine.

III. PROCEDURE

Ethical Committee approval was obtained from IEC prior to beginning the study. Screening was done as per inclusion and exclusion criteria. The purposive sampling method was used to conduct the study; about 64 samples were taken to come to conclusion during the study duration of 03 months. The present study was conducted among patients with Head and Neck Cancer admitted in ONCO I.P.D and O.P.D at Tertiary Care Hospital, Ahmednagar. Total 64 participants were included in the study out of which 32 were allocated in HNC group (Group A) and other 32 were allocated to normal individuals group (Group B). Deep Neck Flexor Endurance Test was performed on participants of both the groups⁽⁹⁾ and Data was analysed by using Mann Whitney test.

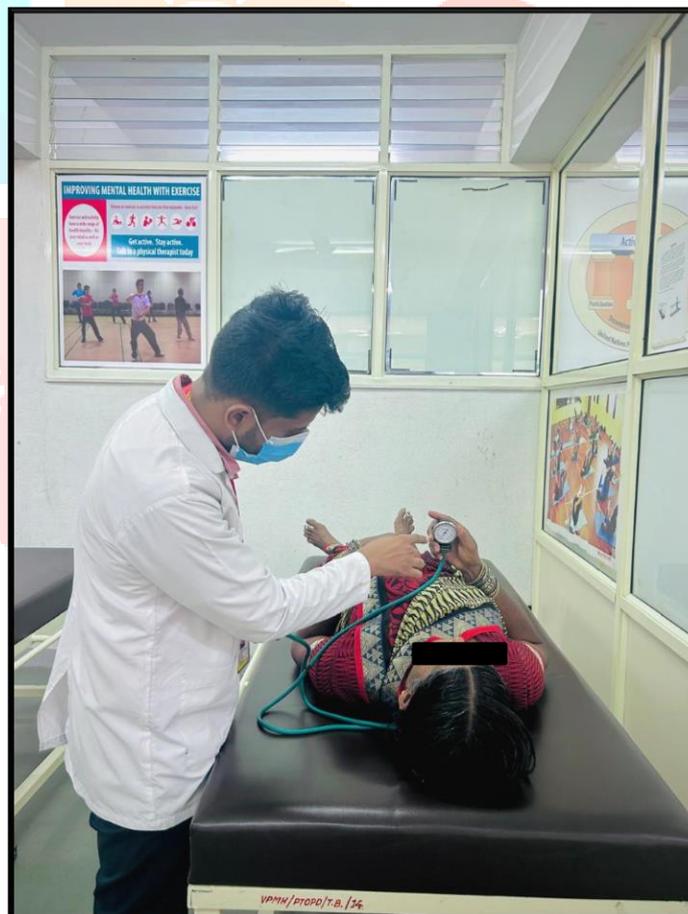


Figure 1: Deep Neck Flexor Endurance in Normal Individual



Figure 2 : Deep Neck Flexor Endurance in HNC patient

IV. DATA ANALYSIS

Data was analysed by using Instat version 3.0. Demographic data such as gender, age was analysed. Mean and Standard deviation was calculated. Between group analysis was done using Mann-Whitney test. p value < 0.0001 considered significant.

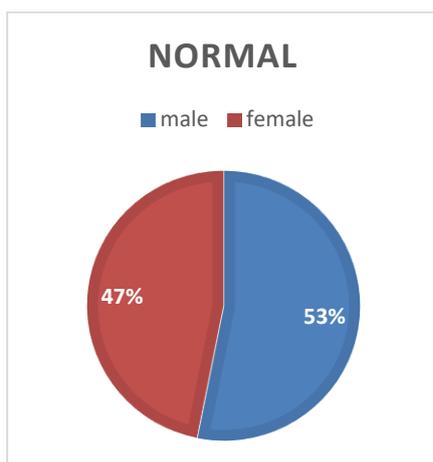
V. RESULT

Study was conducted on 64 patients, out of which 38 and 26 are males and females respectively, the Deep neck flexor endurance test was performed on those patients who were willing to participate.

