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Mini Review

*Corresponding author
Rakesh Garg, MD, DNB
Associate Professor
Department of Anaesthesiology
Pain and Palliative Care
Dr BRAIRCH
All India Institute of Medical Sciences
Ansari Nagar, New Delhi 110029, India
Tel. +91 9810394950; +91 98683998335
E-mail: drrgarg@hotmail.com

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Role of Prehabilitation in Patients Undergoing Cancer Surgeries

Deepti Ahuja, MD; Rakesh Garg, MD, DNB*

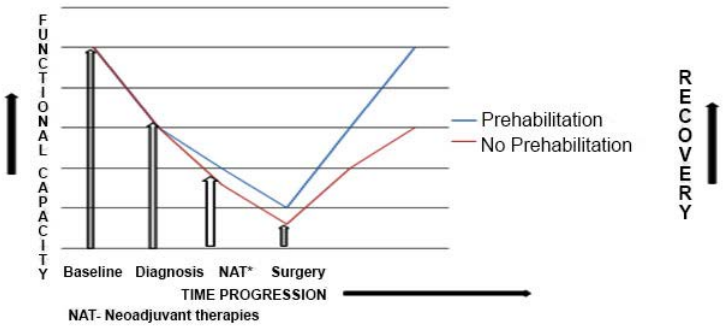
Department of Anaesthesiology, Pain and Palliative Care, Dr BRAIRCH, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110029, India

Cancer is the second leading cause of death worldwide and nearly 1 in 6 deaths is due to cancer. It accounts for 8.8 million deaths in 2015. The occurrence of cancer is increasing and new cases are expected to rise by about 70% over the next 2 decades.[1] With the advances in diagnostic and therapeutic procedures, more number of cancer patients will undergo curative surgical procedures. However, the mortality and morbidity rates after major oncological surgical resection are still high and range between 4%-10% and 20%-60%, respectively.[2,3] These high mortality and morbidity rates may be attributed to the patients' physical status, combined stressful impact of malignancy, neoadjuvant therapies (NAT), or the surgical procedure on patient during peri-operative period.

The post-operative period is not only associated with 20%-40% reduction in physiological and functional capacity, but also increased risk of post-operative complications which may have long-term effect on morbidity and mortality.[4]

In order to overcome current situation, the concept of 'prehabilitation' is increasingly being implemented. "Prehabilitation" in the pre-operative period provides an option to increase the physiologic reserve and functional capacity of the patient in order to hasten recovery and improve outcomes recovery and improve outcomes (Figure 1).[4]

Figure 1: Model of Prehabilitation Pre-operatively in Surgical Patients.



Cancer prehabilitation is "a process on the cancer continuum of care, that occurs between the time of cancer diagnosis and the beginning of acute treatment and includes; physical and psychological assessments that establish a baseline functional level, identify impairments, and provide interventions that promote physical and psychological health to reduce the incidence and/or severity of future impairments".[5] The optimal outcome for a cancer surgery requires panned protocol in the peri-operative period, starting from the pre-operative period and continued through the post-operative period, (Figure 2).[5]

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Figure 2: Interventions Delineated to Enhance Post-operative Outcome of Patients Undergoing Cancer Surgeries.

COMPONENTS OF SURGICAL PREHABILITATION PROGRAMME

Role of Structured Exercise Protocols in Surgical Prehabilitation of Cancer Patients

Among all the components, structured exercise protocols are of paramount importance. These protocols are heterogeneous in composition and include muscle strengthening and aerobic training activities like walking, cycling, jogging, and swimming. The frequency and duration of physical training exercises can be gradually increased. Regular exercise not only prepares cardiovascular, respiratory, musculoskeletal, and endocrine systems before the actual occurrence of physiological stress, but also helps in restoring insulin sensitivity that is lost with sedentary behavior.[6] While prescribing the exercise in specific "dose", duration and modality, feasibility of the exercises for the patient should be kept in mind while targeting the desired outcomes. Exercise intensities that are uncomfortable for the patient may lead to poor adherence and hence lower the success rate of programme. Recent evidence suggests that the type and amount of activity performed during non-exercise time should also be included in the exercise protocol to provide adequate recovery time.[7] The improvement of fitness during an exercise programme can be monitored by using modified Borg Scale, which assesses the level of perceived exertion in response to exercise.[8] In addition to this, sensor technology is being employed to objectively documents the increase in health related quality of life (QoL) with physical exercise (Table 1).[9]

Role of Nutritional Supplementation in Surgical Prehabilitation of Cancer Patients

Optimization of nutritional status is another vital component of prehabilitation programmes in cancer patients who are often frail with decreased muscle mass and low protein reserves. The etiology of malnutritionin cancer patients is multifactorial and encompasses direct tumor related mechanisms (e.g. obstruction), tumor induced metabolic derangements (insulin resistance, catabolism), gastrointestinal abnormalities (nausea, vomiting) due to disease itself and anti-cancer therapies.[10] Peri-operative treatment of disease related-malnutrition has been shown to reduce

Table 1: Components of the Prehabilitation Programme and Optimal Pre-operative Time Period.

