Malnutrition: An Independent Risk Factor for Postoperative Complications

Bryan P. Hooks, D.O.
University of Pittsburgh–Horizon
June 24, 2017
Orthopedic Surgeon–Adult Reconstruction

"Our food should be our medicine and our medicine should be our food"
~ Hippocrates
Disclosures:

- None
Objectives:

- Incidence and impact of malnutrition in surgical patients
- Review literature demonstrating the effects of poor nutrition and association with post operative complications
- Discuss an evidence based approach to optimizing nutritional status
Optimizing Nutrition in our Patients?

Modifiable risk factors for complications

- Smoking
- Obesity
- DM
- Malnutrition
Our approach to Nutrition in Healthcare

- Studies since 2016
- Poor nutritional status is an independent risk factor for post operative complications
- Spine
  - 4 studies
  - 1 study
- J Arthroplasty
  - 4 studies
- J Knee Surg
  - 1 study
- Injury
  - 1 study
Incidence of Malnutrition

- 30-55% of hospitalized patients are malnourished
- Up to 69% of hospitalized patients undergo declining nutritional status during their hospital stay

*J of Parenteral & Enteral Nutrition 2011*
I DON'T ALWAYS USE EVIDENCE FROM MY DATA

BUT WHEN I DO, I MAKE BETTER DECISIONS
Malnutrition: an independent risk factor for complications

- 136 spine fusion patients
  - Albumin <3.5
    - 35.7% complication rate
  - Albumin >3.5
    - 11.7% complication rate

Spine 2014
Malnutrition: an independent risk factor for complications

- Review of 4,310 Lumbar Fusion patients
  - Albumin <3.5
    - SSI: 2.3
    - Wound Dehiscence: 5.8
    - UTI: 2.5
    - Sepsis: 3.8
    - Hospital Readmission: 1.8 (30 day)
    - Length of stay: 3.7 vs 5.2 days

Spine 2016
Malnutrition: an independent risk factor for complications

- Retrospective study of 4,551 Revision Total Knee Arthroplasty patients
  - Albumin <3.5
    - Any complication: OR 2.74
    - Wound Infection: OR 2.57
    - Deep Wound SSI: OR 2.30
    - Pneumonia: OR 2.84
    - UTI: OR 3.01
    - Acute Renal Failure: OR 7.89
    - Sepsis: OR 5.30

J Knee Surg 2016
Malnutrition: an independent risk factor for complications

- Retrospective study of 4,517 Total Knee and Hip patients
  - Patients undergoing revision for a septic indication had a higher rate of hypoalbuminemia than patients undergoing revision for an aseptic indication
  - Relative Risk= 3.6

J Arthroplasty 2016
Malnutrition: an independent risk factor for complications

- Retrospective study of 1,187,969 Primary THAs
- Evaluated Factors associated with Perioperative Periprosthetic Fracture
  - Malnutrition was found to increase the risk of PPF 10-fold

J Arthroplasty 2016
Malnutrition: an independent risk factor for complications

- Prospective study of 300 primary and revision TKA and THA with post op drainage for >48hrs
- Predictors of failure:
  - Timing of surgery
  - Malnutrition
    - 7x more likely to fail

14 different factors studied

Clin Orthop Relat Res 2008
Malnutrition, MORE THAN obesity, associated with complications after TKA

Review of 77,785 Total Knee Replacements

Evaluating obesity (BMI>40) and Malnutrition (Albumin <3.5) as risks factors for 21 different complications

- **Obesity was associated with:**
  - ARI
  - Superficial Infection OR 1.87
  - Sepsis

- **Malnutrition was associated with:**
  - Mortality
  - Superficial SSI OR 1.27
  - Deep SSI OR 3.64
  - Pneumonia
  - Unplanned intubation
  - Septic Shock
  - ARI
  - ARF
  - Cardiac Arrest
  - Blood transfusions

Malnutrition: an independent risk factor for complications

- Review of 20,210 Total Hip Replacements
  - “malnutrition was a more robust predictor than any obesity class for any postoperative complication, major complications, respiratory complications, blood transfusions, and extended length of stay.”

