JOHNS HOPKINS MEDICINE

Oncology Research- A Year in Review

Combined Sections Meeting
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Disclosures

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- Cynthia Barbe, Rachel Slusher, and Lauren Miller have no disclosures regarding the material presented in this educational series.
- We love working in the Acute Care setting with the Oncology Population, especially as we can provide evidenced based therapy interventions across the continuum of care and through their survivorship.

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Objectives

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- 1. Report and interpret new literature surrounding the examination of or treatment for oncology health conditions.
- 2. Compare prior knowledge and practice to ideas and concepts in current literature.
- 3. Discuss with peers the application and impact these studies can have on current and future practice.

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Statistics

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- January 2016- 15.5 million Americans with Cancer
- Expected 2024-19 million Americans with Cancer
- For 2017, it is estimated there will be close to 1.7 million new diagnoses (excludes in situ and BCC/SCC of the skin)
- Close to 601 thousand will pass away from the disease; of these, close to 191 thousand will be from cigarette smoking

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Statistics

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- 2017- most common cancers- lung, colorectal, breast, and prostate
- 87% of cancer diagnoses are in those >50 years of age
- Cancer is the 2nd leading cause of death in the US
  - 600,920 deaths in 2017 (1,650 people per day)
- Direct medical costs in 2014- $87.8 billion
- 41 of 100 men and 38 of 100 women will develop cancer

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Statistics

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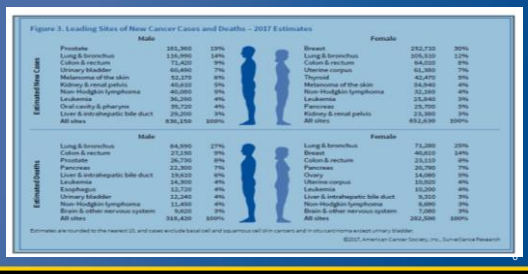
Figure 3. Leading Sites of New Cancer Cases and Deaths - 2017 Estimates

Estimated New Cases

Male			Female		
Prostate	161,360	19%	Breast	252,710	30%
Lung & bronchus	136,990	14%	Lung & bronchus	105,110	12%
Colon & rectum	71,420	9%	Colon & rectum	64,010	8%
Urinary bladder	60,490	7%	Uterine corpus	61,380	7%
Melanoma of the skin	52,170	6%	Thyroid	42,470	5%
Kidney & renal pelvis	40,610	5%	Melanoma of the skin	34,940	4%
Non-Hodgkin lymphoma	40,090	5%	Non-Hodgkin lymphoma	32,160	4%
Leukemia	36,290	4%	Leukemia	25,640	3%
Oral cavity & pharynx	35,720	4%	Pancreas	25,700	3%
Liver & intrahepatic bile duct	26,200	3%	Kidney & renal pelvis	23,380	3%
All sites	836,150	100%	All sites	852,630	100%

Estimated Deaths

Male			Female		
Lung & bronchus	84,590	27%	Lung & bronchus	71,280	25%
Prostate	26,730	9%	Breast	40,610	14%
Pancreas	22,300	7%	Colon & rectum	23,110	8%
Liver & intrahepatic bile duct	19,610	6%	Pancreas	20,790	7%
Leukemia	14,300	4%	Ovary	14,080	5%
Esophagus	12,720	4%	Uterine corpus	10,920	4%
Urinary bladder	12,340	4%	Leukemia	10,200	4%
Non-Hodgkin lymphoma	11,480	4%	Liver & intrahepatic bile duct	9,310	3%
Brain & other nervous system	9,020	3%	Non-Hodgkin lymphoma	8,690	3%
All sites	318,420	100%	Brain & other nervous system	7,080	3%
			All sites	282,500	100%

Estimates are rounded to the nearest 10, and cases exclude basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder.

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TOPICS OF DISCUSSION

1. Physical Activity/Therapy with Cancer
2. Body Composition Changes and Effects
3. Cancer Rehabilitation

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PHYSICAL ACTIVITY/THERAPY & CANCER

ORIGINAL RESEARCH

Exercise training for people following curative intent treatment for non-small cell lung cancer: a randomized controlled trial☆

Vinicius Cavalheri[a,b,*], Sue Jenkins[a,b,c], Nola Cecins[b,c,d], Kevin Gain[e,f], Martin J. Phillips[g], Lucas H. Sanders[h], Kylie Hill[a,b,i]

Brazilian Jour Phys Ther. 2017; 21(1): 58-68.

Introduction

- Purpose: To examine the following: exercise capacity, physical activity and sedentary behavior, peripheral muscle force, health related quality-of-life, fatigue, feelings of anxiety and depression, and lung function: with a supervised exercise program following curative treatment of NSCLC.
- Patients: Randomized to EXER vs CON groups who were 6-10 weeks post-lobectomy or 4-8 weeks after their last cycle of receiving adjuvant chemotherapy. N=17; single blind RCT.

Cavalheri, et al.

- Methods:
  - Data- 6-10 weeks post-lobectomy or 4-8 weeks post last cycle of adjuvant chemotherapy
  - Baseline assessments over 2-3 days, minimum 24 hr between each and after 8 weeks of intervention period
  - EXER- n=9; 3x/week, PTs, 60 minutes, aerobic & resistance
  - CON- n= 8; Usual activity, weekly phone call, conversations included questions about health and well-being
  - Inclusion- referred by OP Pulm Rehab Programs, 2 hospitals and 1 private thoracic surgery office
  - Exclusion- co-morbidities compromising safety, severe NM limitations, if within last 3 months have participated in a supervised exer program, non-English speaking or comprehending

Cavalheri, et al.

- Data Points:
  - First assessment day:
    - 6MWT, SF-36, FACT-L, EORTC QoL-C30, Hospital Anxiety and Depression Scale, FACIT- F, Isometric hand grip
  - Second assessment day:
    - After 7 consecutive days (minimum of 4 days for data to be included):
    - Spirometry, lung volumes, gas transfer- VO2peak, Wmax VO2 at anaerobic threshold), O2pulse
  - Third assessment day:
    - Isometric quadriceps muscle torque

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Hospital Depression & Anxiety Scale

Question	Yes. definitely	Yes. sometimes	No. not much	No. not at all
I awake early and then sleep badly for rest of night	3	2	1	0
I get very frightened or have panic feelings for apparently no reasons	3	2	1	0
I feel miserable and sad	3	2	1	0
I feel anxious when I go out of house on my own	3	2	1	0
I have lost interest in things	3	2	1	0
I get palpitations or sensations of "butterflies" in my stomach and chest	3	2	1	0
I have good appetite	0	1	2	3
I feel scared and frightened	3	2	1	0
I feel life is not worth living	3	2	1	0
I still enjoy the things I used to	0	1	2	3
I am restless and I cannot keep still	3	2	1	0
I am more irritable than usual	3	2	1	0
I feel as if I have slowed down	3	2	1	0
Worrying thoughts constantly go through my mind	3	2	1	0

Anxiety 2, 4, 6, 8, 11, 12, 14, Depression 1, 3, 5, 7, 9, 10, 13, Scoring 3, 2, 1, 0 (for items 7 and 10 scoring is reversed), Grading: 0–7= non case 8–10= borderline case 11+= case

Jadhav, SA. Indian Jour Urol. 2010. 26; 490-493.

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Functional Assessment of Chronic Illness Therapy (FACIT) Fatigue Scale (Version 4)

Below is a list of statements that other people with your illness have said are important. Please circle or mark one number per line to indicate your response as it applies to the **past 7 days**.

		Not At All	A Little Bit	Somewhat	Quite a Bit	Very Much
1	I feel fatigued	0	1	2	3	4
2	I feel weak all over	0	1	2	3	4
3	I feel listless ("washed out")	0	1	2	3	4
4	I feel tired	0	1	2	3	4
5	I have trouble **starting** things because I am tired	0	1	2	3	4
6	I have trouble **finishing** things because I am tired	0	1	2	3	4
7	I have energy	0	1	2	3	4
8	I am able to do my usual activities	0	1	2	3	4
9	I need to sleep during the day	0	1	2	3	4
10	I am too tired to eat	0	1	2	3	4
11	I need help doing my usual activities	0	1	2	3	4
12	I am frustrated by being too tired to do the things I want to do	0	1	2	3	4
13	I have to limit my social activity because I am tired	0	1	2	3	4

Scoring: Items are scored as follows: 4=Not At All; 3=A Little Bit; 2=Somewhat; 1=Quite A Bit; 0=Very Much, EXCEPT items #7 and #9 which are reversed scored. Score range 0-52. A score of less than 30 indicates severe fatigue. The higher the score, the better the quality of life.