Component	Prehabilitation intervention	Optimal time period preoperatively
Cachexia, myopenia, sarcopenia	Structured exercise protocol	2-6 weeks
Nutrition	Nutritional supplementation	6 weeks
Anxiety and depression reduction	Relaxation techniques Problem-solving Coping strategies	
Optimization of respiratory System	Smoking cessation Breathing exercises Incentive spirometry Pharmacotherapy Adequate hydration	6-8 weeks
Optimization of cardiovascular system	Optimization of medical therapy for underlying disease Lifestyle modification Smoking and alcohol cessation	8-12 weeks
Anemia correction	Depends on severity and time period available 1.Oral iron therapy 2.Parenteral iron therapy a)Intramuscular b)Intravenous	Expected rise in hemoglobin concentration: 1. 0.7 gm/100 ml/week 2.a) 0.7-1 gm/100 ml/week b)Transfused blood becomes functional only after 24-48 hours.

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the rate of morbidity and mortality.[11] Cancer patients also have increased protein demands required for the synthesis of hepatic acute phase proteins, proteins involved in immune function and wound healing.[12] The exercise regimen not only requires physical activity but also needs to be supplemented with protein supplements as to build up the muscles. Hence their nutritional status must be assessed by dietician for the risk of malnutrition and counseling regarding supplementation.

Dietary daily protein intake of 1.2 g/kg body weight must be targeted. Whey proteins may be considered as a good supplement for protein enhancement for skeletal muscle as it rich in leucine content and it also stimulates translation initiation of protein synthesis in skeletal muscle.[13] Whey proteins also exhibit anti-inflammatory effects by promoting synthesis of glutathione due to high cysteine content.[14] Furthermore, omega-3 fatty acids, particularly eicosapentaenoic acid and docosahexaenoic acid, which are found naturally in fish oils, should also be supplemented as they have been shown to reduce oxidative stress and inflammation in cancer and surgical patients.[15]

Role of Psychological Stress Reduction in Surgical Prehabilitation of Cancer Patients

The presence of psychological distress like anxiety and depression are commonly found in cancer patients. Pre-operative psychological distressis associated with higher levels of pain, non-compliance with medical treatment, diminished immune response, poor wound healing, longer hospital stayand increased risk of mortality.[16-18] The various interventions as a part of prehabilitation includes; deep breathing, progressive muscle relaxation and meditation, visualization yoga, music, guidedimagery and/or problem-solving, and coping strategies. These strategies not only help in overall improvement of patients in pre-operative status, but also enhance and reinforce patients' motivation to comply with other strategies of prehabilitation, like the exercise and nutritional aspects as well. As a result, techniques have been shown to improve the quality of life (QoL) by reducing anxiety, depression, severity of pain and fatigue.[19-21]

Role of Smoking and Alcohol Cessation in Surgical Prehabilitation of Cancer Patients

Smoking and alcohol consumption are commonly encountered lifestyle risk factors, that adversely affect the outcome after surgery. Alterations in pulmonary and cardiovascular functions, impaired wound healing, diminished immune response, increased risk of infections and bleeding episodes, delaying in administration of neoadjuvant therapy, increased recurrence, second primaries, and high mortality are all associated with smoking and alcohol consumption.[22-25]

These changes can be reversed to some extent by discontinuation in pre-operative period. Counseling with administration of continuous nicotine replacement therapy and Vareniciline either alone or in combination may be helpful in cessation.[26] Though the improvement in body after abstinence from smoking and alcohol starts from beginning itself, but recovery of specific organ dysfunctions varies with regards to time required for optimization of organ specific function (Table 2).[27]

MEASURING OF OUTCOMES AFTER SURGICAL PREHABILITATION

Outcome's measures that have been used to measure the effect of prehabilitation include; compliance to prehabilitation programme, 6MWT (the maximum distance the participant can walk in 6 min), anaerobic threshold (AT), Hospital Anxiety and Depression Scale (HADS), length of hospital stay, and postoperative complications using Clavien-Dindo classification, health-related QoL using 36-item short-list questionnaire (SL-36).[28,29]

CONCLUSION

To conclude, prehabilitation remains a important component of holistic management of an cancer patient. The outcome after surgical intervention would improve if timely interventions like nutrition, exercise etc as part of prehabilitation becomes a integral

Table 2: Beneficial Systemic Bodily Effects of Alcohol and Smoking Abstinence.

Alcohol abstinence	Recovery	Smoking abstinence	Recovery
Immune competence	2-8 weeks	Immune competence	2-6 weeks
Wound healing	8 weeks	Wound healing	3-4 weeks
Endocrine stress response	2-12 weeks	Pulmonary function	6-8 weeks
Pulmonary function	6-8 weeks		
Bone regeneration	<6 months		
Haemostasis	1-4 weeks		
Cardiac function • Without symptoms • With severe failure	 • 1 month • 1-6 months		

part of overall management.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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