Case Discussion

COPD PATIENT

A. Kharat (CH)
COPD AND NUTRITION

Pneumology Case Presentation

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Division of Pneumology
Geneva University Hospitals

ESPEN Krakow
September 2019
Mrs M.M. 1959

- Patient of 59 y/o with severe global respiratory failure
- First respiratory follow up in 2014.
- In 2019:
  - BMI 18kg/m2
  - NIV and O2 dependent 24H/24
  - Treatment: LAMA/LABA, INH, Posaconazole, On/off systemic steroids for COPD exacerbations (> 2x/year)
Clinical examination

- Height 158 cm, weight 47 kg → BMI 18.8 kg/m²
- Respiratory rate 20/min
- Diminished respiratory sounds
Pulmonary Evaluation

- **BODE score 8 points:**
  - **BMI:** 18.8 kg/m²
  - **Obstruction:** FEV1 22% PV (0.49L)
  - **Dyspnea:** modified MRC 4
  - **Exercise -> 6 minute walking test:** 310m (563m pred)

    → 3 year mortality estimated at 54.4%

→ **BODE >5 criteria for transplantation referral**
Comorbidities

• Osteoporosis
• Severe anxiety disorder
Question 1

On the basis of the nutritional status exposed, is this patient malnourished?
Answer 1

- Estimation of nutritional risk, needs and nutritional status evaluation is part of ESPEN recommendaions for polymorbid patient. (Evidence B strong)
  - Nutritional Risk Score (hospitalised)
  - MUST (ambulatory)

Our patient is «polymorbid» considering respiratory diagnosis and the presence of another co-morbidity.
  - NRS score at 3
Nutritional Risk Screening (NRS)

Nutritional Assessment

- Nutritional Risk Screening (NRS) 2002

<table>
<thead>
<tr>
<th>Impaired Nutritional Status</th>
<th>Severity of Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absent</strong> 0</td>
<td>Normal Nutritional Status</td>
</tr>
<tr>
<td>Mild 1</td>
<td>Weight loss &gt; 5% in 3 months</td>
</tr>
<tr>
<td></td>
<td>50-75% of usual food intake over last week</td>
</tr>
<tr>
<td>Mod 2</td>
<td>Weight loss &gt; 5% in 2 months</td>
</tr>
<tr>
<td></td>
<td>BMI 18.5-20.5 with impaired general condition</td>
</tr>
<tr>
<td></td>
<td>25-50% of usual food intake over last week</td>
</tr>
<tr>
<td>Severe 3</td>
<td>Weight loss of &gt; 5% in 1 month</td>
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<tr>
<td></td>
<td>Weight loss &gt; 15% in 3 months</td>
</tr>
<tr>
<td></td>
<td>BMI &lt; 18.5 with impaired general condition</td>
</tr>
<tr>
<td></td>
<td>0-25% of usual food intake over last week</td>
</tr>
</tbody>
</table>
Malnutrition Universal Screening Tool (MUST)

Step 1
BMI kg/m² Score
>20 (>30 Obese) = 0
18.5–20 = 1
<18.5 = 2

Step 2
Unplanned weight loss in past 3–6 months
Score
<5 = 0
5–10 = 1

Step 3
If patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days
Score 2

Step 4
Overall risk of malnutrition
Add scores together to calculate overall risk of malnutrition.
Score 0: Low Risk
Score 1: Medium Risk
Score 2 or more: High Risk

Low Risk
Routine clinical care
- Ensure appropriate food and drink choices
- Repeat screening every 3–6 months, unless there is clinical concerns.
- Document action taken

Medium Risk
Observe
- Follow ‘MUST’ 1 care pathway on page 10 of Guidelines Booklet

High Risk
Treat
- Follow action plan for medium risk
- Refer to Dietitian*
- Re-weigh weekly
- Document action taken
  “unless detrimental or no benefit is expected from nutritional support e.g. end of life care pathway

This tool is to assist your assessment. If in doubt, use your professional judgement.