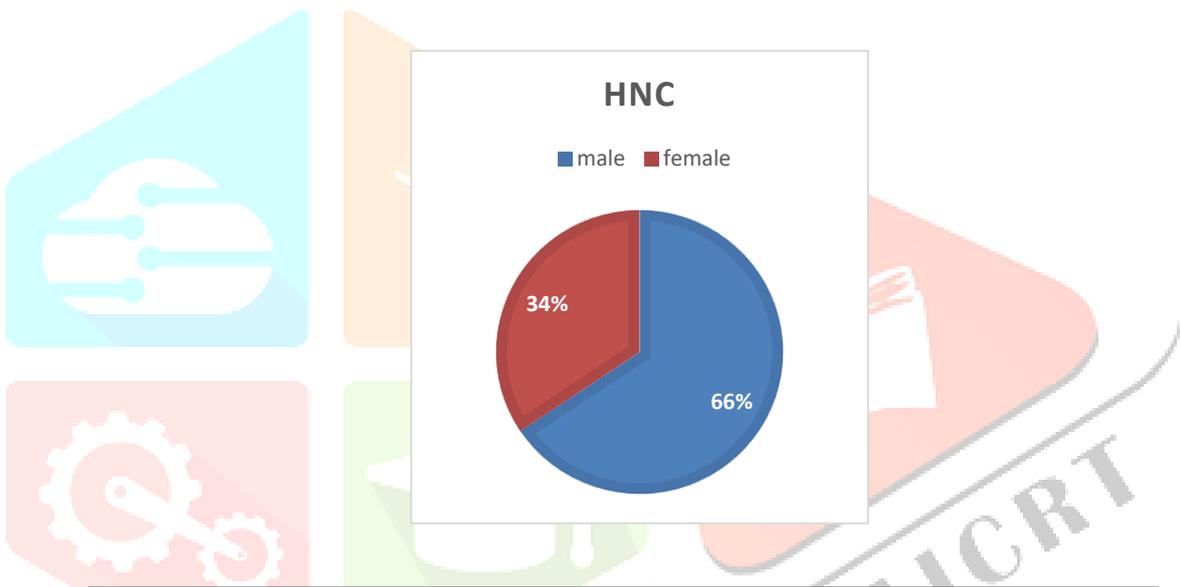
Table 1 - Shows demographic details of normal and HNC Patients

Sr no	Total no of patients	Gender			
		Males		Females	
1.	HNC (32)	21		11	
	Normal (32)	17		15	
2.		Age (Years)			
		21-30	31-40	41-50	51-60
	HNC	6	10	7	9
	Normal	7	9	11	5

Graph 01: Shows Demographic details of Gender distribution among groups

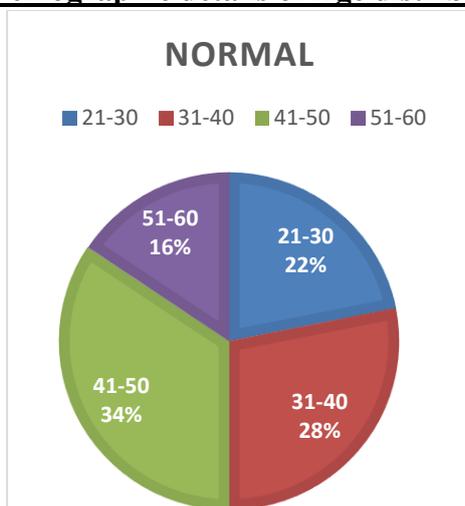


In this pie chart demonstration of Gender distribution of Normal individuals is given. 47% of the population is male and 53% of the population is Female.

