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A CASE REPORT OF EFFECT OF AN INTERDISCIPLINARY, HOLISTIC, METABOLIC AND ONCOLOGICAL REHABILITATION PROGRAM FOR A PATIENT DIAGNOSED WITH AN ANTERIOR ABDOMINAL WALL TUMOUR

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Abstract
Abdominal wall tumors are very rare and are treated with surgery and chemo-radiation therapies. The current case report focused on an in-patient metabolic and oncological rehabilitation program for a 72-year old female patient diagnosed with an anterior abdominal wall tumor with provisional diagnosis of moderately differentiated adenocarcinoma suggestive of upper gastro-intestinal or pancreato-biliary origin was made as per the trucut biopsy report. Six outcome measures were used at end-points including Numerical Pain Rating Scale (NPRS), chest expansion measurements, peak expiratory flow rate (PEFR), Karnofsky Performance Status (KPS) score, Hospital Anxiety and Depression Scale (HADS) and Functional Assessment of Cancer Therapy- General (FACT-G). The different interventions used included advice on splinting techniques and splinted coughing, breathing exercises, range of motion exercises, incentive spirometry, functional training etc. These interventions contributed to the success of this in-patient rehabilitation approach. Thus, an interdisciplinary holistic metabolic and oncological rehabilitation program provides a positive prognosis in a post-operative case of Abdominal Wall Tumour which is moderately differentiated adenocarcinoma suggestive of upper gastro-intestinal or pancreato-biliary origin.
Keyword: Abdominal wall tumor, Metabolic Rehabilitation, Oncological Rehabilitation.

INTRODUCTION

Metabolic Syndrome is a cluster of risk factors for cardiovascular disease and type 2 diabetes and constitutes a growing problem worldwide. Some of these factors included are obesity (central adiposity), dysglycemia, raised blood pressure, elevated triglycerides levels, and low HDL cholesterol levels. [1] Metabolic syndrome is associated with an increased risk of many common cancers like adenocarcinomas. [1, 2]Adenocarcinoma of the pancreas has been significantly linked with obesity. Central weight gain is associated with pancreatic cancer. Obesity at an advanced age is also meant to reduce the overall survival rate of a patient diagnosed with pancreatic cancer. [3, 4]Adenocarcinoma is one of the most common malignant pancreatic tumours affecting the head of pancreas. [2]Pancreato-biliary cancer consists of various cancers of the ampullary, peri-ampullary, and bile duct. [5]

There is accumulating evidence that type 2 diabetes (a metabolic disorder characterized by hyperinsulinaemia in the early phase) is associated, independent of obesity, with cancers of the colorectum (Larsson et al., 2005), pancreas. There are several biological mechanisms that link obesity or a high Body Mass Index (BMI) with risk of cancer. growth-promoting effect of elevated levels of insulin, Elevated levels of IGF-I has been commonly observed in obese people and which is meant to favour tumour growth by mitogenic ad anti-apoptotic processes. Leptin and adiponectin are the most abundantly produced adipokines and the levels of these peptides in the circulation largely reflect the amount and distribution of adipose tissue in the body. Leptin also, like IGF-I shows mitogenic ad anti-apoptotic properties. On the other hand, adiponectin levels have been found to be higher in post-menopausal compared with pre-menopausal women; adiponectin is anti-proliferative, pro-apoptotic and anti-angiogenesis. There could be increased levels of transforming growth factor-b (TGF-b), interferon-g (IFNg), interleukins (IL) such as IL-1, IL-6, IL-10, and IL-8 etc due to obesity. The circulating levels of these pro-inflammatory factors increase with the enlargement of fat mass as many of these factors are secreted from adipocytes. [6, 7]

Diabetes is an established risk factor for pancreatic cancer. Individuals with diabetes were at a 1.9-times-higher risk for pancreatic cancer compared with the risk for those without diabetes. [8]