J Arthroplasty 2016
Patient Nutrition is an independent risk factor for complications: but is it a modifiable risk factor
Optimizing Nutrition in Surgical Patients

- Options for Addressing Nutritional Status
  - Dietary consultation
  - Change daily diet
  - Boost or Ensure to increase protein levels
  - Immunonutrition
Optimizing Nutrition in Surgical Patients

- Options for Addressing Nutritional Status
  - Dietary consultation
  - Change daily diet
  - Boost or Ensure to increase protein levels

- Immunonutrition
Immunonutrition

- Immunomodulating nutrients
  - **Arginine**: Stimulates the immune system and improves nitrogen balance
  - **Glutamine**: Oxidative fuel for cell growth and tissue repair
  - **Omega 3 Fatty Acids**: Reduce inflammation and supports the immune system
  - **Nucleotides**: Stimulates protein synthesis and promotes tissue and cell recovery
Strong foundation of solid evidence

- Immunonutrition formulas have been studied extensively since the 1990s.
- Over 500 publications in a variety of journals have analyzed the safety, efficacy, and cost-effectiveness of Immunonutrition ingredients and formulas.
# Meta-analyses of studies on role of Immunonutrition for surgical patients

<table>
<thead>
<tr>
<th>Meta Analysis</th>
<th># of RCTs</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zheng et al</td>
<td>13</td>
<td>Fewer Post op Infections; Shorter LOS</td>
</tr>
<tr>
<td>Drover et al</td>
<td>35</td>
<td>Fewer Post op Infections; Shorter LOS</td>
</tr>
<tr>
<td>Waitzbert et al</td>
<td>17</td>
<td>Fewer Post op Infections; Shorter LOS</td>
</tr>
<tr>
<td>Marik et al</td>
<td>21</td>
<td>Fewer Post op Infections; Fewer overall complications; Shorter LOS</td>
</tr>
<tr>
<td>Cerantola et al</td>
<td>21</td>
<td>Fewer Post op Infections; Fewer overall complications; Shorter LOS</td>
</tr>
<tr>
<td>Maimuthu et al</td>
<td>26</td>
<td>Fewer Post op Infections; Fewer overall complications; Shorter LOS</td>
</tr>
<tr>
<td>Zhang et al</td>
<td>19</td>
<td>Fewer Post op Infections; Fewer overall complications; Shorter LOS</td>
</tr>
<tr>
<td>Osland et al</td>
<td>21</td>
<td>Fewer Post op Infections; Fewer overall complications; Shorter LOS</td>
</tr>
</tbody>
</table>
Significant reduction in infections and LOS

- Immunonutrition used prior to Major surgery:
  - 51% reduction in post operative infections
  - 15% shorter hospital length of stay

Significant Reduction in Infections and Hospital LOS

- Meta analysis 1,009 patients
  - 50% reduction post operative infections
  - Reduction in length of hospital stay of 2.5 days

- Heys SD, et. Al Ann surg 1999
Reduction of Complications and Cost

- Prospective, Randomized, double-blinded multicenter clinical trial
- 145 patients with upper GI tract malignancy
- 5 days preop and 10 days post op
- Postoperative complications:
  - IMN group had 50% fewer complications (14 vs 27)
- Cost of complications per patient
  - IMN group complication costs were 25% of the control group
  - (75% reduction in cost of complications)
- Net cost saving of DM 1,426 ($813)

Immunonutrition reduces infections and other complications after surgery for cancer

- Randomized controlled study of 29 patients receiving either Immunonutrition supplemented diet or oral nutrition supplement
- Patients who received the specialized immunonutrition diet had
  - 33% reduction in post operative complications
  - 39% reduction in infections rates

Hamilton-Reeves. Eur Urol. 2015 Nov 30
Well-nourished vs Malnourished

<table>
<thead>
<tr>
<th></th>
<th>Reduction of Serum Albumin POD 3</th>
<th>All Complications</th>
<th>Mean Chest tube drainage time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>25.71%</td>
<td>44.40%</td>
<td>6 days</td>
</tr>
<tr>
<td>IMN</td>
<td>14.69%</td>
<td>19.40%</td>
<td>4 days</td>
</tr>
</tbody>
</table>

Prospective randomized controlled trial of 58 well-nourished patients who underwent anatomic resection for non-small cell lung CA