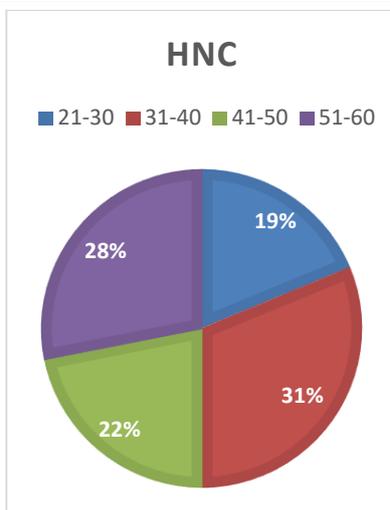


In this pie chart demonstration of Gender distribution of HNC Patients is given. 66% of the population is male and 34% of the population is Female.

Graph 02: Shows Demographic details of Age distribution among groups



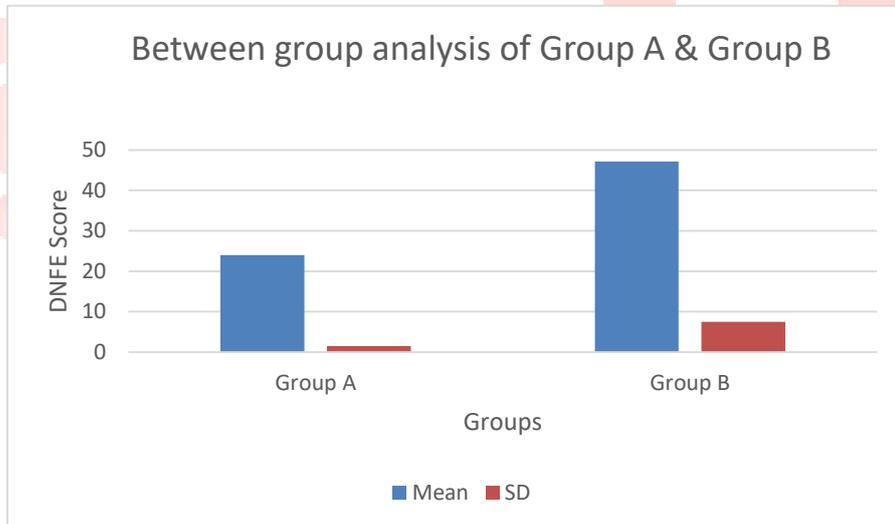
In this pie chart demonstration of the age distribution of normal individuals is given there is 22% of the population aged between 21-30, 28% of the population aged between 31-40, 34% of the population aged between 41-50, 16% of the population aged between 51-60.



In this pie chart demonstration of the age distribution of HNC patients is given there is 19% of the population aged between 21-30, 31% of the population aged between 31-40, 22% of the population aged between 41-50, 28% of the population aged between 51-60.

Table 02: Shows between group analysis of Group A (HNC) and Group B (NORMAL)

	Mean	SD	U' Value	P Value	Significance
Group A	24	1.49	1024	<0.0001	Extremely significant
Group B	47.15	7.52			



GRAPH 3: Shows between group analysis among Group A & Group B

In this clustered column chart demonstration of mean and standard deviations of group analysis of HNC Patients and normal individuals is given there. The mean of Normal individuals is 47.15 and the standard deviations is 7.52. The mean of HNC Patients is 24 and 1.49.

Table 03: : Shows between group analysis among HNC Male and Normal Male

	Mean	SD	P Value	Significance
Group A	24.179	1.842	<0.0001	Extremely significant
Group B	51.373	4.671		

