Exercise and physical activity during cancer treatment

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Outline

• Scene setting and rationale
• Exercise based approaches
• Challenges to a ‘training mind-set’
• Physical activity programmes
• Summary and conclusions
Whole body exercise performance

Whole body exercise performance

- resection-related impairment
- radiation induced pneumonitis
- Chemotherapy induced anaemia

Age, comorbidities (cardiovascular), sedentary lifestyle

Effect of bed rest in older adults

Table. Effects of 10 Days of Bed Rest in Older Adults

<table>
<thead>
<tr>
<th>No. of Participants (N = 12)*</th>
<th>Mean (95% Confidence Interval)</th>
<th>Bed Rest</th>
<th>Change</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle fractional synthetic rate, % per h†</td>
<td>10</td>
<td>0.077 (0.059 to 0.095)</td>
<td>0.061 (0.036 to 0.067)</td>
<td>−0.027 (−0.007 to −0.047)</td>
</tr>
<tr>
<td></td>
<td>% Change</td>
<td></td>
<td>−30.0 (−7.0 to −54.0)</td>
<td></td>
</tr>
<tr>
<td>DEXA lean mass, kg‡</td>
<td>10</td>
<td>48.05 (40.61 to 55.49)</td>
<td>46.51 (39.57 to 53.45)</td>
<td>−1.50 (−0.62 to −2.48)</td>
</tr>
<tr>
<td>Whole body</td>
<td>% Change</td>
<td></td>
<td>−3.2 (−1.4 to −5.0)</td>
<td></td>
</tr>
<tr>
<td>Lower Extremity</td>
<td>% Change</td>
<td></td>
<td>−6.3 (−3.1 to −9.5)</td>
<td></td>
</tr>
<tr>
<td>Isokinetic muscle strength, Nm per s§</td>
<td>11</td>
<td>120 (96 to 145)</td>
<td>101 (81 to 121)</td>
<td>−19 (−11 to −30)</td>
</tr>
<tr>
<td>% Change</td>
<td></td>
<td></td>
<td>−15.6 (−8.0 to −23.1)</td>
<td></td>
</tr>
</tbody>
</table>

3-fold loss compared to young adults in 1/3 time
Trajectories of functional decline

Lunney et al. JAMA 2003;289:2387-92
Trajectories of functional decline

Gill et al. NEJM 2010;362:1173-80
Impact of cancer on function

Cancer Cachexia

Impairments
- ↓ muscle mass, function ± quality
- energy deficiency
- ↑ symptom burden

Functional Consequences
- ↓ exercise capacity
- ↓ physical activity level
- ↓ performance of daily tasks

Described by:
- Frequency
- Intensity
- Type
- Timing

Short-Term Preoperative High-Intensity Interval Training in Patients Awaiting Lung Cancer Surgery: A Randomized Controlled Trial

- >80% underwent major resection via open thoracotomy
- ↑ peak VO$_2$ (15%), peak work rate (6%) and 6MWD (15%) compared to deterioration in usual care
- Primary endpoint: 30 day mortality or in-hospital complications (Grade ≥2 TMM)
- Change in sample size after interim analysis

<table>
<thead>
<tr>
<th>Table 4. Primary and Secondary Outcomes after Lung Resection</th>
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</thead>
<tbody>
<tr>
<td><strong>Outcomes</strong></td>
</tr>
<tr>
<td>Primary composite end point</td>
</tr>
<tr>
<td>30-Day mortality</td>
</tr>
<tr>
<td>Respiratory complications</td>
</tr>
<tr>
<td>ARDS</td>
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<tr>
<td>Ventilation (&gt;6 h)</td>
</tr>
<tr>
<td>Pneumonia</td>
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<tr>
<td>Atelectasis</td>
</tr>
<tr>
<td>Cardiovascular complications</td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
</tr>
<tr>
<td>Acute heart failure</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
</tr>
<tr>
<td>Stroke</td>
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<tr>
<td>Arrhythmias</td>
</tr>
<tr>
<td>Surgical complications</td>
</tr>
<tr>
<td>Reoperation</td>
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<tr>
<td>Bronchopleural fistula</td>
</tr>
<tr>
<td>Wound infections</td>
</tr>
<tr>
<td>Renal dysfunction</td>
</tr>
<tr>
<td>Length of stay in PACU, h</td>
</tr>
<tr>
<td>Unplanned ICU admission</td>
</tr>
<tr>
<td>Length of stay in hospital, d</td>
</tr>
</tbody>
</table>