Stratton et al, British Journal of Nutrition 2004
Consequences of malnutrition

Malnutrition

- Morbidity $\uparrow$
  - wound healing $\downarrow$
  - infections $\uparrow$
  - complications $\uparrow$
  - convalescence $\downarrow$

- Mortality $\uparrow$

- Treatment $\uparrow$

- Length of hospital stay $\uparrow$

- Costs $\uparrow$

- Quality of life $\downarrow$
Outpatient consultation January 2019

Respiratory History

• Very severe COPD (GOLD 4D) secondary to former tobacco use
• Chronic hypoxemia with home O2-therapy (1-2L/min)
• Global respiratory failure treated by NIV since 2016
• Endoscopic lung volume reduction by coils (June 2015, June 2017)

Complication: Aspergilloma around the coils

Discussion regarding lung transplantation and work-up in 2019.
Thoracic Imaging
## Lung Function Tests

### Interpretation:

Very severe obstructive Sd, Air trapping, hyperinflation
Decreased in diffusion capacity

Stable during the past year

### Table of Lung Function Tests

<table>
<thead>
<tr>
<th></th>
<th>Avant BD</th>
<th></th>
<th></th>
<th>Après BD</th>
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<tbody>
<tr>
<td></td>
<td>Pred</td>
<td>Actuel</td>
<td>% Pred</td>
<td>Actuel</td>
<td>% Pred</td>
<td>% Chng</td>
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<tr>
<td>--DEBITS ----</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVF (L)</td>
<td>2.60</td>
<td>1.92</td>
<td>73</td>
<td>2.60</td>
<td>1.92</td>
<td>73</td>
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<tr>
<td>VEMS (L)</td>
<td>2.19</td>
<td>0.49</td>
<td>22</td>
<td>2.19</td>
<td>0.49</td>
<td>22</td>
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<tr>
<td>VEMS/CVF (%)</td>
<td>78</td>
<td>26</td>
<td>32</td>
<td>78</td>
<td>26</td>
<td>32</td>
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<tr>
<td>VEMS/CVL (%)</td>
<td>0</td>
<td>25</td>
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<td>0</td>
<td>25</td>
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<tr>
<td>DEM25-75% (L/sec)</td>
<td>2.93</td>
<td>0.17</td>
<td>5</td>
<td>2.93</td>
<td>0.17</td>
<td>5</td>
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<tr>
<td>DEP (L/sec)</td>
<td>5.84</td>
<td>1.33</td>
<td>22</td>
<td>5.84</td>
<td>1.33</td>
<td>22</td>
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<tr>
<td>CODES FVL</td>
<td>R1R2</td>
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<tr>
<td>CPT (L)</td>
<td>4.64</td>
<td>5.86</td>
<td>126</td>
<td>4.64</td>
<td>5.86</td>
<td>126</td>
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<tr>
<td>CVL (L)</td>
<td>2.60</td>
<td>1.99</td>
<td>76</td>
<td>2.60</td>
<td>1.99</td>
<td>76</td>
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<td>CI (L)</td>
<td>2.04</td>
<td>1.22</td>
<td>59</td>
<td>2.04</td>
<td>1.22</td>
<td>59</td>
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<tr>
<td>VR (L)</td>
<td>1.79</td>
<td>3.87</td>
<td>216</td>
<td>1.79</td>
<td>3.87</td>
<td>216</td>
</tr>
<tr>
<td>VR/CPT (%)</td>
<td>39</td>
<td>66</td>
<td>169</td>
<td>39</td>
<td>66</td>
<td>169</td>
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<tr>
<td>CRF (L)</td>
<td>2.60</td>
<td>4.64</td>
<td>178</td>
<td>2.60</td>
<td>4.64</td>
<td>178</td>
</tr>
</tbody>
</table>

### Codes VGT

---DIFFUSION -----  
| DLCOunc (mM/min/kPa)| 7.35 | 2.77 | 37   |
| DLCOcor (mM/min/kPa)| 7.35 | 2.89 | 39   |
| Kco (mM/min/kPa/L)  | 1.52 | 0.84 | 55   |
| VA (L)             | 4.64 | 3.43 | 73   |
| CVI (L)            | 1.80 |       |       |
# Evolution of body composition 2014-2017