Item Number	Reverse Item?		Item Response	Item Score
1		4	-	=
2		4	-	=
3		4	-	=
4		4	-	=
5		4	-	=
6		4	-	=
7		4	+	=
8		4	-	=
9		4	+	=
10		4	-	=
11		4	-	=
12		4	-	=
13		4	-	=

Sum individual item scores: _____
Multiply by 13: _____
Divide by number of items answered: _____

The copyright holder allows this work to be used for non-commercial and/or educational purposes; https://www.physio-pedia.com/File:FACIT.JPG

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- Results:
  - EXER- if only 2 sessions at site, were given an ergometer for home use
  - 44% adherence (completed >15 sessions)
  - Gains in VO2peak
  - Gains in O2 pulse
  - Gains in Wmax
  - Gains in 6MWT distance- by 52 meters

Cavalheri, et al. 16

- Discussion:
  - The improvement in VO2peak is important because this measure is a predictor of mortality in those undergoing treatment for NSCLC. Similarly, the increase in 6MWT distance is a prognostic indicator in this population. The increase in O2 pulse may suggest that with the training provided in this study there is an increase in stroke volume. Because there was no change in either quadriceps or handgrip, it may suggest there was an insufficient load to produce changes. And finally, the finding of no changes in fatigue and anxiety/depression is due to no reported fatigue and low anxiety and depression at the participants' baseline.

Cavalheri, et al. 17

- Limitations:
  - Patients who were eligible, yet did not participate, did no want to travel to clinic or had other responsibilities; small sample although a pilot study; and low adherence.
- Conclusion:
  - Patients participating in an 8 week supervised exercise program demonstrated an increase in exercise capacity. This design can be use for future research.

Cavalheri, et al. 18

PHYSICAL ACTIVTY/THERAPY & CANCER

- "After a 12 week pulmonary rehabilitation program for patients who are curatively treated for NSCLC stages I to IIIa, results demonstrated an increase in exercise capacity and QoL with a decrease in fatigue".

  (Janssen, SM, et al)
- "Only one-third of patients with late stage- IIIC or IV NSCLC- are likely to have interest in a rehabilitation program, even though they have a high level of disability. Earlier education and integration of therapy services may decrease patient misperceptions of our role in their care.

  (Cheville, AL, et al)

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Respiratory Muscle Training Improves Exercise Performance and Quality of Life in Cancer Survivors: A Pilot Study

Andrew D. Ray, PT, PhD[1]; Brian T. Williams, MS[2]; Martin C. Mahoney, MD, PhD[3]

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Rehab Oncol. 2017; 35: 81-89.

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Introduction

- Purpose:
- To examine if a respiratory muscle training program improves quality of life and exercise capacity in breast and lung cancer survivors
- Patients:
- Those surviving breast and lung cancer who report mild to moderate symptoms of dyspnea- not related to cardiopulmonary disease; n=11, single arm pilot study

Ray, et al.

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- Methods:
  - Baseline and post-4 week MRT Program
  - RMT- 3 days/week = 12 sessions (1 in clinic/lab, 2 at home); 3 sets of 15 repetitions against spring loaded valves
  - Resistance started at 40% baseline max pressures, increased by 10% each week- recorded each session
  - Inclusion- score of $\geq$2 on Medical Research Council Dyspnea Scale, stable disease and > 6 month life expectancy, completed treatment therapies, 18-75 y/o, walk unassisted 100 m, no contraindications to participate in aerobic exercise
  - Exclusion- known Cardio-Pulm disease, FEV1 60% predicted value (mod-servere lung disease), ischemic heart disease, CHF, arrhythmias, O2sat <90%

Ray, et al.

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- Data Points:
  - First session- spirometry MIP & MEP, MVV12, cycling peak exercise test, MRC Dyspnea Scale, Baseline Dyspnea Scale, Transitional Dyspnea Index
  - Second session- submax cycling test 70% VO2peak, TUG, 6MWT, self administered QoL and fatigue questionnaires
  - 2 sessions at least 3 days apart
  - RMT- 3 days/week = 12 sessions (1 in clinic/lab, 2 at home); 3 sets of 15 repetitions against spring loaded valves
  - Resistance started at 40% baseline max pressures, increased by 10% each week- recorded each session

Ray, et al.

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The MRC Breathlessness Scale

Grade	Degree of breathlessness related to activities
1	Not troubled by breathlessness except on strenuous exercise
2	Short of breath when hurrying on the level or walking up a slight hill
3	Walks slower than most people on the level, stops after a mile or so, or stops after 15 minutes walking at own pace
4	Stops for breath after walking about 100 yds or after a few minutes on level ground
5	Too breathless to leave the house, or breathless when undressing

From: The MRC breathlessness scale
Occup Med (Lond). 2008;58(3):226-227. doi:10.1093/occmed/kqm162
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Stenton, C. Occupational Medicine. 2008; 58(3): 226-227.

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MAHLER'S DYSPNEA INDEXES

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BASELINE DYSPNEA INDEX (BDI)

- Designed to rate the severity of dyspnea at a single time point
- Magnitude of task, magnitude of effort, and functional impairment
- Each category has 5 grades ranging from 0 (severe) to 4 (unimpaired)
- Added together for a baseline focal score (range 0–12)- lower score = more dyspnea

http://www.thoracic.org/members/assemblies/assemblies/srn/questionaires/bdi-tdi.php

TRANSITION DYSPNEA INDEX (TDI)

- Designed to capture a change (or no change) from the baseline assessment
- Magnitude of task, magnitude of effort, and functional impairment
- At the transition period, changes in dyspnea were rated by 7 grades, ranging from −3 (major deterioration) to +3 (major improvement)
- Ratings for each of the 3 categories added to form a transition focal score (range −9 to +9)

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- Results:
  - 10 subjects completed the study- 10 s/p surgery, 6 s/p chemo, 5 s/p radiation, 5 s/p all 3 treatments
  - Breast Cancer Survivors demonstrated baseline inspiratory muscle weakness compared to Lung Cancer Survivors
  - RMT significantly increased MIP and MEP by 29% (p= 0.003) and 34% (p < 0.001), respectively, as well as an increase in MVV12 by 12% (p= 0.017)
  - Participants were able to exercise longer to achieve a higher workload; submax cycle time increased from 16.9 to 31.4 minutes, p= 0.014
  - 6MWT distance increased from 427 to 471 m (p= 0.005)
  - BDI and TDI improved significantly (p= 0.012); SF-36 physical health scale and total score increased significantly (p= 0.039 and p= 0.014)

Ray, et al.

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TABLE 1
Effects of Respiratory Muscle Training on Selected Respiratory Variables[a]

	Pre	Post	P
FEV_1, L	1.83 ± 0.4	1.85 ± 0.4	.348
% predicted	*82 ± 18*	*82 ± 19*	*.442*
FVC, L	2.50 ± 0.6	2.51 ± 0.6	.383
% predicted	*82 ± 17*	*83 ± 17*	*.431*
MVV_{12}, L	68.0 ± 23.2	74.9 ± 24.3	.017
% predicted	*71 ± 25*	*78 ± 36*	*.103*
MIP, cm H_2O	74.6 ± 26.8	99.1 ± 24.1	<.001
% predicted	*89 ± 25*	*125 ± 23*	*<.001*
MEP, cm H_2O)	72.4 ± 23.2	97.0 ± 27.4	<.001
% predicted	*50 ± 18*	*67 ± 20*	*<.001*

Abbreviations: FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 second; MEP, maximal expiratory pressure; MIP, maximal inspiratory pressure; MVV_{12}, maximal voluntary ventilation in 12 seconds.
[a]*P* values less than .05 were considered significant. Data are presented as mean ± SD.

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- Discussion: A RMT program demonstrated increases in MIP, MEP, peak and submax exercise performance, and QoL, as well as decreases in dyspnea in Breast and Lung Cancer Survivors. Effects of cancer treatment as well as tumor location and vascular dysfunction can lead to muscle weakness.
- Limitations:
  - Excluded patients with mod-severe lung disease
  - Limited studies in expiratory strength in Cancer Survivors
  - Small sample size
  - Limited generalizability

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- Conclusions:
  - 4 weeks of a RMT program improves respiratory muscle function, thus leading to improved exercise performance, as well as QoL and dyspnea in Breast and Lung Cancer Survivors.

Ray, et al.

PHYSICAL ACTIVITY/THERAPY & CANCER

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- It is feasible to implement an individualized aerobic exercise program to improve exercise capacity, 6MWT, functional independence, fatigue, and strength in patients with a brain tumor who were in an inpatient rehabilitation continuing care to an outpatient setting.
  (Ayotte, SL and Harro, CC. 2017)
- It is feasible to utilize a cardiopulmonary exercise test to screen patients with leukemia for cardiac function after chemotherapy and prior to stem cell transplant, as well as use results as a prediction of physical performance of these patients.
  (Kim, SK, et al. 2017)

Physical Therapy Intervention During a Red Blood Cell Transfusion in an Oncologic Population: A Preliminary Study

Anson B. Rosenfeldt, Lauren M. Pilkey, Robert S. Butler

Jour Acute Care Phys Ther. 2017; 8(1): 20-28.

