MANAGING COMPLEX PATIENTS: NUTRITION SUPPORT AND ANTICOAGULATION
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DISCLOSURE
Potential conflicts of interests
– None for all speakers

OBJECTIVES
Evaluate parenteral and enteral nutrition strategies for a patient with short bowel syndrome
Choose a parenteral anticoagulant for a patient with a history of heparin induced thrombocytopenia (HIT) and acute kidney injury (AKI)
Select an oral anticoagulant for a patient with short bowel syndrome and chronic kidney disease

PATIENT CASE
45 year old Caucasian female
CC: shortness of breath, fever and chills for 2 days
PMH: Stage 4 CKD (baseline Cr 2.4), history of multiple DVT/PEs (on warfarin), HIT (2011), NSTEMI (2013), HTN, short bowel syndrome (secondary to bowel infarction)
Allergies: heparin (HIT), iodine (hives, throat swelling)

PATIENT CASE
In the Emergency Dept.
• Chest X ray: Bilateral pleural effusions suggestive of pneumonia
• Intubated for hypercapnic respiratory failure
• Nephrology consulted for AKI on CKD

PATIENT CASE: HOME MEDICATIONS
Aspirin 81 mg daily
Cinacalcet 60 mg daily
Diazepam 5 mg q6h prn
Lisinopril 10 mg daily
Methocarbamol 500 mg q6h
Metoprolol succinate 25 mg daily
Morphine extended release 100 mg q12h
Oxycodone 15 mg q4h pm
Simvastatin 20 mg every evening
Warfarin 5 mg daily
PATIENT CASE: PROBLEM LIST

1. Septic shock secondary to pneumonia
   • Pressors, antibiotics, fluids started
2. AKI in patient with CKD
   • Nephrology consulted for possible CRRT
3. History of DVT/PE on chronic anticoagulation
   • Pharmacy consulted for recommendations
4. Malnutrition
   • Nutrition support team consulted

ENTERAL OPTIONS

Enteral formula options
- Standard
- High Protein (Nutren Replete, Promote)
- Renal Failure (Nepro, Novosource)
- Pulmonary (Nutren Pulmonary, Pulmocare)
- Malabsorption (Vivonex RTF, Vital AF 1.2)

PATIENT CASE – NUTRITION CONSULT

You are consulted for nutrition for this patient

<table>
<thead>
<tr>
<th>Ht</th>
<th>Wt</th>
<th>IBW</th>
<th>BMI</th>
<th>Scr</th>
<th>BUN</th>
<th>K</th>
<th>Mg</th>
<th>Phos</th>
</tr>
</thead>
<tbody>
<tr>
<td>5’6”</td>
<td>61.5</td>
<td>59.3</td>
<td>21.9</td>
<td>4.1</td>
<td>47</td>
<td>5.3</td>
<td>2.2</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Patient is intubated
NJ and IJ successfully placed in ICU
Dialysis expected soon for AKI

ROUTE OPTIONS

What are the available routes for nutrition?
- Oral
- Enteral – NJ already placed
- Parenteral – patient has a short term IJ

What is the best route to begin nutrition?
- Enteral via NJ

PATIENT CASE – TRANSITION TO CRRT

On hospital day 3, patient is started on CRRT by Nephrology
Current formula is causing significant diarrhea
- Yesterday patient had 6 bowel movements

Enteral formula options:
- Standard
- High Protein
- Renal Failure
- Pulmonary
- Malabsorption

RENAL FAILURE FORMULAS

Differences from standard formulas
- Decreased potassium, magnesium, phosphorus
  • Renal Failure Formula: K ~25 mEq/L
  • Standard Formula: K ~48 mEq/L

SCCM/ASPEN guidelines recommend against their use in ICU patients
- Exception: significant electrolyte abnormality


ASPEN/SCCM. J Parenter Enteral Nutr 2009.
**CRRT CONSIDERATIONS FOR NUTRITION**

AKI characterized by high rates of catabolism

Protein needs increased during CRRT
- 1.8 – 2.5 g/kg/day

Electrolytes are being removed by CRRT

Electrolytes can be adjusted through dialysate solutions
- Except phosphorus

*ASPEN. J Parenter Enteral Nutr 2009.*

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**MALABSORPTION FORMULAS**

Semi-elemental (Peptamen, Vital HN)
- Contain peptides of varying length, simple sugars, glucose, or starches and fat primarily as MCT
- Di- and tri-peptides utilize specific transport mechanisms

Elemental (Vivonex TEN, Tolerex)
- Contain individual amino acids, glucose polymers, 2-3% of calories from LCT
- Require minimal digestive function, MCT can be absorbed in absence of bile salts
- Hyperosmolar

*Adult Nutrition Support Core Curriculum ASPEN 2012.*

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**MALABSORPTION**

Evaluation of causes
- Too rapid rate of infusion into the small intestine
- Small intestine bacterial overgrowth
- Medications

Choosing a formula
- Hyper-tonicity is a problem for most patients
- Hyper-tonicity should be avoided in patients with short bowel syndrome (SBS)

*Adult Nutrition Support Core Curriculum ASPEN 2012.*

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**PATIENT CASE – LOW INR CONSEQUENCES**