<table>
<thead>
<tr>
<th>Date de l'examen</th>
<th>Poids</th>
<th>Eau corporelle</th>
<th>% EPC normes [45.5-57.8]</th>
<th>Masse non grasse (Kg)</th>
<th>% MNG normes [64.0-75.8]</th>
<th>Masse non grasse sèche (Kg)</th>
<th>% MNGS normes [16.4-19.8]</th>
<th>Masse grasse (Kg)</th>
<th>% MG normes [24.3-36.0]</th>
<th>Masse non grasse/grasse (Kg)</th>
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<tbody>
<tr>
<td>12/07/2017</td>
<td>53.4</td>
<td>27</td>
<td>50.5</td>
<td>36.2</td>
<td>67.9</td>
<td>9.3</td>
<td>17.3</td>
<td>17.2</td>
<td>32.1</td>
<td>2.1</td>
</tr>
<tr>
<td>14/12/2016</td>
<td>50.5</td>
<td>27.9</td>
<td>55.3</td>
<td>36.8</td>
<td>72.9</td>
<td>8.9</td>
<td>17.7</td>
<td>13.7</td>
<td>27.1</td>
<td>2.7</td>
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<tr>
<td>09/12/2015</td>
<td>46.7</td>
<td>33.2</td>
<td><strong>71.1</strong></td>
<td>41.4</td>
<td><strong>88.6</strong></td>
<td>8.2</td>
<td>17.5</td>
<td>5.3</td>
<td><strong>11.4</strong></td>
<td>7.8</td>
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<tr>
<td>14/10/2014</td>
<td>48.8</td>
<td>29.9</td>
<td><strong>61.2</strong></td>
<td>38.3</td>
<td><strong>78.6</strong></td>
<td>8.5</td>
<td>17.4</td>
<td>10.5</td>
<td><strong>21.4</strong></td>
<td>3.7</td>
</tr>
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</table>
Electrical bioimpedance measurement (transplantation work-up 2019)

<table>
<thead>
<tr>
<th>Age (date de l'examen)</th>
<th>57 ans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poids actuel</td>
<td>48.3 kg</td>
</tr>
<tr>
<td>Poids idéal (kg)</td>
<td>57.2 kg</td>
</tr>
<tr>
<td>Poids idéal (%)</td>
<td>84.44 %</td>
</tr>
<tr>
<td>Activité physique</td>
<td>faible</td>
</tr>
<tr>
<td>Degrés de stress</td>
<td>--</td>
</tr>
<tr>
<td>Taille</td>
<td>158 cm</td>
</tr>
<tr>
<td>Poids habituel</td>
<td>kg</td>
</tr>
<tr>
<td>Indice de la masse corporelle</td>
<td>19.3 kg/m²</td>
</tr>
<tr>
<td>Régime</td>
<td>Normal</td>
</tr>
<tr>
<td>Température</td>
<td>°C</td>
</tr>
</tbody>
</table>

**Eau corporelle**

<table>
<thead>
<tr>
<th></th>
<th>26 kg, soit 53.8 %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Masse non-grasse</strong></td>
<td>34.2 kg, soit 70.7 %</td>
</tr>
<tr>
<td><strong>Masse non-grasse seche</strong></td>
<td>8.2 kg, soit 17 %</td>
</tr>
<tr>
<td><strong>Masse grasse</strong></td>
<td>14.1 kg, soit 29.3 %</td>
</tr>
</tbody>
</table>

* tout ce qui est non-gras dans l'organisme, ** masse non-grasse moins eau corporelle

**Evaluation de la Dépense Énergétique de Base**

|                        | 1119 kcal/j |

**FFM index: 13.6%**

< P5 considering regional norms
Question 2

In this «stable» ambulatory patient with chronic respiratory disease and an anxiety disorder, what is the adequate strategy at this point?

A/ Continue standard respiratory care (NIV, O2)
B/ Start parenteral nutrition
C/ Start oral/enteral nutritional support
D/ Consider psychiatric evaluation and treatment (anxiety+++)
E/ Change respiratory treatment (adding more O2)
Chronic Obstructive Pulmonary Disease

• COPD is a multi-organic disease, and BODE is a good predictor for mortality at 52 months.
  – Decrease in BMI is linked to increase risk morbi-mortality
  – Low FFM is found in 45% of patients on lung transplant list
  – Shift of body composition (loss of FFM >>> Loss FM)
  – SNIP/MIP (respiratory muscle evaluation)
  – Muscle weakness (peripheric and axial)

• Ventilation in COPD (hyperinflation, lung parenchyma disease, muscle strain in muscle wasting patients)

Question 3 A/B

• How do you estimate our patient’s nutritional status?
• How much energy would you give our patient?
Muscle alteration in COPD

Shift muscle fibers from type I to II
Decreased muscular capillary density,
Decreased mitochondrial density and
function (lower limb especially)
Low oxidative capacity in the limbs

A low cardiorespiratory fitness and limb
muscle dysfunction in COPD patients, is
associated with a higher risk of all-cause
mortality

ESPEN LLL Programme 2017 (Topic 38, module 38.1)
Mechanism in COPD

• Energy expenditure increase
  • Increase resting energy requirement (hypermetabolism)
  • Systemic inflammation
  • Increase metabolism (higher respiratory activity due to modified mechanical respiratory status)
  • Decrease respiratory muscle efficiency (Resp W increase ++)