When diagnosed 1 year previous to pancreatic cancer, diabetes imparts a 2-fold relative risk for developing ductal adenocarcinoma of the pancreas. When diabetes had been diagnosed for less than 4 years, patients had a 50% greater risk of pancreatic cancer compared with individuals who had diabetes for more than 4 years (OR 2.1 *vs*. 1.5; P=0.005). Diabetes and impaired glucose tolerance (IGT) are present in 80% of the patients with ductal adenocarcinoma of the pancreas. [9]excessively high risk of colorectal and pancreatic cancer associated with high levels of circulating C-peptide/insulin and markers of hyperglycemia. The mechanism of the association between diabetes and pancreatic cancer is elusive but is known

to include metabolic, hormonal, and immunological alterations that influence tumor growth. studies suggest that islet cell turnover, which is associated with insulin resistance, is critical for pancreatic carcinogenesis. Abnormal glucose metabolism is a biochemical hallmark of tumor cells, and most tumors have highly effective upregulated, insulin-independent glucose uptake mechanisms. [10]

Hyperglycemia/insulin resistance and visceral obesity are the key features of metabolic syndrome. [11]

In individuals with very low HDL cholesterol (≤20 mg/dl), cancer risk has increased 6.5 fold. Obesity, inflammation and insulin resistance are all interconnected and this is potentially as a result of adipose tissue hypoxemia. It is also stated that development of insulin resistance in obese individuals is associated with tumor necrosis factor alpha (TNF-α) secreted from adipose tissue impairing intracellular insulin signal cascade, elevation in free fatty acid levels, decrease in adiponectin levels and also inhibition of peroxisome proliferator-activated receptor gamma by TNF-α and interleukin (IL)-1 stimulated with nuclear factor kappa B (NF-κB). [12] Metabolic syndrome is associated with type 2 diabetes mellitus. [13]

Tumors of the abdominal wall are very rarely seen. Most of them are one amongst the following: desmoidtumors, dermatofibrosarcomaprotruberans or soft-tissue tumors. Surgical resection, reconstruction, radiation and chemotherapy are the various treatment options used.[14, 15] Such patients are bound to undergo a lot of pain and inability to perform functional activities leading to physical impairments. There could also be psychological dysfunction and a reduction in their overall quality of life.

Exercise therapy, electrotherapy, as well as manual therapy such as kinesiology taping are common physiotherapy techniques are extensively in the management of various conditions. [16-19]

The various physiotherapy interventions used in patients who have undergone an abdominal surgery include exercise therapy and advanced electrotherapy. They have been proven effective in reducing post-operative complications as well as aiding faster recovery.[20, 21]

Case Report

A 72-year old overweight (BMI = 26 kg/m^2) female complained of pain in her abdomen since five years, associated with generalized weakness. There was swelling in the anterior part of her abdomen towards the right side. She gave no history of vomiting or nausea. The pain was dull aching in type and intermittent in nature. The intensity of her pain was 6/10 on the Numerical Pain Rating Scale (NPRS). She had been experiencing a loss of appetite resulting in a significant weight loss of 6-7 kilograms. Her sleep wasn't disturbed. She gave history of high intake of non-vegetarian foods, especially red meat and low intake of vegetables and fruits. She gave no history of alcohol intake or cigarette smoking. Family history of cancer was insignificant.

Her past surgical history revealed that she had undergone a laproscopic cholecystectomy five years ago. She also had a history of breast carcinoma for which she had undergone a modified radical mastectomy three years ago. Thereafter she had undergone six cycles of chemotherapy (paclitaxel and 5-fluorouracil) for the same. Post her cancer treatment, she never had a recurrence.

Her obstetric history suggested that she had ten live births, first one at the age of 21 years and thereafter after every one and a half to two years. She had undergone one miscarriage and there was no history of still birth. Her menstrual history suggested that her age at menarche was 17 years and age at menopause was 50 years. She used to have irregular menstruation for a couple of years during and after her chemotherapy sessions.

On palpation per abdomen, there was a palpable hard non-mobile non-tender mass over the right hypochondriac region. There were no bleeding or skin changes seen. She had no respiratory, cardiovascular, neurological or orthopaedic ailments.