High-intensity training following lung cancer surgery: a randomised controlled trial

- ↑ SF-36 physical + mental
- ↑ EORTC C30 dyspnoea

Edvardsen et al. Thorax. 2015;70:244-50
Effect of a multimodal high intensity exercise intervention in cancer patients undergoing chemotherapy: randomised controlled trial

- Large but select group
- ↓ fatigue
- ↑ exercise capacity
- ↑ muscle strength
- ↑ PAL
- ↑ SF-36 scores
- EORTC-C30 unchanged

Adamsen et al. BMJ 2009;339:b3410
Patient-Reported Outcomes, Body Composition, and Nutrition Status in Patients With Head and Neck Cancer: Results From an Exploratory Randomized Controlled Exercise Trial

Adamsen et al. Cancer 2016;112:1185-1200

+ Physician referral
+ Health education
+ Behaviour change support
+ Individualised nutrition
+ Social support

n=60
60 min, 4x/wk
Mod R+A, 12 wks

- Loss to follow up 36% vs. 23%
- Survival markedly different in non-completers
- Fatigue unchanged but function improved

### Table 3. Estimated differences in fatigue (physical, mental, and total) and physical performance outcomes between the physical exercise group (PEG) and the usual care group (UCG) using multiple imputation

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Baseline Mean (SD)</th>
<th>8 Wks Mean (SD)</th>
<th>Estimated mean difference (95% CI)</th>
<th>p-value^a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total fatigue</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UCG</td>
<td>18.0 (0.58)</td>
<td>17.2 (0.62)</td>
<td>−0.5 (−2.0–1.0)</td>
<td>0.53</td>
</tr>
<tr>
<td>PEG</td>
<td>18.1 (0.48)</td>
<td>16.8 (0.60)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Physical fatigue</strong></td>
<td></td>
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<tr>
<td>UCG</td>
<td>12.6 (0.43)</td>
<td>12.1 (0.50)</td>
<td>−0.3 (−1.6–1.0)</td>
<td>0.62</td>
</tr>
<tr>
<td>PEG</td>
<td>12.9 (0.37)</td>
<td>11.9 (0.51)</td>
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<td></td>
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<tr>
<td><strong>Mental fatigue</strong></td>
<td></td>
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<tr>
<td>UCG</td>
<td>5.4 (0.22)</td>
<td>5.2 (0.19)</td>
<td>−0.3 (−0.6–0.3)</td>
<td>0.53</td>
</tr>
<tr>
<td>PEG</td>
<td>5.2 (0.19)</td>
<td>4.9 (0.19)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Shuttle walk test, m</strong></td>
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<tr>
<td>UCG</td>
<td>390 (17.8)</td>
<td>369 (21.5)</td>
<td>60 (16.0–103.4)</td>
<td>0.008</td>
</tr>
<tr>
<td>PEG</td>
<td>339 (17.1)</td>
<td>380 (24.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sit-to-stand, times per 30 seconds</strong></td>
<td></td>
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<tr>
<td>UCG</td>
<td>11.6 (0.38)</td>
<td>11.9 (0.48)</td>
<td>0.5 (−0.5–1.5)</td>
<td>0.34</td>
</tr>
<tr>
<td>PEG</td>
<td>10.9 (0.32)</td>
<td>11.7 (0.47)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Maximal stepping, cm</strong></td>
<td></td>
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<tr>
<td>UCG</td>
<td>92.0 (2.2)</td>
<td>90 (2.0)</td>
<td>3.0 (−1.8–7.7)</td>
<td>0.22</td>
</tr>
<tr>
<td>PEG</td>
<td>85.8 (2.3)</td>
<td>88.9 (2.3)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Handgrip strength, kg</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>UCG</td>
<td>29.6 (0.94)</td>
<td>28.3 (0.97)</td>
<td>2.0 (0.4–3.5)</td>
<td>0.01</td>
</tr>
<tr>
<td>PEG</td>
<td>26.4 (0.85)</td>
<td>27.5 (0.95)</td>
<td></td>
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</tr>
</tbody>
</table>

^a Analysis of covariance with baseline measurement and group as covariates (coefficient for treatment group in analysis of covariance). Abbreviations: CI, confidence interval; SD, standard deviation.