Introduction

- Purpose:
- To examine adverse events- if any- while providing therapy care during a red blood cell transfusion in the oncology population.
- Patients:
- Patients admitted to the hospital with diagnoses of leukemia, lymphoma, and s/p bone marrow transplant who received blood transfusions. n=65, retrospective study (chart reviews)

- Methods:
  - 3 groups- PT, PT during transfusion (PT + RBC), and transfusion (RBC)
  - Adverse events- change in SBP >10 mmHg with symptoms, change in SBP to > 200 mmHg or DBP >115 mmHg, HR- >85% MHRest based on age, pulse ox/O2sat <88% for 30 sec
  - Other events- patient requesting to stop, dislodging of line, syncope, reaction to RBCs

- Results:
  - 65 patients experienced 90 events- 26 of which unique- 18 in the PT, 26 in the RBC, and 21 in the PT + RBC groups
  - PT group had a significantly higher pre- and post- HR compared to RBC and PT + RBC groups (who had lower HgB & Hct levels compared to PT group)
  - 3 adverse events in PT group- 2 with SBP drop >10 mm Hg with changes in position, 1 asking to stop treatment
  - Billing- eval, re-eval, NMR, GT- PT group billed more TA and PT + RBC group billed more TE

TABLE 2. Summary of Laboratory Values and Vital Signs by Group[a]

	Total (N = 78)	PT-Only (n = 26)	RBC-Only (n = 26)	PT + RBC (n = 26)	P
Hemoglobin, g/dL	8.2 ± 1.0	9.2 ± 0.8[b,c]	7.7 ± 0.9[d]	7.8 ± 0.5[d]	<.01
Hematocrit, %	24.3 ± 3.3	27.1 ± 2.7[b,c]	23.1 ± 3.3[d]	22.7 ± 1.6[d]	<.01
Pretreatment systolic blood pressure, mm Hg	123.8 ± 16.3	121.9 ± 18.5	123.2 ± 13.2	126.4 ± 17.0	.59
Posttreatment systolic blood pressure, mm Hg	128.1 ± 15.5	122.4 ± 17.7	131.1 ± 14.3	130.7 ± 13.0	.07
Pretreatment diastolic blood pressure, mm Hg	68.8 ± 10.5	68.4 ± 11.6	67.9 ± 9.2	70.2 ± 10.9	.70
Posttreatment diastolic blood pressure, mm Hg	72.0 ± 10.6	70.3 ± 9.4	73.7 ± 10.7	71.9 ± 11.7	.52
Pretreatment heart rate, bpm	88.4 ± 17.3	96.8 ± 16.3[b,c]	84.5 ± 16.5[d]	83.9 ± 16.6[d]	.01
Posttreatment heart rate, bpm	91.6 ± 17.3	101.9 ± 14.2[b,c]	84.2 ± 14.4[d]	88.8 ± 18.2[d]	<.01
Pretreatment oxygen saturation, %	97.3 ± 2.3	96.7 ± 2.7	—[e]	97.9 ± 1.6	.05
Posttreatment oxygen saturation, %	97.1 ± 2.5	96.6 ± 3.2	—[e]	97.6 ± 1.5	.17

Abbreviations: bpm, beats per minute; PT-Only, physical therapy intervention alone; PT + RBC, physical therapy intervention during an RBC transfusion; RBC, red blood cell; RBC-Only, RBC transfusion without physical therapist intervention.

[a]Values presented as mean ± SD. Analysis of variance used for all variable analysis.

[b]Significantly different from RBC-only.

[c]Significantly different from PT + RBC.

[d]Significantly different from PT-only.

[e]Data not available for all subjects. Nursing staff did not document oxygen saturation during an RBC transfusion.

TABLE 3. Units Billed by Physical Therapist per Group

	PT + RBC	PT-Only	P
Evaluation, units	6	6	1.00
Reevaluation, units	1	0	1.00
Therapeutic activity, units	7	23	<.01
Therapeutic exercise, units	30	10	<.01
Gait training, units	8	11	.39
Neuromuscular reeducation, units	1	0	1.00

Abbreviations: PT, physical therapy; PT-Only, physical therapy intervention alone; PT + RBC, physical therapy intervention during an RBC transfusion; RBC, red blood cell.

- Discussion: With monitoring of vital signs pre- and post PT, it is safe to perform PT interventions while patients are receiving a RBC transfusion.
- Limitations:
  - Small sample size
  - Limited generalizability
  - Only accounted for transfusion reactions record during infusion- nothing after completion
  - No discussion as timing of when PT could start session after beginning of blood transfusion

Rosenfeldt, et al. 37

- Conclusions:
  - This study provides early evidence that patients with hematological malignancies who are receiving an active RBC transfusion can safely participate in PT interventions- utilizing close monitoring of VS and medical reactions to transfusions.

Rosenfeldt, et al. 38

PHYSICAL ACTIVITY/THERAPY & CANCER

- Physical Therapy interventions can be safely and effectively used with oncology patients who have low/abnormal red blood cells and platelets when clinical reasoning is applied for treatment modification.
  (Gilcrest, L, and Tanner, LR. 2017)
- It is feasible for patients who are post- hematopoietic stem cell transplant to participate in an exercise program despite thrombocytopenia.
  (Rexer, R, et al. 2016)

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Thank you for your time & attention!

Bubbe & Murphy

Samantha (Sami)

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BODY COMPOSITION CHANGES AND EFFECTS

1. **Cachexia**
   - Is high intensity exercise appropriate?
2. **Sarcopenia**
   - Assessing the impact on the pre and post bone marrow transplant patient
3. **Cancer related fatigue**
   - Which non-pharmaceutical interventions combat it?

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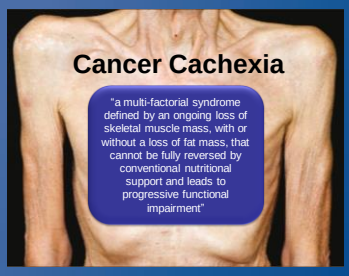

Cancer Cachexia

"a multi-factorial syndrome defined by an ongoing loss of skeletal muscle mass, with or without a loss of fat mass, that cannot be fully reversed by conventional nutritional support and leads to progressive functional impairment"

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Addressing Cachexia

- Upper GI tract and lung cancer
  - Over half affected at diagnosis
- How might exercise help?
  - Modulate muscle metabolism/stimulate protein synthesis
  - Improve insulin sensitivity
  - Anti inflammatory effect
- Does exercise help?
  - 2014 Cochrane review with no relevant studies
  - Multimodal intervention feasible (Solheim, et al)

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Journal of Cancer 2016, Vol. 7 2378

IVYSPRING INTERNATIONAL PUBLISHER

Journal of Cancer

2016; 7(15): 2378-2387. doi: 10.7150/jca.17162

Research Paper

Positive Prehabilitative Effect of Intense Treadmill Exercise for Ameliorating Cancer Cachexia Symptoms in a Mouse Model

Hyunseok Jee[1, 3], Ji-Eun Chang[2], Eun Joo Yang[1]

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Introduction

- Kakos=bad, hexis=condition
- Cancer cachexia
  - At least 5% change in any of the three: muscle strength, fatigue, anorexia, low fat-free mass, normal biochemistry
  - Exercise→anti-inflammatory→block cytokines involved in catabolism
- Purpose of study
  - Emphasize the importance of prehabilitation
  - Understand effects of exercise intensity on cancer-related cachexia
- Hypothesis
  1. Mice with cancer have a shorter lifespan than non-cancer control mice
  2. Different exercise intensities may affect cancer cachexia symptoms to different degrees

Jee, et al. 46

Methods

- 40 male mice, four weeks old; four week study
- Control
  - Non-cancer control group (N=10, NC)
  - Cancer (colon) control group (N=10, CC)
- Exercise (treadmill 45min, every other day)
  - Cancer with moderate exercise (N=10, ME)
    - 0.5km/h (70% max HR)
  - Cancer with intense exercise (N=10, SE)
    - 1.0km/h (90% max HR)

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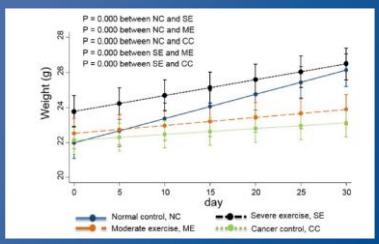
Data Points

- Tissue to body weight ratio
  - Lung tissue, diaphragm, gastrocnemius, soleus
- Quality of life
  - Behavior tests: average speed and step count
  - Food intake
  - Daily body weight
- Muscular Homeostasis and Cytokine-related proteins
  - IGF-1: muscle mass mediating factor
  - IL-6, TNF-alpha: indicators of immune function

Jee, et al. 48

Results-Weight changes



Results-Tissue weight

	Lung		Diaphragm		Gastrocnemius		Soleus	
	Tissue weight (g)	Ratio to weight	Tissue weight (g)	Ratio to weight	Tissue weight (g)	Ratio to weight	Tissue weight (g)	Ratio to weight
Normal control	151.67 ± 15.87	6.10 ± 0.66	75.18 ± 6.92**	3.02 ± 0.29	108.15 ± 7.07	4.35 ± 0.27	6.10 ± 0.58**	0.24 ± 0.05
Cancer control	284.24 ± 284.48	15.77 ± 18.58	69.30 ± 12.21**	3.60 ± 1.12	79.87 ± 9.20$^{**(\#)}$	4.13 ± 0.96	4.62 ± 0.67$^{**(\#)}$	0.24 ± 0.05
Moderate exercise	240.49 ± 220.37	12.43 ± 17.14	78.41 ± 16.28	3.52 ± 1.24	106.46 ± 22.75**	4.64 ± 1.03	5.03 ± 0.76**	0.22 ± 0.05
Severe exercise	152.15 ± 14.10	5.80 ± 0.37	88.62 ± 9.06	3.39 ± 0.37	124.35 ± 8.40$^{\#\#}$	4.75 ± 0.34	6.95 ± 1.40$^{\#\#**}$	0.26 ± 0.05

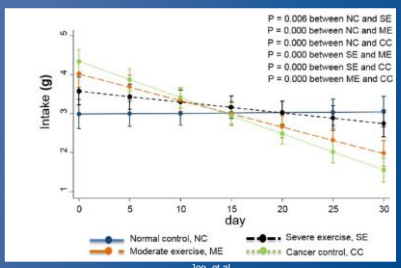
N = 10 for each group. Values are means ± S.D. Gastrocnemius = Gastrocnemius muscle, Soleus = Soleus muscle, Moderate exercise = Cancer with moderate exercise, Severe exercise = Cancer with severe exercise. **P<0.01: statistical significances between Normal control and Cancer control, $^{\#\#}$P<0.01: statistical significances between Cancer control and Moderate exercise, $^{\#}$P<0.01: statistical significances between Cancer control and Severe exercise, and *P<0.05, **P<0.01: statistical significances between Moderate exercise and Severe exercise.