INVESTIGATIONS

Diagnostic procedures like Contrast Enhanced Computed Tomography (CECT) of the abdomen/pelvis suggested a 3.4 x 10.7 x 6.7 cm lesion over the anterior abdominal wall, anterior to 10th, 11th and 12th ribs. [22, 23] On immunochemistry, tumour cells strongly expressed CK7 and CK19 & were focally positive for CK20. CA 125 score was 15.9. A provisional diagnosis of moderately differentiated adenocarcinoma suggestive of upper gastro-intestinal or pancreato-biliary origin was made as per the trucut biopsy report. She underwent six cycles of gemcitabine and cisplatin before the surgery. Her Positron Emission Tomography (PET) scan suggested fluorodeoxyglucose uptake avid focal cutaneous thickening in and subcutaneous plane of right lower anterior chest wall / upper abdominal wall. The lesion appeared to involve underlying skin in some sections. The lesion also appeared to involve underlying muscles and reached upto 6th and 7th costal cartilages, being likely metastatic. There was also mild FDG uptake in the left small internal mammary nodes seen.

SURGICAL PROCEDURE

An excision biopsy of the left intra mammary lymph node was also performed. The tumour involved the underlying muscles of the lower chest and upper abdomen and underlying 7th to 9th ribs and xiphoid process.The patient underwent a wide local excision of the abdominal wall tumour with mesh-plasty. Reconstruction was done using a muscular pedicle latissimusdorsi (LD) flap from the right side. [24] Two drains, one in the chest and one in the abdomen and a Foley's catheter were placed; a Ryle's tube was inserted. On post-operative day 2, the patient was referred for in-patient physiotherapy.

INTERVENTION

The patient underwent in-patient Metabolic and Oncological rehabilitation after she was admitted in the post-operative ward. The rehabilitation program was conducted by a qualified Physiotherapist having good knowledge in regard to Metabolic Syndrome and Oncology. Rehabilitation was started from post-operative day 2. The treatment protocol from post-operative day 2 to post-operative day 6 has been described in table 1. Splinting techniques were taught to the patient on the first day of rehabilitation. Application of cold gel pack was advised around the suture sites four to five times a day for pain relief. Sitting by propping the bed up was advised. At the time of discharge, the patient was advised to perform all exercises at home and also to visit the physiotherapy out-patient department for further rehabilitation. The patient started her out-patient rehabilitation program 4 months after the surgery. Exercises included in this phase of rehabilitation were a combination of aerobic and resistance training. Karvonen's formula was used to decide the initial intensity of aerobic training as well as its progression. Resistance training was given for all major muscle groups of the upper body, lower body, abdominal and back muscles. BMI was measured pre-intervention, at 2, 4 and 6 months.

Table 1: In-patient rehabilitation program over a period of 16 days

Post-op days	Exercise program	Dosage
2-4	Diaphragmatic breathing	5-8 repetitions
	Pursed lip breathing	5-8 repetitions
	ACBT	3-5 cycles
	Incentive spirometry	10 repetitions x 1 set of inspiration and expiration each
	Ankle toe movements	10 repetitions x 2 sets
	Active right side fingers and elbow movements	10 repetitions each
	Active-assisted right side shoulder movements (flexion and abduction upto 90º)	10 repetitions each
	Splinting techniques demonstration	-
	Propped up positioning	3-5 times/day (duration = as long as the patient feels comfortable)
5-7	Diaphragmatic breathing	8-10 repetitions
	Pursed lip breathing	8-10 repetitions
	ACBT	5-6 cycles
	Incentive spirometry	10 repetitions x 2 sets of inspiration and expiration each
	Ankle toe movements	20 repetitions x 2 sets
	Heel slides	10 repetitions
	Turning onto both sides	3-5 times
	Sitting by the side of the bed (with minimal manual support)	3-5 times/day (duration = 20-30 min)
	Sitting to standing by the side of the bed (with maximum manual support)	1-2 minutes, 3-5 times/day
	Active right side fingers and elbow movements	15-20 repetitions each
	Active-assisted right side shoulder movements (flexion and abduction upto180º)	15-20 repetitions each
	Finger ladder for right shoulder flexion and abduction	8-10 repetitions each
8-10	Diaphragmatic breathing	10-12 repetitions
	Pursed lip breathing	10-12 repetitions
	Incentive spirometry	15-20 repetitions x 2 sets of inspiration and expiration each
	Ankle toe movements	20 repetitions x 2 sets
	Active right side fingers and elbow movements	15-20 repetitions each
	Active right side shoulder movements (flexion and abduction upto 180º)	15-20 repetitions each
	Beach pose	10 repetitions
	Hand behind the head	10 repetitions
	Hand behind the back	10 repetitions
	Shoulder wheel	10 repetitions clockwise and ante clockwise
	Sitting to standing by the side of the bed (with moderate to minimum manual support)	1-2 minutes, 5-7 times/day
	Ambulation on a straight path like a corridor/lobby (with moderate to minimum manual support)	3-5 times/day
11-13	Diaphragmatic breathing	10-12 repetitions
	Pursed lip breathing	10-12 repetitions
	Incentive spirometry	15-20 repetitions x 3 sets of inspiration and expiration each
	Resisted right side fingers and elbow movements	8-10 repetitions each
	Resisted right side shoulder movements	9-10 repetitions each