On hospital day 3, patient has episode of hypoxia despite mechanical ventilation

Pulmonary embolus (PE) is highly suspected
- D-dimer is elevated and V/Q scan is suggestive of PE
- Lower extremity Doppler shows occlusive thrombus

DVT prophylaxis with compression stockings

Pharmacy is consulted to manage the patient’s anticoagulation

*Adult Nutrition Support Core Curriculum ASPEN 2012.*

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**PATIENT CASE – INTOLERANCE**

Hospital day 8, the patient continues to have intolerance to enteral feeding

Patient meeting 40 - 50 % of estimated needs

If TPN is a consideration:
- Access
- Predicted tolerance to TPN formula

*Adult Nutrition Support Core Curriculum ASPEN 2012.*

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**TPN**

Estimated needs/tolerances
- High protein formula (1.7 - 2 g/kg/day)
- Stress/critically ill (28 – 32 kcal/kg/day)
- Lipids (0.8 – 1.2 g/kg/day)
- Glucose infusion rate (max. 3 – 4 in critically ill)
- Potential vitamin/mineral deficiencies (full dose MVI and trace elements, if possible)
- Fluid needs (may provide hydration outside TPN)

*Adult Nutrition Support Core Curriculum ASPEN 2012.*
ACUTE ANTICOAGULATION

Considerations
- Indicated agents
- Parenteral or oral agent
- Patient history of serologically confirmed HIT
- AKI requiring CRRT (started hospital day 3)

HEPARIN USE AFTER HIT

Immune reaction is transient
- Sero-negative within 50-133 days

Use in patients for cardiac procedures is recommended in 9th edition CHEST guidelines
- Multiple small case series validate use in this situation
- Patients should be tested for HIT antibodies prior to heparin administration

Case series showing safe use in hemodialysis patients with history of HIT

ACUTE ANTICOAGULATION

Indicated Agents
- Heparin
- Low-molecular-weight heparin
- Fondaparinux
- Argatroban
- Bivalirudin

Parenteral or oral agent

HEPARIN INDUCED THROMBOCYTOPENIA

IgG immune-mediated drug reaction

Serological testing for HIT
- Antigen assay
- Serotonin release assay

FONDAPARINUX IN PATIENTS WITH HISTORY OF HIT

Not associated with HIT
 Preferred agent to use in PCI if history or high risk of HIT
- Little evidence for acute VTE/PE treatment
- Not FDA approved for treatment of HIT

Table 1. PCI Parameters in Patients with High Risk of HIT

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<th>Angimax (200 kg, male)</th>
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<td>90</td>
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<tr>
<td>Mean arterial pressure (50-90)</td>
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<td>34</td>
<td>34</td>
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BIVALIRUDIN IN PATIENTS WITH HISTORY OF HIT

Not associated with HIT
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ARGATROBAN IN PATIENTS WITH HISTORY OF HIT
Not associated with HIT

Dosage reduction
- Hepatic insufficiency
- Critically ill
- Post cardiac surgery

No dosing adjustments recommend in renal insufficiency
- Continuous renal replacement therapy (CRRT)
- Hemodialysis (HD)

Glasbrenner-Aravabian PI 2012.

TPN SBS REIMBURSEMENT
Outpatient TPN reimbursement is a major consideration

Medicare guidelines for SBS
- Resection in prior 3 months and residual small intestine < 5 ft (150 cm)
- Malabsorption responsible for weight loss of ≥ 10% in prior 3 months and albumin < 3.5 g/dL
  - Fecal fat > 50%
  - Stool losses > 50% of an oral fluid intake of 2.5-3 L and a urine output of < 1L per day

Glasbrenner-Aravabian PI 2012.

ASSESSMENT QUESTION #1
Which parenteral anticoagulant is preferred in patients with a history of HIT three years ago and acute kidney injury?

A. Enoxaparin
B. Argatroban
C. Bivalirudin
D. Fondaparinux

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Glasbrenner-Aravabian PI 2012.

REIMBURSEMENT CRITERIA
General requirements for reimbursement:
- PN required for > 3 months
- Cannot maintain weight on oral or oral/enteral
- Diagnosis on Medicare list
- Weight history
- Serum albumin within 1 week of home PN

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  - Stool losses > 50% of an oral fluid intake of 2.5-3 L and a urine output of < 1L per day

Glasbrenner-Aravabian PI 2012.

REIMBURSEMENT CRITERIA
One of the following with supporting documentation
- Short bowel syndrome (SBS)
- Small bowel resection with < 5 ft (150 cm) remaining
- Enteritis exacerbation requiring bowel rest for > 3 months
- Pancreatitis requiring bowel rest for > 3 months
- Enterocutaneous fistula requiring bowel rest for > 3 months where distal feeding is not an option
- Complete mechanical small bowel obstruction where surgery is not an option
- Severe fat malabsorption where fecal fat exceeds 50%
- Severe motility disorder that is unresponsive to prokinetic medication

Glasbrenner-Aravabian PI 2012.