Results-Behavioral test

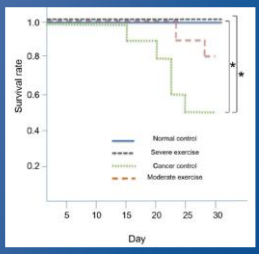
	Distance (cm)	Right forelimb steps	Left forelimb steps	Right hindlimb steps	Left hindlimb steps	Total steps	Average speed (cm/sec)
Normal control	60	12.17 ± 3.78	12.82 ± 3.50	12.25 ±3.70	13.08 ± 4.40	51.46 ± 16.64	12.10 ± 6.93
Cancer control	60	13.24 ± 2.82	14.09 ± 2.71*	11.57 ± 1.69	11.57 ± 1.61	51.75 ± 6.86	7.17 ± 3.09
Moderate exercise	60	10.43 ± 1.57	10.29 ± 1.19*	10.07 ± 0.84	10.21 ± 1.00	42.67 ± 4.73	12.05 ± 7.03
Severe exercise	60	10.97 ± 1.92	11.33 ± 1.59	11.00 ± 2.25	11.25 ± 1.74	44.55 ± 7.24	15.19 ± 7.76

N = 10 for each group. Values are means ± S.D., *P<0.05 indicates significant differences compared to the normal control.

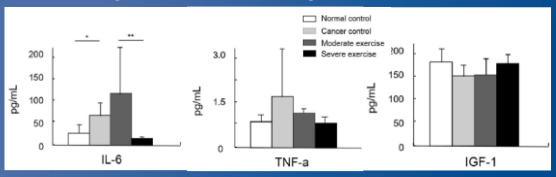
Results-Food intake



Results-Survival



Results-Muscular homeostasis and cytokine-related proteins



Discussion

- Intense exercise
  - Greater benefit on survival than moderate exercise
  - Positively affect cachexia symptoms
    - Tissue/body weight changes, QOL indicators, protein analyses
- Aerobic chosen over resistance
  - More anti-catabolic process
- Prevent cancer cachexia-induced decreased exercise capacity
  - Exercise before muscle atrophy=prehabilitation
  - Improve respiratory muscle function

Jee, et al. 55

Limitations

- Animal study
- Small sample size
- Feasibility of "severe" exercise (90% max HR)
- Feasibility of early exercise intervention in at-risk population

Jee, et al. 56

Conclusions

- Need to simulate metabolic changes of 90% max HR in human population for clinical tests
- Intense exercise has positive effects on cancer cachexia symptoms
  - Body weight
  - Survival rate
- Emphasis on prehabilitation

Jee, et al. 57

J Cancer Res Clin Oncol (2017) 143:1083–1092
DOI 10.1007/s00432-016-2336-8

ORIGINAL ARTICLE – CLINICAL ONCOLOGY

Clinical impact of sarcopenia and relevance of nutritional intake in patients before and after allogeneic hematopoietic stem cell transplantation

Shouichi Tanaka[1] · Osamu Imataki[2] · Atsuo Kitaoka[3] · Shuji Fujioka[1] · Etsuyo Hanabusa[3] · Yumiko Ohbayashi[4] · Makiko Uemura[2] · Nobuo Arima[5] · Tetsuji Yamamoto[6]

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Introduction

- Sarcopenia-loss of muscle mass
  - Common element of cachexia
  - Used to measure frailty in cancer patients
  - Related to toxicity of chemotherapy
- Hematopoietic stem cell transplant (HSCT)
  - Patients at risk for immune reactions
  - Relationship between physical function and quality of life
- Purpose of Study
  - Measure effects of physical rehabilitation and nutritional support program aimed at maintaining physical activity

Tanaka, et al. 59

Methods

- Retrospective evaluation of 34 patients s/p allogeneic HSCT (2007-2012)
- Chemotherapy treatment prior to transplant
- Rehabilitation program
  - 5x/week, 20minutes; -7days throughout admission
  - Resistance training, aerobic exercise
  - 3-4 METs
  - Physical therapist supervised
  - Nutritionist visit daily
- Graft evaluation
  - Engraftment: 1st of 3 consecutive days with netrophil count increased by > 500/microliters
  - Acute GVHD graded by standard diagnostic criteria
  - Corticosteroid initial dose researched

Tanaka, et al. 60

Data Points

- Physical Measurements
  - Test protocol/ "Tanaka program"
  - Body composition, hand grip, knee extensor, single leg stance, 6MWT
  - Assessment points
    - "Before"-1 week pre preparation regimen
    - "After"-Free from continuous immunosuppressant (~30days post transplant)
- Nutritional Measurements
  - Five time points: admission, start of preparation regimen, transplantation day, start of oral immunosuppressants, discharge
  - Total caloric intake (enteral, parenteral), body weight (ratio to ideal body weight), serum albumin, C-reactive protein

Tanaka, et al. 61

Patient population

- N=34; Females (16) Males (18)
- Median age: 51.5yrs; Mean age: 47.4
- Acute myeloid leukemia (11), acute lymphoblastic leukemia (6), myelodysplatic syndrome (6), malignant lymphoma (8), multiple myeloma (1), other (2)
- Related stem cells (2), unrelated (30)
- Myeloablative (14), non-myeloablative (20)
- Median length of stay: 54 days (13-268)

Tanaka, et al. 62

Results- Pre-Transplant

- 12 patients with sarcopenia at start (9 females, 3 males)
  1. Maximum lower leg circumference <30cm
  2. Left hand grip strength <30kg for males, <20kg for females
- Hand grip and knee extensor weaker than age matched control
  - Majority <10% of healthy population

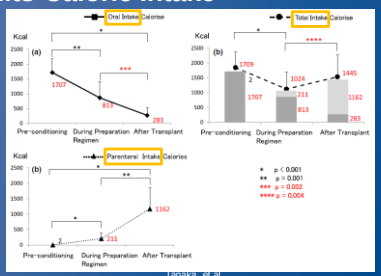
Tanaka, et al. 63

Results-Body Composition

	Pre-transplant	Post-transplant	Change volume	Change rate (%)	Probability
(a) Muscle strength					
Right-hand grip strength (kg)	30.6±12.4	27.5±11.1	−6.0±9.0	18.3	0.001
Left-hand grip strength (kg)	26.6±11.4	24.2±9.9	−3.7±4.7	14.8	0.006
Right-knee extensor strength (kg)	29.7±11.6	23.4±8.4	−6.4±7.6	19.3	0.001
Left-knee extensor strength (kg)	27.3±10.2	22.5±8.9	−5.2±5.5	18.7	<0.001
(b) Maximal circumference of the extremities					
Right upper arm (cm)	26.7±4.9	25.8±4.4	−0.9±1.7	3.7	0.012
Left upper arm (cm)	25.3±4.0	24.9±3.8	−0.7±1.4	2.8	0.031
Right lower arm (cm)	23.7±2.7	23.2±2.6	−0.5±0.7	2.7	0.002
Left lower arm (cm)	22.9±2.7	22.6±2.6	−0.5±0.8	2.4	0.001
Right upper leg (cm)	40.8±5.2	39.5±5.9	−1.4±1.9	4.0	0.001
Left upper leg (cm)	40.4±5.1	38.6±5.6	−1.8±1.9	4.9	<0.001
Right lower leg (cm)	33.4±3.9	31.7±4.0	−1.9±1.4	6.4	<0.001
Left lower leg (cm)	33.3±3.9	31.3±4.0	−2.1±1.7	7.1	<0.001
(c) One single-leg stance time					
Right leg standing time (min)	86.2±41.0	77.5±42.6	−9.5±45.5	7.4	0.334
Left leg standing time (min)	85.4±42.3	73.0±41.4	−18.2±54.2	12.2	0.266