• Decreased dietary intake
  • Fatigue, dyspnoea → makes it more difficult to eat
  • Chronic inflammation (TNFa, cytokines)
Answer 3A/B

- Energy: $48.3kg \times 35\text{kcal/kg (COPD)} = 1700\text{kcal/d}$
- Proteins: $48.3kg \times 1.2-1.3(g/kg) = 58-72g/d$

Used strategy by nutrition team considering at steady state:
- Energy: $35\text{kcal/kg}$
- Protein: $1.2-1.5g/kg$
Nutritional Assessment (January 2019)

• Laboratory results:
  25-hydroxy vitamin D (D2+D3) 74nmol/l, CRP 5.5mg/l, albumin 43g/l, Osm 288mOsm/kg, ferritin 393ug/l, B12 393pg/l, folate 5.3ng/l

→ Evaluation of calorie intake including oral supplementation (600kcal and 24 gr protein): caloric needs covered.
Hospital Admission (April 2019)

- **Acute exacerbation of COPD** with respiratory acidosis.
- Lab results: Inflammatory syndrome, leucocytosis
- Chest Xray: no lung infiltrate
- Microbacteriology in expectoration: no germ found

→ Admitted to ICU for increase in NIV and optimisation of respiratory parameters
# Sequential Laboratory Values

<table>
<thead>
<tr>
<th>Date</th>
<th>17.01.2019</th>
<th>24.04.2019</th>
<th>08.05.2019</th>
<th>17.05.2019</th>
<th>27.05.2019</th>
<th>06.06.2019</th>
<th>01.07.2019</th>
<th>12.07.2019</th>
<th>19.07.2019</th>
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</thead>
<tbody>
<tr>
<td>Prealbumin (mg/l)</td>
<td>175</td>
<td>143</td>
<td>101</td>
<td>102</td>
<td>87</td>
<td>97</td>
<td>121</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>Ferritin (ug/l)</td>
<td>91</td>
<td>145</td>
<td></td>
<td></td>
<td>139</td>
<td></td>
<td></td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>CRP (mg/l)</td>
<td>5.5</td>
<td>76</td>
<td>11</td>
<td>16</td>
<td>9</td>
<td>16</td>
<td>9</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Albumin (g/l)</td>
<td>43</td>
<td>33</td>
<td>36</td>
<td>33</td>
<td>36</td>
<td></td>
<td>34</td>
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</tbody>
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Outpatient clinic | Hospital admission
Admission Nutritional Evaluation

- Calculated daily calorie needs = 1133 kcal (25kcal/kg)
- Insufficient protein-energetic intake (patient covers 71-73% respectively)
  - Proposition:
    1/ Increase intake (snacks) and oral supplementation (2x 300kcal/d)
    2/ Intensive physiotherapy
Nutritional Evaluation: May 2019

- Patient transferred to rehabilitation for global deconditioning
- Weight: 46.5 kg → BMI 18.6 kg/m²
- Oral nutritional supplementation consists of the equivalent of 900 kcal and 54g protein daily
- Laboratory results: Prealbumin 101 mg/l; CRP 16.5 mg/l; osmolality 301 mOsm/kg
- Time of NIV increase to 16h/24h

→ Diagnosis: Severe persistent protein-caloric deficiency
Question 4
What should we do considering the inflammatory steady state?

A/ Continue current respiratory treatment
B/ Start parenteral nutrition
C/ Start tube feeding
D/ Start anabolic steroids
E/ Remove patient from transplant list
COPD exacerbation and effect on nutrition

• COPD exacerbations are classified as either infectious or non-infectious and associated with:
  – Systemic inflammation
  – Hypoxemia
  – Inactivity
  – Corticosteroid treatment

  ➔ These mechanisms can lead to muscle wasting/atrophy, higher energy needs and increase metabolic rate
COPD exacerbation and Nutrition

• Reassess calorie and protein requirements considering changes in metabolic rate/protein turnover during acute exacerbation of COPD

• Anabolic steroids
  • To be considered at **steady state** and in absence of major inflammation and cancer
  • Induce Fat Free Mass gain → improves exercise tolerance
    – CAVE: in combination with INTENSIVE PHYSIOTHERAPY (Physical training, resistance exercise)
Nutritional Evaluation May 2019