GRAPH 4: Shows between group analysis among HNC Male and Normal Male

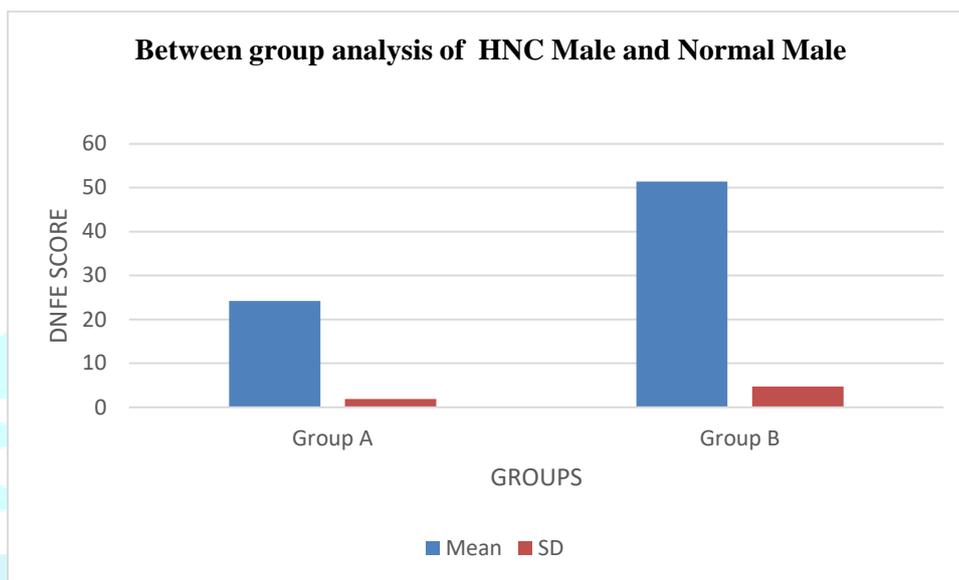
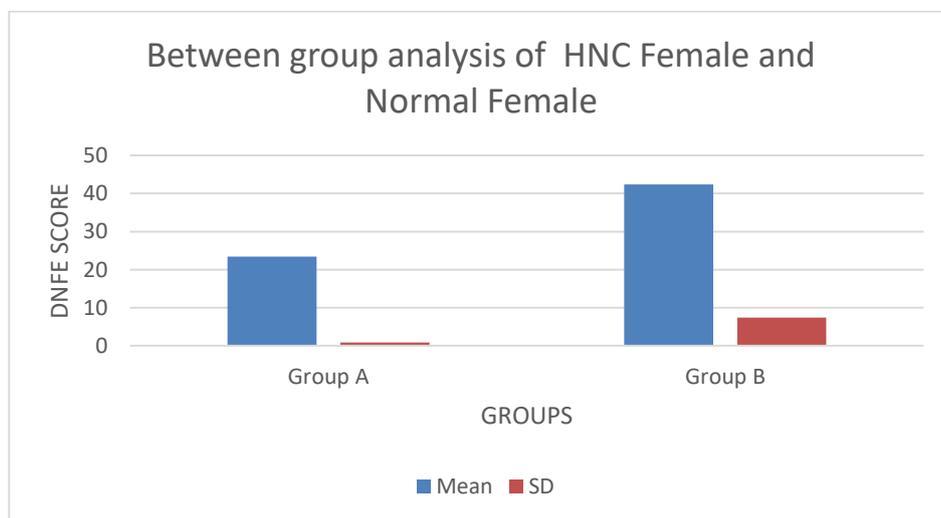


Table 04: Shows between group analysis among HNC Female and Normal Female

	Mean	SD	P Value	Significance
Group A	23.394	0.814	<0.0001	Extremely
Group B	42.378	7.368		



GRAPH 5: Shows between group analysis among HNC Female and Normal Female

VI. DISCUSSION

This study aimed at comparison of the Deep neck flexor endurance in patients with head and neck cancer vs normal individuals. To accomplish the aim, total 64 participants were included in the study as per the inclusion criteria. 64 participants were allocated into two groups with 32 samples in each group. Deep neck flexor endurance was measured. Graphs showing the demographic details of head and neck Cancer and normal individuals are plotted. Mean and standard deviations for DNF of each group were analysed.