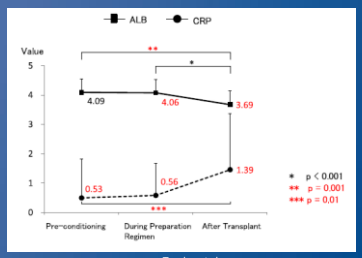
Tanaka, et al. 64

Results-Caloric Intake



Tanaka, et al. 65

Results-Nutrition and Inflammation



Tanaka, et al. 66

Discussion

- Hand grip ↓ 23%, knee extensor ↓ 20%
- Body weight ↓ 2.6kg
- Patients with acute GVHD with steroids had 16% progressive strength loss through 3 months post transplant
- Underlying muscle weakness before transplant
- Weakness more impaired in later transplant period
  - Greatest instability from transplant to engraftment

Tanaka, et al. 67

Limitations

- Small sample size
- Maximum circumference not sensitive for evaluation of strength
- No representative parameter for sarcopenia
- Use of concomitant treatment drugs not assessed
- Comorbidities and mortality not assessed
- All patients received rehabilitation

Tanaka, et al. 68

Conclusions

- Rehabilitation may be helpful to retain physical status/function
  - Prehabilitation may help maintain strength/prevent sarcopenia
- Oral caloric intake post transplant associated with maintained muscle mass
- Can we provide nutritional consultation?
  - APTA Website: Nutrition and Physical Therapy

"role of the physical therapist to screen for and provide information on diet and nutritional issues to patients, clients, and the community within the scope of physical therapist practice"
APTA House of Delegates 2015

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Cancer Related Fatigue

'a distressing, persistent, subjective sense of physical, emotional and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning'

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BJSM

Exercise and other non-pharmaceutical interventions for cancer-related fatigue in patients during or after cancer treatment: a systematic review incorporating an indirect-comparisons meta-analysis

Roger Hilfiker, Andre Meichtry, Manuela Eicher, Balfe Lina Nilsson, Ruud H Knols, Martin L Verra and Jan Taeymans

Br J Sports Med published online May 13, 2017

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Introduction

- Affects 25-99% of population; persists 5 + years post treatment
- Associated with decreased quality of life
- Possible mechanisms: Proinflammatory cytokines, hypothalmus-pituitary-adrenal axis deregulation, circadian rhythm desynchronization, skeletal muscle wasting, genetic deregulation
- Risk Factors: genetic, psychological, behavioral
- Purpose of study
  - Assess relative effects of different exercise and non-pharmaceutical interventions on CRF during and after cancer treatment

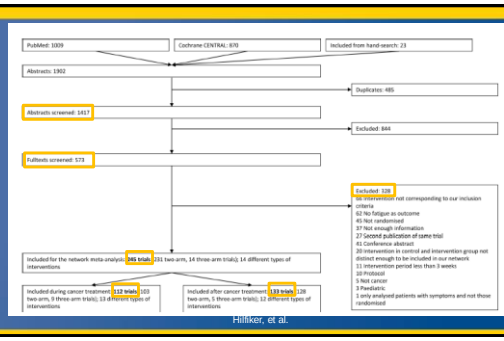
Hilfiker, et al. 72

Methods

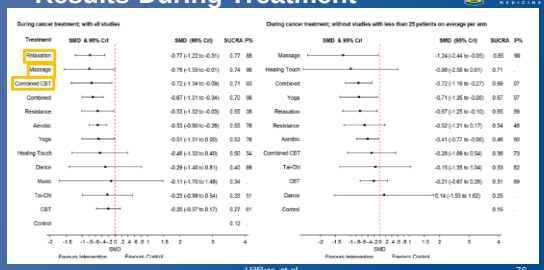
- Design-systematic review, indirect-comparisons meta-analysis
- Database/search-PubMed, Cochrane Database of Systematic Review and Cochrane Controlled Clinical Trials
- Inclusion-randomized or quasi-randomized trials; exercise or non-pharm interventions; all cancer types; during or after treatment
- Exclusion-drug, nutritional, acupuncture, electroacupuncture, acupressure, 'healing without touch' (moxibustion), writing studies; <3 week duration; aiming to improve sleep

Data Points

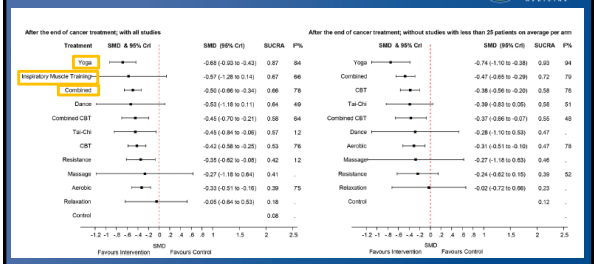
- Data Extraction
  - Effect size for fatigue (higher = more fatigue)
- Summary Measures-standardized mean difference (SMD)
  - 0.2-small effect size
  - 0.5-moderate effect size
  - 0.8- large effect size
- Bayesian network meta-analysis
  - Compare and rank relative effectiveness of different interventions



Results-During Treatment



Results-After Treatment



Discussion

- Effectiveness of different interventions varies depending on cancer treatment status
- Further education to PT on different intervention types
  - Ex: CBT, relaxation therapy, yoga, Tai-Chi, dance therapy

Limitations

- Difficulty classifying interventions
  - Different intervention combinations
  - Lacking information on training intensity
  - Heterogeneous control groups
- Only two digital databases utilized
- Effect size wasn't extracted beyond first end point
- Moderate to high risk of bios, many studies with small sample sizes, heterogeneity

Hilfiker, et al. 79

Conclusions

- During cancer treatment utilize:
  - Relaxation exercises, massage, CBT with physical activity, aerobic and resistance training
- After cancer treatment utilize:
  - Physical activity enhancing interventions
- Patients and providers have options

Hilfiker, et al. 80

JOHNS HOPKINS MEDICINE

CANCER REHABILITATION

Inpatient Cancer Rehabilitation – why are we talking about this now?

- Survival rates of cancer patients have increased – better diagnostics and advances in treatments
- Many patients are now living with cancer as a chronic disease, living at least 5 years after diagnosis
- They deal with the physical and psychological burdens not only during active treatment, but for many years to come
- Many cancer treatments cause devastating side effects, long hospital stays
- This population has unique needs and higher risks for transfer back to acute care

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- Rehabilitation professionals can diagnose and treat patients' physical, psychological, and cognitive impairments in an effort to maintain or restore function, reduce symptom burden, maximize independence and improve quality of life in this medically complex population
- This is not yet regularly integrated into many models of cancer care

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- Recommendations from "Toward a National Initiative in Cancer Rehabilitation: Recommendations From a Subject Matter Expert Group," published in 2016, strongly suggest efforts towards integrating cancer rehabilitation care models into oncology from the point of diagnosis, incorporating evidenced based rehab clinical tools, and including rehab professionals in shared decision making to provide comprehensive care.

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Outline

- Inpatient prehab
- Effectiveness of inpatient rehab, with control group
- Patient perception of effectiveness of inpatient rehab
- SAR and metastatic/advanced cancers

Original Article

Short-term inpatient-based high-intensive pulmonary rehabilitation for lung cancer patients: is it feasible and effective?

Kun Zhou[1*], Jianhua Su[2*], Yutian Lai[1*], Pengfei Li[1], Shuangjiang Li[1], Guowei Che[1]

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Contributions: (I) Conception and design: K Zhou, J Su, Y Lai; (II) Administrative support: None; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: P Li, Y Lai; (V) Data analysis and interpretation: S Li; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

*These authors contributed equally to this work.

Correspondence to: Guowei Che. Department of Thoracic Surgery, West China Hospital, Sichuan University, Guoxuexiang No. 37, Chengdu 610041, China. Email: guoweci_che@yahoo.com.

- Background
  - Morbidity rate ranks first of all malignant tumors in China (about 4.8/6 cases diagnosed in 2010 have died).
    - Same as US
    - Post operative pulmonary complications (PPC) are the leading cause of morbidity and mortality after lung resection surgery
  - Exercise has shown effectiveness to relieve symptoms, increase exercise tolerance, improve quality of life, and potentially reduce length of stay and post operative complications.
  - Evidence is lacking on how and when to implement the pulmonary rehabilitation regimen

- Purpose
  - Develop, refine, and examine the feasibility of systemic-intensive preoperative rehabilitation combined with inspiratory muscle training and endurance exercise
  - Will it improve cardiopulmonary intolerance and reduce the rate of post operative pulmonary complications?

- Methods
  - Subjects: Retrospective collection of 939 surgical patients with lung cancer between March 1, 2014 and June 30, 2015.
    - Inclusion: primary NSCLC, >50 years old, received lobectomy
    - Exclusion: not primary NSCLC, did not undergo lobectomy, received preoperative chemo/radiation
  - Grouping:
    - Non pulmonary rehabilitation (NPR) group (n =742) vs pulmonary rehab (PR) group (n = 197): received 7 day pre-operative in hospital systematic rehabilitation
    - Inclusion for rehab: >20 pack year smoking history, BMI >28, FEV1% <60%, COPD, asthma, or airway hyper reactivity (considered risk factors for post operative complications
    - Exclusion for rehab: refusal, contraindications for rehab program including MI or CVA less than a year ago, unstable angina, aneurysm, hemoptysis in the last 90 days, musculoskeletal or mental disorders.