PATIENT CASE – LONG-TERM NUTRITION
Patient is extubated and transferred to a medical floor

Medical team consults for transition to enteral nutrition with plans for discharge to skilled nursing facility in approximately one week

Patient has been receiving TPN at full support with a soft diet for comfort

Nutrition options for discharge:
- TPN, enteral, oral

Glasbrenner-Aravabian PI 2012.

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Glasbrenner-Aravabian PI 2012.
SBS AND THE ORAL DIET

Adult patients with SBS absorb less calories compared to patients without SBS
- Oral intake should be increased by 50% over estimated needs

Calcium and magnesium losses common

Absence of the colon will alter dietary needs

DIET RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Colon-in-Continuity</th>
<th>End-Jejunostomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>35 - 45 kcal/kg, up to 60 kcal/kg</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>50 - 60% of kcal</td>
</tr>
<tr>
<td>Protein</td>
<td>1.5 - 2 g/kg or 20 - 30% of kcal</td>
</tr>
<tr>
<td>Fat</td>
<td>20 - 30% of kcal</td>
</tr>
<tr>
<td>Fiber</td>
<td>10 - 15 g/day</td>
</tr>
<tr>
<td>Fluid</td>
<td>iso-tonic/hypo-osmolar</td>
</tr>
<tr>
<td>Oxalate</td>
<td>Low oxalate</td>
</tr>
<tr>
<td>Lactose</td>
<td>Do not restrict if tolerated</td>
</tr>
<tr>
<td>Sodium</td>
<td>Encourage liberal use of salt</td>
</tr>
</tbody>
</table>

ORAL NUTRITION

Calorie count daily

Increase oral diet slowly
- Goal: hyperphagia

Manage diarrhea/malabsorption

Discontinue TPN when possible

DIARRHEA MANAGEMENT

Increase oral diet slowly
- Goal: hyperphagia

Manage diarrhea/malabsorption

ASSESSMENT QUESTION #2

Which is an indication for parenteral nutrition in a patient with short bowel syndrome?

A. Ten percent weight loss
B. Cost
C. Severe diarrhea
D. Patient preference

PATIENT CASE – LONG-TERM ANTICOAGULATION

Patient is extubated and transferred to a medical floor.

Medical team consults pharmacy for transition to long-term anticoagulation for acute PE in patient with CKD and SBS

AKI has resolved and CRRT stopped 5 days prior
- Current CrCl ~ 25 mL/min
LONG TERM ANTICOAGULATION

Considerations
- Oral versus parenteral agents
- Indicated agents
- Safety in patients with renal insufficiency
- Absorption in patient with short bowel syndrome

ORAL VERSUS PARENTERAL THERAPY

<table>
<thead>
<tr>
<th>Parenteral Agents</th>
<th>Oral Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparin</td>
<td>Warfarin</td>
</tr>
<tr>
<td>Enoxaparin</td>
<td>Dabigatran</td>
</tr>
<tr>
<td>Fondaparinux</td>
<td>Rivaroxaban</td>
</tr>
<tr>
<td>Bivalirudin</td>
<td>Apixiban</td>
</tr>
<tr>
<td>Argatroban</td>
<td></td>
</tr>
</tbody>
</table>

WARFARIN FOR PE TREATMENT

Standard of care
- Preferred agent in 9th edition CHEST guidelines
- INR goal of 2 – 3

Renal Insufficiency
- No adjustment necessary

Absorption in small bowel patients
- Case reports suggest dosing is patient specific and highly variable
- Extensively absorbed in stomach and proximal small intestine

ORAL AGENTS INDICATED FOR TREATMENT OF PE

<table>
<thead>
<tr>
<th>Indicated?</th>
<th>Studied?</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warfarin</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Apixiban</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

DABIGATRAN FOR PE TREATMENT

Not indicated but studied
- Similar efficacy and safety to warfarin
- Dose: 150 mg BID

Renal Insufficiency
- Decrease dose if CrCl < 30 mL/min (75 mg BID)
- Contraindicated if CrCl < 15 mL/min

Absorption in small bowel patients
- No evidence in this patient population
- No evidence on site of intestinal absorption

RIVAROXABAN FOR PE TREATMENT

Indicated for treatment of VTE
- Similar efficacy to warfarin
- Fewer episodes of major bleeding

Renal Insufficiency
- Increased AUC with decreasing renal function
- Contraindicated in CrCl < 15 mL/min (atrial fibrillation)
- Contraindicated in CrCl < 30 mL/min (DVT/PE)

Absorption in small bowel patients
- No evidence in this patient population
- No evidence on site of intestinal absorption
APIXABAN FOR PE TREATMENT

Not indicated but studied
  – Similar efficacy to warfarin
  – Fewer episodes of major and minor bleeding

Renal Insufficiency
  – Decrease dose if 2 of 3 criteria are met
    • SCr ≥ 1.5 mg/dL, age ≥ 80 years, weight ≤ 60 kg

Absorption in small bowel patients
  – No evidence in this patient population
  – No evidence on site of intestinal absorption

ASSESSMENT QUESTION #3

Which medication has the most evidence in patients with stage IV chronic kidney disease?
A. Apixaban
B. Dabigatran
C. Rivaroxaban
D. Warfarin

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