Result shows that, with p value < 0.0001 there is significant difference for DNF Endurance between normal and HNC patients. As per our analysis, DNF Endurance is found to be reduced in HNC patients as compare to normal individuals. The deep neck flexor (DNF) muscles provide stability to the cervical spine during head and cervical spine movements. Deep neck flexor endurance (DNFE) is an important component of cervical spine function. To ensure that the cervical spine is functioning normally, an easy and precise method of testing the deep cervical flexor muscle endurance is needed. Forward Head Posture (FHP) may appear in the cervical spine as a result of decreased lumbar lordosis and increased kyphosis. Patients with FHP may have less muscle activation of Longus Colli compared to healthy adults, and FHP may have a negative effect on neck endurance. Also, Difference in physical activity between HNC patients and normal healthy individuals is one of the contributing factors for Deep Neck Flexor Endurance test results ⁽²⁾. Surgical intervention, Radiation therapy shows long term side effects on cervical muscle endurance which includes fibrosis and its impact on muscle function which can contribute to decreased flexibility and muscle stiffness, reducing the endurance of the neck muscles. ⁽³⁾

Kao, S. S., Kupferman, T. A. et. al in the article, 'Complications of surgery for head and neck cancer', discussed the various complications associated with surgery for head and neck cancer, including muscle weakness and impaired function which supports our findings. ⁽⁴⁾ Other authors, Raghavendra, M., & Raghunath, P. did a study "Muscle wasting and nutritional status in cancer patients." And found that, muscle wasting and atrophy in cancer patients is due to treatment and reduced physical activity which is a causative factor for reduction of deep neck flexors endurance. ⁽⁵⁾

Deshmukh, S. R. et. al did a study on, 'Genetic variations and their role in head and sneck cancer', which states that, some individuals may have genetic factors that make their muscles more resilient to the side effects of cancer treatments like surgery and radiation therapy. ⁽⁶⁾ Some patients might have an enhanced adaptive response to treatment, leading to less muscle damage and better recovery. These adaptive responses could include efficient muscle repair processes, robust anti-inflammatory responses, and effective activation of satellite cells (muscle stem cells) that facilitate muscle regeneration ⁽⁷⁾ which in turn decreases the chances of alteration in cervical muscle endurance by negatively supporting our study. ⁽⁸⁾

Also, Capozzi, L. C., Nishimura, et al conducted a systematic review "The impact of physical activity on health-related fitness and quality of life for patients with head and neck cancer and found that Regular exercise and strength training can help maintain muscle endurance and counteract muscle atrophy in HNC patients. Exercise regimens that include aerobic exercises, resistance training, and flexibility exercises can promote overall physical fitness and muscle health.

The reduced endurance of DNF In (HNC) patients compared to normal individuals can be attributed to several factors. HNC patients often undergo treatments like surgery, radiation, and chemotherapy, which can lead to muscle atrophy, fibrosis, and neuromuscular impairments¹

These treatments can affect the muscle function and structural integrity of neck muscles, reducing their endurance. Additionally, pain, fatigue, and altered biomechanics due to tumour presence or treatment side effects can further compromise muscle performance, leading to decreased endurance in this population.¹

As per the investigation, HNC patients and Normal healthy individuals were included in the study. Deep Neck Flexor Endurance test was performed on both of these patients and it came to know that HNC patients have reduced Deep Neck Flexors Endurance as compared to normal individuals.

VII. CONCLUSION

It is concluded that, Head and Neck Cancer patients had reduced Deep Neck Flexors endurance as compared to normal individuals.

VIII. LIMITATIONS

- Sample were collected from only one tertiary care hospital
- Sample size was limited

IX. FUTURE SCOPE OF STUDY

The study can be done in different types of cancer patients, more samples & other outcome measures can be addressed.

X. CONFLICT OF INTEREST

There are no conflicts of interests to declare.

XI. FUNDING

This study was not funded by any source.

XII. ACKNOWLEDGMENT

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