- Preoperative pulmonary rehabilitation program
  - IMT exercises – trained, supervised, and recorded by *lung cancer nurse specialists*
    - Diaphragmatic breathing: 2x/day, 15-20 minutes
    - Incentive spirometry: 3x/day, 20 minutes
  - Aerobic endurance training – trained and supervised by physiotherapists
    - Nustep for 30 minutes daily
      - Patients adjusted the resistance gear range according to their own speed and power at first, and then increased the resistance range progressively
      - Stopped for obvious discomfort and allowed to rest if they couldn't tolerate

**Patients were charged $28 for daily nursing care and exercise.

- Primary Outcome: the occurrence of postoperative pulmonary complications (PPC)
  - Pneumonia
  - Air leak for >7 days
  - Atelectasis
  - Pleural effusion requiring drainage
  - ARDS
  - Respiratory failure
  - Mechanical ventilation for >48 hours
  - PE
  - Empyema
- Used Clavien-Dindo complication classification system. PPC's reaching grades II-V were included in final analysis

Zhou, et al. 91

- Results
  - There was no difference in preoperative characteristics
  - PR group:
    - 17 completed 1-3 days
    - 20 completed 4-6 days
    - 160 completed the regimen
    - 37 did not complete (requiring earlier surgery, perceived lack of benefit, could not endure the intensity, time/expense).

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Characteristics	PR group, n=197	NPR group, n=748	P
Age, mean ± SD	58.6±9.6	58.6±9.3	0.584
Gender			
Men	116 (58.9)	406 (54.7)	0.296
FEV_1, L	2.2±0.6	2.9±0.5	0.059
ppoFEV_1,%	69.9±17.5	69.3±18.4	0.679
Dlco, mL/min/mmHg	21.7±5.0	22.2±5.0	0.231
ppoDlco%	72.2± 23.3	71.4±24.6	0.684
Comorbidities			
Hypertension or/and coronary disease	10 (5.0)	37 (5.0)	0.969
Current smoking status	50 (25.4)	176 (23.7)	0.628
COPD	22 (11.2)	92 (12.4)	0.658
Diabetes	13 (6.6)	49 (6.6)	0.988
Clinical stage			0.624
Stage I	102 (51.8)	350 (47.2)	
Stage II	69 (35.0)	303 (40.8)	
Stage III	24 (12.2)	81 (10.9)	
Stage IV	2 (1.0)	8 (1.1)	
Surgical approach			
VATS	122 (61.9)	489 (65.9)	0.298
Open	75 (38.1)	253 (34.1)	
Duration of drainage	4.3±2.8	4.6±2.5	0.110
Average time of in-hospital stay, day	14.7±4.0	16.7±6.2	<0.001
Preoperative, day	8.6±1.9	8.4±1.8	0.230
Postoperative, day	6.2±3.3	8.9±5.6	<0.001

Data are shown as number (%) or mean ± standard deviation. PR, pulmonary rehabilitation; NPR, non-pulmonary rehabilitation; FEV_1, forced aspiratory volume in one second; ppoFEV_1, postoperative predicted FEV_1, Dlco, diffusion capacity for carbon monoxide of the lung; COPD, chronic obstructive pulmonary disease; VATS, video assisted thoracic surgery.

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- Results
  - ***Total length of stay***: PR group significantly less (about 2 days)
  - ***Postoperative length of stay***: PR group significantly less (about 2 days)
  - ***Preoperative length of stay***: no difference (about 8 days)
  - ***Costs:***
    - The PR group spent an average of $142 for the rehabilitation regimen and did have a higher preoperative cost
    - No significant difference was found in average hospital stay cost (about $7,000)
    - Post op costs much lower in the PR group

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- Results
  - Leading complications in both groups within 30 days were:
    - Pneumonia
    - atelectasis needing bronchoscope
    - air leak >7 days
  - In PR group, lower incidences of:
    - Total complications
    - Pneumonia
    - Atelectasis
- PR intervention and operation time were independent risk factors to the occurrence of complications
- FEV1 was independent risk factor for pneumonia
- PR interventions, early tumor stage, and COPD were independent risk factors for atelectasis

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Table 4 PPCs rate in 30 days between the PR and NPR groups

Outcome variables	PR group, n=197	NPR group, n=742	p
PPCs rate	30 (15.3)	194 (26.1)	0.022
Grade II			
Pneumonia	22 (11.2)	128 (17.3)	0.024
Atelectasis needing bronchoscope	13 (6.6)	91 (12.3)	0.038
Air leak ≥7 days	16 (8.1)	62 (8.4)	0.916
Pleural effusion needing drainage	14 (7.1)	49 (6.6)	0.802
Grade III			
Bronchopleural fistula	4 (2.0)	13 (1.8)	0.766
Mechanical ventilation ≥48 h	8 (4.1)	27 (3.6)	0.781
Empyema	6 (3.0)	30 (4.0)	0.517
Grade IV			
Respiratory failure or ARDS	4 (2.0)	8 (1.1)	0.289
Pulmonary embolism	2 (1.0)	5 (0.7)	0.922
Back to ICU	4 (2.0)	7 (0.9)	0.256
Grade V			
Death	2 (1.0)	4 (0.5)	0.611

Data are shown as number (%). PPCs rate was defined as PPCs with Clavien-Dindo grade over level II (grade II-V). PPCs, postoperative pulmonary complications; PR, pulmonary rehabilitation; NPR, non-pulmonary rehabilitation; ARDS, acute

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- Discussion – length of program
  - In China, there are deficiencies in basic level hospitals and community care including inadequate skills and equipment
    - A short in-hospital PR regimen is considered to be more feasible and appropriate
    - Usually spend 7-10 days preparing for surgery (completing diagnosis, finishing pre-op examinations)

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- Discussion – cost of program
  - PR did not increase the total costs, but the participants paid $142.
  - Patients were already staying in the hospital for the 7-8 days prior to surgery.
- Discussion – effectiveness
  - PR significantly reduces incidence of PPC's
  - PR was independent risk factor for occurrence of complications and atelectasis
  - Though not measured, anticipate that the patients who participated in rehab intervention would have better cardiopulmonary endurance, leading to better tolerance of the surgery and better postoperative outcomes

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- Limitations
  - Retrospective study
  - Single medical center
  - Risk factors selected from National Expert Consensus and Guidelines for Thoracic Surgery
  - Many contraindications for rehabilitation regimen
  - Baseline FEV1 presented a marginally statistical significant difference between PR and NPR
    - Those with poorer lung function more likely to participate in the rehabilitation program
    - This could also bias the results
  - Did not specifically analyze the post operative complication cost (after 30 days), which may further support cost effectiveness.
  - No use of outcome measures like 6 min walk test or CPET (cardiopulmonary exercise test)

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Original Research

Patient-Reported Usefulness of Acute Cancer Rehabilitation

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- Background
  - Cancer patients often have unmet needs after experiencing both functional loss and disability as a result of the disease and treatment
  - Cancer rehab is becoming more of an integral part of comprehensive care services that support both psychological and functional well being – reflecting increased awareness that the impact of *quality of life is just as important as quantity*
  - There are few physiatrists trained in providing cancer rehab care, and even fewer cancer rehabilitation centers providing comprehensive services
  - Studies have shown that inpatient rehabilitation can improve functional status and symptoms, ***but no studies on the patient perception of usefulness***

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- Purpose
  - To explore patient-reported perception of usefulness after undergoing acute inpatient cancer rehabilitation
  - Collected patient reported outcome measures of their psychosocial, self-care, and functional independence to determine if the need of the patient was met

- Methods
  - Patients were eligible for the study when they were admitted to the cancer rehabilitation unit from another acute service after undergoing medical treatment for cancer or complications
  - Exclusion:
    - Delirium or acute symptom distress existed
    - Cog impairment prevented them from understanding informed consent
    - Transferred back to acute care before completing

- Methods
  - Outcome measures:
    - 22-item Likert-type scale developed by MD Anderson interdisciplinary team was administered 48 hours after discharge
    - Demographics
    - Rehabilitation stay characteristics
    - FIM at admission and discharge
      - Broken down into subsets the grouped similar tasks together

Response Q1-Q21*	Respondents (n)	(q1-q3)
Q1. I understood the goals of my rehabilitation.	199	5 (5, 5)
Q2. Rehabilitation helped me regain physical function.	200	5 (5, 5)
Q3. Rehabilitation helped me regain physical independence.	200	5 (4, 5)
Q4. Rehabilitation helped me with hope.	199	5 (5, 5)
Q5. Rehabilitation helped with my mood.	199	5 (4, 5)
Q6. Rehabilitation helped me with my pain.	196	5 (4, 5)
Q7. Rehabilitation helped me feel less anxious about discharge from the hospital.	199	5 (4, 5)
Q8. I would recommend this rehabilitation program.	200	5 (5, 5)
Q9. I am prepared to deal with my medications.	199	5 (5, 5)
Q10. I am prepared to deal with my self-care (bathing, dressing and feeding)	195	5 (5, 5)
Q11. I am prepared to deal with my skin care.	193	5 (5, 5)
Q12. I am prepared to deal with my nutrition/diet.	191	5 (5, 5)
Q13. I am prepared to deal with my bladder care.	195	5 (5, 5)
Q14. I am prepared to deal with my bowel care.	197	5 (5, 5)
Q15. I am prepared to deal with my communication/thinking.	196	5 (5, 5)
Q16. I am prepared to deal with my sexuality.	174	5 (4, 5)
Q17. I am prepared to deal with my spiritual issues.	193	5 (5, 5)
Q18. I am prepared to deal with my activity/exercise.	200	5 (5, 5)
Q19. I am prepared to deal with my equipment/equipment care.	195	5 (5, 5)
Q20. I am prepared to deal with my financial issues.	193	5 (4, 5)
Q21. I understand my discharge plan/follow up.	194	5 (4, 5)
Response Q22*		
Q22. Overall, I believe the acute inpatient rehabilitation stay was:	200	6 (5, 6)

- Results
  - Between Sept 2014 – July 2015, 327 patients were admitted to the acute inpatient rehabilitation unit, and 200 of those were enrolled with completed surveys in the study.
    - Top two reasons for non-inclusion were cog impairment (n = 20), and transfer back to primary service (n=32)
  - Demographics: majority of patients were female, white, married, had attained a college degree or higher. Self identified as Christian/Protestant. Liquid tumors and brain/CNS were the top 2 cancer types.