Oldervoll et al. Oncologist 2010;89:611-6

n=231
60 min, 2x/wk
Mod R>A, 8wks
EXERCISE

Some motivation required.
Individual factors influencing behaviour

**Capability**

- **Physical**: Symptoms & treatment side-effects, Medical complications, Comorbidities, Sedentary lifestyle
- **Psychological**: Mood, Feeling overwhelmed, Introversion, Confusion about PA

**Opportunity**

- **Physical**: Venue & transport, Format, type of PA, supervision, Time & convenience, Timing after diagnosis, Weather, Delivery of information, Access to services
- **Social**: Group exercise, Carers and relatives influence, Encouragement from HCPs

**Motivation**

- **Automatic**: Experienced impact of PA, Sedentary lifestyle, Opportunity for behaviour change, Perceived relevance, Fear of PA
- **Reflective**: Patient beliefs about benefits and harms of PA

**Behaviour**

- Physical Activity

Granger et al. Support Care Cancer 2017;25:983-99
Contextual factors influencing behaviour

1. Patient physical and psychological influences
   - Symptoms
   - Psychological factors
   - Comorbidities

2. Patient knowledge and past behavior
   - Past physical activity behavior

3. Clinicians knowledge and beliefs about physical activity
   - Clinicians belief about physical activity
   - Education and knowledge

4. Workplace culture
   - Culture of physical activity
   - Prioritization and time

5. Healthcare system - environmental and structural influences
   - Staffing and services
   - Pathways, protocols and referrals
   - Integration of the MDT and continuity of care for the patient
   - Timing in the current model of care

Improving accessibility of exercise
- Offer programme proactively -

- more likely patients have capacity
- focus on maintenance may allow benefit from low dose programmes
  - dose response
  - ‘more the better’
  - ‘any better than none’
- low intensity or low volume models sufficient to prevent disuse atrophy

Typically ≥ 2/3 patients asked about an exercise programme report interest.

General preference to undertake exercise:
- at home
- alone and unsupervised
- following systemic treatment.

Improving accessibility of exercise
- Offer a range of programmes -

Maddocks et al. Psycho-Oncology 2011;20:173-8
Lowe et al, Support Care Cancer 2010;18:1469-75
Improving accessibility of exercise
- Promote usual physical activity-

- Treat activity as a ‘vital sign’
- Reassure patients around normal exertion symptoms
- Promote opportunities to be active by ‘licensing’ daily tasks, active hobbies and interests
- Ask the patient about their goals
A Home-Based Exercise Program to Improve Function, Fatigue, and Sleep Quality in Patients With Stage IV Lung and Colorectal Cancer: A Randomized Controlled Trial

- ‘REST’ programme
- Rapid Easy Strength Training
- Simple pedometer

- ↓ fatigue
- ↑ mobility
- ↑ sleep quality

Cheville et al. JPSM 2013;45(5):811-21
Randomised controlled trial on the effectiveness of home-based walking exercise on anxiety, depression and cancer-related symptoms in patients with lung cancer

Effect of walking on circadian rhythms and sleep quality of patients with lung cancer: a randomised controlled trial

It had a revolutionary effect on me... It was just the right thing at the right time. I think more about walking now, I think I can walk there instead of catching the bus.

I would recommend it, particularly to people who are not sporty... When I’m on the walks I forget about the cancer.

I (the group) makes me do more than I would if I was walking on my own, as I live on my own it’s great being out and meeting other people.

I no longer dwell on being terminal – just on getting on with making life as enjoyable as possible, greatly helped by friends made on regular walks.

Tsianakas et al. BMJ Open 2017;7:e013719
Conclusions

• Cancer and its treatment reduce physical function through an effect on cardiovascular and muscular fitness

• Exercise and physical activity can help alleviate the consequences of these impairments on patients.

• Intensive, supervised exercise programmes are effective across a range of outcomes, but are not always acceptable or practical.

• Early intervention with a focus on physical activity may help improve acceptability and accessibility.