IMN group: nutrition containing arginine, omega-3 FA and nucleotides for 10 days pre-op

Well-nourished vs Malnourished

- Prospective, randomized, double-blinded clinical trial
  - 260 patients with Lower GI cancer undergoing elective surgery

- Perioperative IMN significantly reduced the rate of postoperative infections regardless of baseline nutritional status


Postoperative complications:
- IMN group 11%
- Control 24%
- 54% fewer postoperative infections with IMN

Postoperative infections:
- **Well Nourished**
  - IMN group 10%
  - Control 21%
- **Malnourished**
  - IMN group 14%
  - Control 39%
Cost Effectiveness

What is Value?

| ↑ Costs  | ↑ Costs  |
| ↓ Health outcomes | ↑ Health outcomes |
| ✗ | ✗ |

| ↓ Costs  | ↓ Costs  |
| ↓ Health outcomes | ↑ Health outcomes |
| ✗ | ✓ |
Cost effectiveness

- Hospital cost savings
  - Randomized double-blind controlled study (310 patients)
    - Cost effectiveness analysis showed net saving of 2,386 Euros ($2,619) per patient
      - Included the cost of the immunonutrition
    - Gianotti et. al. Shock 2000
Cost effectiveness

- Hospital cost savings
  - From a meta-analysis of 6 studies (889 patients)
    - $6,000 cost saving per patient based on hospital length of stay
    - $3,300 cost saving per patient based on reduction of infectious complications

Cost effectiveness

- Economic Impact of Malnutrition on Hospital Admission
  - Study of 469 patients
  - 42% classified as malnourished
  - Malnutrition on admission increased the cost of care by 19.3%

Climate change in healthcare

- Hospitals and Physicians will have to pay for complications and re-admissions (https://innovation.cms.gov/initiatives/cjr)
  - Effective April 1st 2016 participation in Comprehensive Care for Joint Replacement is mandatory.
  - CMS and private payers are aggressively transferring the financial risks of poor outcomes and high costs to providers.
  - Physician outcomes and patient satisfaction are now publically reported.
CMS CJR Overview

- Comprehensive Care for Joint Replacement (CJR)
  (https://federalregister.gov/a/2015-29438)
  - Mandated retrospective bundled payment for Episodes of Care issued to 800 Acute Care Hospitals in 67 MSA’s (Metropolitan Statistical Areas), effective April 1, 2016
  - Hospital responsibility to repay Medicare will be phased in and capped (stop-loss) Year 2: 5%, Year 3: 10%, Year 4 & 5: 20% of Medicare target prices
  - Applies to all TKA & THA Procedures under DRG’s MS-469 and MS-470
Defining the Financial Risk

- **30 Day Rehospitalization Rate**
  - **19.6%**

- **90 Day Rehospitalization Rate**
  - **34%**

Based on a study of 12 million Medicare patients
Defining the Financial Risk

Cost of Readmission for CMS-Tracked Conditions

- All-cause Readmissions
  - Avg. Cost of Readmission $11,200
  - 25.1% readmission rate

- Congestive heart failure Readmissions
  - Avg. Cost of Readmission $13,000
  - 21.2% readmission rate

- Joint Replacement Readmissions
  - Avg. Cost of Readmission
    - $12,300 for THR
    - $10,200 for TKR
  - 8.2% readmission rate for THR
  - 5.1% readmission rate for TKR

Ellie Rizzo Becker's Hospital Review  December 12, 2013
My Protocol

- Two bottles of Immunonutrition each day 6 days prior to surgery and 6 days after surgery
  - Immunonutrition is most effective take 5-7 days pre-operatively and 5-7 days post-operatively
- 60%-70% of my patients are willing to pay for Immunonutrition out of Pocket

- I recommend Immunonutrition to every patient undergoing many major or inpatient surgery.
- I do not know which patient are willing to pay for it, but each one deserves to opportunity to invest in their own recovery.
SUMMARY

- **Malnutrition is an epidemic in healthcare in the United States**
- **Nutritional status is the most robust modifiable risk factor for postoperative complications**
- **Immunonutrition is proven to reduce complications and improve outcomes**
  - **Well nourished and malnourished patients**
  - **Immunonutrition is proven to reduce costs**