Post-op days	Exercise program	Dosage
	Beach pose	12-15 repetitions
	Hand behind the head	12-15 repetitions
	Hand behind the back	12-15 repetitions
	Shoulder wheel	12-15 repetitions clockwise and ante clockwise
	Spot marching by the side of the bed (with moderate to minimum manual support)	10-20 steps, 5-7 times/day
	Ambulation on a straight path like a corridor/lobby (with minimum to no manual support)	3-5 times/day
14-16	Diaphragmatic breathing	10-12 repetitions
	Pursed lip breathing	10-12 repetitions
	Incentive spirometry	20 repetitions x 3 sets of inspiration and expiration each
	Resisted right side fingers and elbow movements	10-12 repetitions each
	Resisted right side shoulder movements	10-12 repetitions each
	Beach pose	15 repetitions
	Hand behind the head	15 repetitions
	Hand behind the back	15 repetitions
	Shoulder wheel	15 repetitions clockwise and ante clockwise
	Ambulation on a straight path like a corridor/lobby (with minimal to no manual support)	5-7 times/day
	Ambulation on an inclined path (with minimal to no manual support)	3-5 times/day
	Stair climbing	1-3 flights, 3-5 times/day

ACBT: Active Cycle Breathing Technique

OUTCOME MEASURES

Six outcome measures were used in order to assess the effects of the exercise program before and after the surgery (Table 2). The Numerical Pain Rating Scale (NPRS) was used to measure pain intensity.[25] The Karnofsky Performance Status (KPS) score was used to assess functional impairment.[26] The Hospital Anxiety and Depression Scale (HADS) was used to measure symptoms of anxiety and depression during hospital stay.[27] Chest expansion measurements were taken using a measuring tape at three points (axilla, 4th intercostal space and xiphisternum).[28] A peak expiratory flow meter was used to assess the maximum flow rate generated during a forceful exhalation.[29] Lastly, the Functional Assessment of Cancer Therapy – General (FACT-G) questionnaire was used to assess the overall quality of life. [30]

Table 2: Outcome measures used pre-surgery and at four end-points post-surgery

Outcome Measures	Pre-op	Post-op day 1	Post-op day 2	Post-op day 9	Post-op day 16
NPRS	6/10	8/10	6/10	3/10	1/10
KPS	90/100	40/100	50/100	50/100	70/100
HADS					
Anxiety	20/21	6/21	7/21	17/21	19/21
Depression	21/21	8/21	11/21	18/21	20/21
PEFR (L/min)	220 L/min	60 L/min	60 L/min	120 L/min	160 L/min
FACT-G	103/108	64/108	65/108	100/108	102/108
Chest Expansion (cm)					
Axilla	3.7	Could not be assessed due to pain	4.4	4.9	5.3
4th intercostal space	6		5.8	6.2	8.3
Xiphisternum	3.8		4.2	4.8	4.9

FACT-G: Functional Assessment of Cancer Therapy – General,VAS: Visual Ananlogue Scale, KPS: Karnofsky Performance Status, PEFR: Peak Expiratory Flow Rate

DISCUSSION

The current study aimed to assess a post-operative exercise program in an obese elderly female who was diagnosed with an anterior abdominal wall tumour. The patient was looked after by a team of healthcare professionals involved in the management of Metabolic Syndrome and Oncology including a surgical oncologist, a plastic surgeon, a physiotherapist, two nurses etc.