- Results
  - Majority of patients reported that they completely agreed that rehab helped with regaining function and independence, and prepared them to deal with self care, including bowel and bladder.
  - Perceived as helpful with lifestyle changes including diet and exercise, as well as with emotional health including improvements in mood, hope, communication, and spiritual issues.
  - Overall, participants surveyed reported their cancer rehabilitation stay was extremely good or very good.
  - Significant improvement in all 5 subscales of FIM scores between admission and discharge

Q1. I understood the goals of my rehabilitation.	17 (8.5%)	175 (87.9%)
Q2. Rehabilitation helped me regain physical function.	28 (14%)	165 (82.5%)
Q3. Rehabilitation helped me regain physical independence.	37 (18.5%)	144 (72%)
Q4. Rehabilitation helped me with hope.	24 (12.1%)	163 (81.9%)
Q5. Rehabilitation helped with my mood.	37 (18.6%)	139 (69.8%)
Q6. Rehabilitation helped me with my pain.	37 (18.9%)	119 (60.7%)
Q7. Rehabilitation helped me feel less anxious about discharge from the hospital.	44 (22.1%)	44 (22.1%)
Q8. I would recommend this rehabilitation program.	14 (7%)	184 (92%)
Q9. I am prepared to deal with my medications.	18 (9%)	174 (87.4%)
Q10. I am prepared to deal with my self-care (bathing, dressing and feeding)	30 (15.4%)	153 (78.5%)
Q11. I am prepared to deal with my skin care.	25 (13%)	154 (79.8%)
Q12. I am prepared to deal with my nutrition/diet.	24 (12.6%)	159 (83.2%)
Q13. I am prepared to deal with my bladder care.	21 (10.8%)	160 (82.1%)
Q14. I am prepared to deal with my bowel care.	26 (13.2%)	157 (79.7%)
Q15. I am prepared to deal with my communication/thinking	17 (8.7%)	170 (86.7%)
Q16. I am prepared to deal with my sexuality.	14 (8%)	128 (73.6%)
Q17. I am prepared to deal with my spiritual issues.	10 (5.2%)	172 (89.1%)
Q18. I am prepared to deal with my activity/exercise.	25 (12.5%)	171 (85.5%)
Q19. I am prepared to deal with my equipment/equipment care.	27 (13.8%)	155 (79.5%)
Q20. I am prepared to deal with my financial issues.	24 (12.4%)	143 (74.1%)
Q21. I understand my discharge plan/follow up.	43 (22.2%)	134 (69.1%)
	Very Good	Extremely Good
Q22. Overall, I believe the acute inpatient rehabilitation stay was:	60 (30%)	128 (64%)

- Results
  - Significant association between FIM score changes in grooming (p=.03), UB dressing (p=.03), lower body dressing (p<.01), toileting (p=.05), transfers bed (p=.05), transfers toilet (p=.04), transfers tub (p=.04) and the perception of usefulness in rehabilitation
  - Significant association between FIM efficiency in UB dressing (p=.04) and LB dressing (p=.04) and perception of usefulness in rehabilitation

- Discussion
  - Major improvement in functional gains suggest that cancer patients benefited from the higher intensity of the therapies provided
    - This study showed as much as a 14-point change in FIM scores, which could be interpreted as between 28-70 fewer minutes of caregiver help per day
  - Improvements in functional score may also enable cancer patients to continue cancer treatment
    - FIM is closely correlated with Karnofsky Performance Status

- Discussion
  - Inpatient acute cancer rehab is still uncommon, and many patients end up having to go to a general inpatient rehabilitation program
    - Many of them have other stringent criteria to meet before acceptance into ACIR, including 60% compliance rule as a requirement to participate in the Medicare Prospective Payment System
    - The rehabilitation unit in this study is part of the National Cancer Institute Comprehensive Cancer Centers that are exempt from this
      - May include sicker patients who often benefit from rehabilitation but require close monitoring of their medical status
    - 32 patients (10%) required return to primary service
      - Rates have been reported anywhere between 17-41% in specific cancer populations

- Limitations
  - Possible ceiling effect due to the high levels of agreement and support in the survey
  - Could be bias in the respondents answering favorably, despite promise of anonymity
  - Survey was developed by their own staff
  - Patient population – recruited after completion of rehab, so excluded those who transferred back who could provide valuable data.
  - Proxy answers from family of those cognitively impaired could be useful.
  - For some FIM items, anywhere from 7-30 of the 200 patients were not evaluable.

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Research Paper

Short-term effectiveness of inpatient cancer rehabilitation: A longitudinal controlled cohort study

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- Background
  - In Switzerland, inpatient rehab lasts about 3 weeks, consisting of physical therapy and other treatments – nutrition counseling, lymphatic drainage, psychotherapy.
    - Rehabilitation for cancer patients is not well established in Switzerland
    - Despite comparable levels of impairments, cancer patients are less likely to use rehabilitation than patients suffering from chronic diseases
  - Many studies regarding the beneficial effects on health and HRQoL use pre-post design ***without a control***.

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- Purpose
  - Compare changes in the general health and HRQoL of cancer patients who underwent inpatient rehabilitation (IR) with those in control groups of patients with (A+) and without (A-) medical advice for inpatient rehabilitation.

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- Participants
  - 476 patients who underwent acute treatment for cancer in two hospitals and three rehabilitation clinics in Switzerland between April 2013 and November 2014
  - Inclusion:
    - >18 years old
    - Sufficient German knowledge
    - If over aged 50, MMSE of >25
  - 101 refused to participate
  - 90 were not included due to not meeting criteria
  - Of the 285 who were included, 40 dropped out between baseline and follow up.

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- Participants
  - 13 A+ patients did not utilize inpatient rehab due to wait times to admission
  - 17 A+ patients did not receive reimbursement of costs from their health insurance companies
  - Total 245
    - IR = 133
    - A+ = 30
    - A- = 82

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- Intervention
  - No standardized cancer specific rehabilitation programs were used
  - The use and intensity of treatments were tailored to each individual
  - IR can be reimbursed by insurance companies for 2-3 weeks
  - The A+ and A- groups received outpatient treatments such as PT, nutrition conseling, and psychotherapy.

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- Outcome measures
  - Demographic data
  - Disease relevant data
  - Sociodemographic info (standardized questionnaires)
  - Short-Form Health Survery (SF-36)
  - Functional Assessment of Cancer Therapy General Scale, version 4 – used to assess HRQoL
  - FACT Fatigue subscale to measure fatigue
  - Validated German version of the Hospital Anxiety and Depression Scale

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Table 1. Patient's sociodemographic and medical characteristics at baseline

Characteristics	Inpatient rehabilitation (IR) n=133 (54.3%)	Control with Advice (A+) n=30 (12.2%)	Control - No advice (A-) n=82 (33.5%)	p IR vs. A+	p IR vs. A-	p A+ vs. A-
Age in years (M/IQR) *	62.0 (+/- 14.0)	57.5 (+/- 19.0)	59.0 (+/- 19.0)	0.030	0.012	0.610
Hospital stay in days (M/IQR) *	18.0 (+/- 9.0)	18.5 (+/- 12.0)	8.5 (+/- 8.0)	0.709	<0.001	<0.001
Sex (%)						
Male	78 (59%)	19 (63%)	36 (44%)	0.637	0.035	0.068
Living (%)						
Alone	42 (32%)	8 (27%)	17 (21%)	0.398	0.063	0.304
Children in household (%)						
Yes	18 (14%)	6 (20%)	13 (16%)	0.367	0.638	0.605
Level of education (%)				0.372	0.816	0.698
Basic school (8-9 years)	9 (7%)	4 (13%)	8 (10%)			
Vocational training	68 (51%)	15 (50%)	39 (48%)			
College/high school	22 (17%)	2 (7%)	12 (15%)			
University	34 (26%)	9 (30%)	23 (28%)			
Employment status						
Employed	46 (35%)	16 (53%)	47 (57%)	0.036	0.001	0.707
Insurance type (%)						
Basic	76 (57%)	25 (83%)	63 (77%)	0.006	0.003	0.458
Comorbidities (%)				0.423	0.001	0.647
None	43 (32%)	14 (47%)	49 (60%)			
1	43 (32%)	8 (27%)	17 (21%)			
2	28 (21%)	6 (20%)	11 (13%)			
>2	19 (14%)	2 (7%)	5 (6%)			