• Patient transferred to rehabilitation for global deconditioning
• Weight: 46.5 kg → BMI 18.6 kg/m2
• Oral supplementation: 900kcal and 54 gr of protein daily
• Lab results: Prealbumin 101mg/l; CRP 16.5 mg/l; osm 301mOsm/kg

Proposition: Enteral supplementation → Patient refused
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*Outpatient clinic*  
*Hospital admission*
Weight Curve April-July 2019

Admission
April 2019
49kg

Medical ward
July 2019
45kg
Nutritional Evaluation: June-July 2019

• Increase in ventilatory needs (patient fully NIV dependent) with severe muscle wasting and persistent weight loss.
  – Weight 45kg.
  – Prealbumin: 87mg/l

→ Intervention: Tube feeding to cover caloric and protein needs as patient has no spontaneous intake (NIV dependent).
Question 5

Which strategy should be intensified at this stage?

A/ Increase physical activity
B/ Focus on nutritional perspective
C/ Use of anabolic steroids
D/ Instore insulin
E/ Multi-modal approach
Multimodal approach

Multimodal nutritional rehabilitation improves clinical outcomes of malnourished patients with chronic respiratory failure: a randomised controlled trial

Christophe M Pison,¹,²,³ Noël J Cano,⁴,⁵,⁶ Cécile Chérion,¹ Fabrice Caron,⁷ Isabelle Court-Fortune,⁸ Marie-Thérèse Antonini,⁹ Jésus Gonzalez-Bermejo,¹⁰,¹¹ Lahouari Meziane,¹²,¹³ Luis Carlos Molano,¹⁴,¹⁵,¹⁶ Jean-Paul Janssens,¹⁷,¹⁸ Frédéric Costes,¹⁹,²⁰ Bernard Wuyam,²¹,²² Thomas Similowski,¹⁰,¹¹ Boris Melloni,²³ Maurice Hayot,¹²,¹³ Julie Augustin,⁷ Catherine Tardif,²⁴ Hervé Lejeune,²⁵,²⁶ Hubert Roth,¹,²,³,²⁷ Claude Pichard,¹⁸,²⁸ the IRAD Investigators*
Multimodal approach

**Inclusion:** Chronic respiratory failure, BMI \( \leq 21 \text{ kg/m}^2 \), FFM index < P25

**Design:** randomized, multi-center, over 3 months

**Intervention**
1) Control (n= 62) : education only
2) Rehabilitation (n=60): Testosterone + oral nutritional supplement (188 kcal 3x/d) + exercise 3-5 x/wk

**Results**
Multimodal nutritional rehabilitation aimed at improving body composition increased exercise tolerance, quality of life in women and survival in compliant patients, supporting its incorporation in the treatment of malnourished patients with chronic respiratory failure.

_C Pison et al, Thorax, 2011_
Nutritional Evaluation (June-July 2019)

After stabilisation, increase of intake to 120% estimated needs. Introduction of anabolic steroids with intensive physiotherapy (and electro-stimulation).

July: Due to respiratory deterioration, non-optimal control of CO2 and impossibility to pursue NIV, multi-disciplinary discussion led to proposition to start ECCO2-R treatment.
ExtraCorporeal Carbon Dioxyde Removal (ECCO2R)

Mechanism: Central catheter epurates CO2 to obtain arterial CO2 control
→ Blood gas stabilisation

Tracheostomia and PEG
Complications:
  Pneumoperitonitis → emergency laparotomy
  Multi-germ peritonitis → large spectrum AB
Admission
April 2019
49kg

Medical
ward
July 2019
45kg

Multiple ICU admissions for acute respiratory acidosis
Current Evolution

Patient with night invasive ventilation on tracheostomia.
Intensive mobilisation (significative improvement with MRC 56/60)
Night enteral nutrition with PEG
Oral alimentation favored during the day

→ Weight: 56.2kg (48kg)
→ Albumin 33g/l, prealbumin 137mg/l, ferritin 232ug/l, CRP 25mg/l
Take Home Message

• Malnutrition is common in COPD and every patient should be screened.
• Muscle wasting is associated with morbi-mortality in COPD patients
• NIV is NOT a contraindication for tube feeding
• Multi-modal approach should be standard of care
THANK YOU FOR YOUR ATTENTION
• Learning Objective:
  • Know the nutritional state undernutrition/obesity/sarcopenia/cachexia of COPD patients and its consequences
  • - Know the nutritional needs of COPD patients
  • - Know the reasons for insufficient energy intake and treatment multimodal treatments
  • - Know the impact of nutritional support physical activity and ergogenic aids on body composition and outcome