The decrease in the BMI of the patient has been describes in table 3. Exercise can potentially improve levels of HDL in the body either via lipoprotein lipase facilitating transfer of lipid to HDL or hepatic triglyceride lipase reducing High Density Lipoprotein (HDL) clearance. This means that a reduction in adiposity can potentially improve Metabolic Syndrome.[31]

Table 3: Differences in Body Mass Index

Pre-intervention	2 months	4 months	6 months
26 kg/m^2	24.4 kg/m^2	22.8 kg/m^2	21.5 kg/m^2

There was a reduction seen in pain scores during the course of rehabilitation. Cold gel pack application for 6 hours after surgery has been shown to be effective in reducing incisional pain in women who have undergone gynaecological surgeries. [32]Another study done in 2020 suggested that postoperative frozen gel packs can be a simple modality used to treat post-surgical pain. It also significantly reduced narcotic use and promoted better functional recovery in patients undergoing surgery for breast cancer.[33]

In the current study, the patient reported higher levels of anxiety and depression and a poor quality of life in the beginning of the exercise program. As the metabolic and oncological +rehabilitation program succeeded, she reported lesser depression and anxiety and an improvement in her overall quality of life. A similar study was done by Morten et al to investigate the benefits of a 6-week supervised exercise intervention amongst patients diagnosed with advanced stage lung cancer undergoing chemotherapy. The study suggested that exercise helped in reducing anxiety and depression in those patients and also improved their overall quality of life. [34]Another study by Ji-hee et al studied the effect of post-operative exercise program in colorectal cancer patients and proved that exercise after surgery improved overall quality of life. [35]

In the present study, the patient reported a better KPS score by the end of the in-patient Metabolic and Oncological Rehabilitation Program. This finding lies in alignment with a study done by Courneya et al suggested that exercising at least 3–5 times per week, for 20–30 min, at 65% to 75% of the predicted heart rate maximum resulted in increased cardiovascular fitness and improved overall quality of life in survivors of colorectal cancer.[36]

Barber et al, in their study, described that post-operative patients diagnosed with head and neck cancers showed mild to severe depressive symptoms. Those patients with moderate to severe depression had a poor performance status. [37] In the current study, possibly the patient had a poor KPS score initially due to depression and anxiety related to hospital admission and stay along with post-surgical pain. As her symptoms reduced over the course of rehabilitation, her performance status also improved. Burnham T. et al also concluded that low-intensity exercise training helps in enhancing psychological functions in cancer survivors. [38]

It has been proven that incentive spirometry and deep breathing exercises are effective in reducing post-operative complications in upper abdominal surgeries. [20] The results of the present study also showed that the patient had an improvement in her chest expansion at all the three levels along with her PEFR readings.

In the present study, the patient was made to perform bed-side sitting by day 5 followed by mobilization by day 8. Initially, complete assistance was given to the patient for walking. Gradually, the patient had started walking independently. Thus, stair climbing was introduced by day 14 along with walking on an inclined path. A study done by Almeida et al studied the effect of early mobilization on functional capacity in patients undergoing major abdominal surgery. The results of our study are in inclination with their resultssuch that early post-operative mobilization does improve functional capacity and aids in overall recovery of the patient. [39] Early post-operative mobilization has also shown to improve social and emotional well-being. [40]

Thus, the present study suggests that a tailor-made Metabolic and Oncological Rehabilitation protocol for a post-surgical case of anterior abdominal wall tumour is effective in reducing post-operative complications and improving the patient's overall quality of life.

CONCLUSION

A combination of breathing exercises, upper limb movements and functional activities along with regular assessments using validated outcome measures contributed to the success of this rehabilitation approach. It led to a reduction in pain, hospital-associated anxiety and depression and an improvement in performance status and respiratory parameters leading to an overall improvement in the patient's quality of life.

A lack of knowledge about the importance of exercise in the field of oncology is one of the major barriers as to why physiotherapy is not practiced in this field. [41] Physical therapy for the overall rehabilitation of cancer patients must be included in the future for betterment of the patients as well as add on to research in the fields of metabolic and oncology physiotherapy.

Thus, an interdisciplinary holistic metabolic and oncological rehabilitation program provides a positive prognosis in a post-operative case of Abdominal Wall Tumour which is moderately differentiated adenocarcinoma suggestive of upper gastro-intestinal or pancreato-biliary origin.

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