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Tumor stage (%)				0.094	0.001	0.003
I	11 (10%)	2 (9%)	17 (25%)			
II	27 (24%)	6 (26%)	18 (27%)			
III	26 (23%)	5 (22%)	20 (30%)			
IV	51 (44%)	10 (44%)	12 (18%)			
Cancer site (%)				0.063	<0.001	<0.001
Digestive organs	49 (37%)	6 (20%)	4 (5%)			
Thoracic organs	20 (15%)	2 (7%)	5 (6%)			
Head and neck	22 (17%)	13 (43%)	13 (16%)			
Hematological malignancies	15 (11%)	7 (23%)	7 (9%)			
Female genital organs	7 (5%)	1 (3%)	11 (13%)			
Sarcoma	5 (4%)	0 (0%)	15 (18%)			
Breast	8 (6%)	0 (0%)	16 (20%)			
Others	7 (5%)	1 (3%)	11 (13%)			
Cancer type (%)				0.582	0.010	0.026
Carcinoma	101 (76%)	21 (70%)	50 (61%)			
Sarcoma	10 (8%)	1 (3%)	15(18%)			
Myeloma	8 (6%)	3 (10%)	4 (5%)			
Lymphoma	7 (5%)	4 (13%)	3 (4%)			
Mesothelioma	3 (2%)	1 (3%)	0			
Brain tumor	3 (2%)	0 (0%)	8 (20%)			
Others	1 (1%)	0 (0%)	2 (2%)			
Treatment type (%) [4]				0.179	.0008	0.397
Surgery	102 (77%)	25 (83%)	74 (90%)			
Stem cell transplantation	6 (5%)	3 (10%)	5 (6%)			
Other	24 (18%)	2 (7%)	3 (4%)			
Physical therapy						
Yes	130 (98%)	15 (50%)	34 (42%)	<0.001	<0.001	0.420
Nutrition counselling						
Yes	78 (59%)	11 (37%)	10 (12%)	0.029	<0.001	0.003
Psychological therapy						
Yes	42 (32%)	2 (7%)	6 (7%)	0.005	<0.001	1.000

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- IR compared with A+
  - Showed significant improvements in the following SF-36 categories: bodily pain (p = .015), physical functioning (p=.001), physical component summary (p<.0001), vitality (p=.001), mental health (p=.07).
  - Showed significant improvements in following FACT test components: physical (p=.002), function (p=.032), total score (p=.013), fatigue (p=.002).
  - Showed significant improvement regarding HADS depression (p=.001)
  - At baseline, significantly poorer scores on SF-36 physical functioning and SF-36 physical component score. Support systems were higher. Controlling for these with multivariate regressions did not change significance

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- IR compared to A-
  - Higher improvements in the following SF-36: vitality (p<.001), physical functioning (p=.04), mental health (p=.046)
  - Higher improvements in the following FACT: physical (p=.002), functional (p=.015), total (p=.003), fatigue (p<.001)
  - Higher improvements in HADS depression (p=.006)
  - At baseline, function, mental health, and fatigue were significantly poorer. Controlling for these baseline differences by multivariate regression modelling did not reduce the correlation by large amounts

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- Discussion
  - Patients referred to inpatient rehabilitation showed significant improvements in physical and psychosocial health, HRQoL, fatigue, anxiety, depression, attaining small to moderate size effects
  - The effects of the IR to A+ comparison were higher and less affected by baseline differences in the scales than those of the IR to A- comparison.
  - Fatigue decreased at T1 for all patients, but especially those with IR
  - A+ group even reported decrease in social functioning and general health
  - Need for structured standardization procedures for appropriateness of patient's referral to inpatient rehab (?)

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- Limitations
  - Broad inclusion criteria increased the external validity, but this limits the interpretation for specific diagnoses and patient groups
  - Small sample sizes of main control group
  - High rates of drop out may lead to bias

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Discharge to Subacute Rehabilitation Facilities Does Not Benefit Patients Hospitalized With Progressive Gastrointestinal Cancer

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- Background
  - Subacute rehabilitation (SAR) is less vigorous rehab but does not routinely incorporate pain management or palliative care
  - Poor prognosis with debilitating pain or exhaustion too great to participate in therapy, is hospice more appropriate? Families often decline this for hope for further treatment
  - Many patients are not fully aware of the intent of their treatment and their overall prognosis

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- Purpose
  - Retrospective review of consecutive series of patients with advanced metastatic GI cancer who were discharged from inpatient to SAR
  - Analyzed median survival and whether these patients subsequently received systemic chemo therapy.

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- Methods
  - Institutional database used to ID patients who were admitted from Sept 1, 2008 and December 31, 2014
  - ***Excluded***: non metastatic cancer, low grad neuroendocrine tumors, those receiving or awaiting first line chemo, those lost to follow up, haven't had active treatment for several years, or admitted due to reversible toxicity due to chemo that was expected to be resumed (diarrhea, n/v, abscess, myelitis).
  - ***Primary outcomes***: medial overall survival from the time of hospital discharge, percentage of patients who received further chemotherapy
  - ***Secondary outcomes***: percentage of patients who died at SAR, those who died within 3 and 6 months of hospital discharge, those who transitioned to hospice within 3 months of hospital discharge, who were readmitted within one month, and who followed up with their oncologists for an outpatient appointment

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- Results
  - 22 patients included
    - Progressive GI malignancies despite having already received two lines of chemo or those who were ineligible due to low performance status
    - 55% female, median age 74. DNR present in 10 patients.
    - Median overall survival was 24 days (6-156 days)
    - 7 patients died at SAR
    - Neither overall survival or death varied across cancer types or hospital admission diagnosis
    - 3 patients lived beyond 3 months and none were alive at 6 months
    - 9 were transitioned to hospice within 3 months
    - 8 were readmitted within 1 month
    - 2 followed up with oncologist for outpatient appointments
    - None of them received further chemotherapy after discharge

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- Discussion
  - Discharge to SAR associated with short survival and no further chemo therapy receipt
  - May have been a detriment incurred by a SAR discharge that a hospice discharge may have avoided
  - Sample size is small, but the clinical setting is not one where uncommonly a hope is voiced by oncologists, nurses, patients, and families. "If you could only get stronger with rehabilitation, then you could get more chemotherapy."
  - SAR does not achieve this goal in such progressive GI malignancies

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- Limitations
  - Small sample size
  - Retrospective in a single center
  - Possible that SAR may have benefited the patients in a way that was not measurable (providing services that hospice could not, maintaining hope)
- Future studies might investigate whether these conditions hold true for other malignancies

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- Conclusions
  - SAR could be more harmful than beneficial in this population
  - Advances in research, education, and health care policy are needed to improve the quality of the ways in which clinicians, particularly primary oncology teams, dually inform and empathize with these patients with serious illness who are often struggling at the end of life
  - Communicating how SAR might not help these particular patients and how it might potentially do harm – indicating other end of life care could be pursued – represents one important strategy for facilitating more informed goals of care discussions

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IN SUMMARY:

Physical Activity/Therapy and Cancer

1. **Physical activity/therapy**
   - Total body or focused area activity improves exercise capacity in cancer survivors, thus leading to a decrease in fatigue and an increase in quality of life.
2. **Physical therapy**
   - Interventions during an active red blood transfusion are safe and effective without adverse effect while providing close monitoring of the patients.

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Body Composition Changes and Effects

1. **Cachexia**
   - High intensity aerobic exercise shows promising results to combat cachexia (in an animal model)
2. **Sarcopenia**
   - Transplant patients are at high risk of developing (even with exercise throughout clinical course)
   - Relationship between muscle strength and nutrition may spark interest in expanding PT knowledge set
3. **Cancer related fatigue**
   - Variety of non-pharmaceutical interventions reduce fatigue during and after cancer treatment

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Inpatient Cancer Rehabilitation

1. **Prehabilitation prior to lung surgery**
   - Feasible and cost effective for inpatients to participate in a prehabilitation program
   - Effective in lowering rates of surgical complications
2. **Patient reported usefulness**
   - Patients completely agree with both physical and emotional effectiveness of inpatient rehabilitation
   - Significant improvements in FIM scores = decreased caregiver burden
3. **Short term effectiveness, compared with control**
   - Significant improvements in physical and emotional functioning and HRQOL compared with those who did not or could not go
4. **Progressive GI cancer and subacute rehabilitation**
   - May not be an effective or appropriate discharge location for these patients

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THANK YOU

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- **Image Hyperlinks:**
- https://cancerstaging.org/references-tools/Pages/What-is-Cancer-Staging.aspx
- http://www.thelancet.com/cms/attachment/2001025056/2003891173/fx1.jpg
- http://www.cancerjournal.net/article.asp?issn=0973-1482;year=2012;volume=8;issue=1;spage=91;epage=95;aulast=Yadav
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