Eating During Dialysis: Challenges, Considerations, and Costs

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Annual Dialysis Conference
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Agenda

• Discuss the literature examining potential risks and benefits of eating & drinking during hemodialysis
• Review worldwide practices surrounding eating during dialysis
• Discuss challenges and considerations for providing meals during hemodialysis
Protein energy wasting

28 - 54% (interquartile range) of maintenance dialysis patients present with Protein-Energy Wasting (PEW) worldwide.

Carrero et al 2018
Poor growth and pediatric outcomes

Furth et al 2002
Intradialytic nutrition choices

- Intraradialytic oral nutrition (IDON)
  - Enteral supplements
  - Oral food and drinks
- Intraradialytic parenteral nutrition (IDPN)
- Intraradialytic lipids (IDIL)
History of meals and dialysis

1960s
Inefficient dialysis meant treatment times over 24 hours
Dialysis units provided meals

1970s
Standard dialysis treatment was 8 hours - 3 times per week
Patients ate meals provided or meals from home

1980s
United States
Treatment times to be shortened with rapid volume depletion
Hypotension became common.
Banning meals began

Europe and Asia
Did not reduce dialysis times to the same extent
Continued to provide meals or patients bring their own food.

Franch et al 2016
To eat or not to eat during hemodialysis?

<table>
<thead>
<tr>
<th>Evidence Supporting Eating</th>
<th>Evidence Against Eating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement in nutritional markers</td>
<td>Intradialytic hypotension (HTN)</td>
</tr>
<tr>
<td>Reduced markers of inflammation</td>
<td>Reduced dialysis efficiency</td>
</tr>
<tr>
<td>Increased fat &amp; lean mass</td>
<td>Adverse GI symptoms</td>
</tr>
<tr>
<td>Improved QOL</td>
<td>Aspiration risk</td>
</tr>
<tr>
<td>Better adherence and satisfaction</td>
<td>Staff burden &amp; food safety concerns</td>
</tr>
<tr>
<td>Cost</td>
<td>Cost</td>
</tr>
</tbody>
</table>
Evidence against eating
Intradialytic hypotension

- During hemodialysis treatment
  - Decrease in systolic blood pressure of 20mm/hg
  - Decrease in mean arterial pressure (MAP) of 10mm/hg + symptoms

- Blood pressure = cardiac output + total peripheral resistance

- Acute changes in BP during dialysis can lead to:
  - suboptimal perfusion to brain and heart and other vascular tissues
  - abdominal discomfort, yawning, nausea, vomiting, muscle cramps, restlessness, dizziness, syncope and anxiety
Hypotension in general population

• Eating in normal subjects cause:
  • 20% decrease in systemic vascular resistance
  • 35% increase in splanchnic blood flow
  • 69% increase in hepatic blood flow

• Health young adults
  • Maintain normal blood pressure
  • Increase bowel blood volume

• Blood pressure is maintained by compensation in cardiac output

• Splanchnic pooling with sequestration of blood is offset by sympathetic muscle activity

Barakat 1993
Postprandial hypotension

- Elderly
  - Lack of sympathetic muscle response
- Autonomic nervous system dysfunction
  - Diabetes, autoimmune disorders, cancer, etc.
- Low intravascular volume due to hemodialysis

Luciano et al 2010
Figure 3. Potential influence of eating during hemodialysis on blood pressure (BP). A decrease in RBV followed by a reduction in total peripheral resistance (TPR) lead to drop in BP. Note the hypothetical scenario of simultaneous caffeine intake, for example, by drinking coffee, on maintaining or even increasing BP. HR, heart rate; RBV, relative blood volume.
# Postprandial hypotension & potential dietary factors

<table>
<thead>
<tr>
<th>Pediatrics HD</th>
<th>Adult HD</th>
<th>General population</th>
</tr>
</thead>
</table>
| • Breakfast & Lunch  
  • Timing of meals during treatment | • Quantity consumed  
  • >200kcal  
  • >200ml  
  • Timing of meal  
  • Warm meals (>50⁰C)  
  • Breakfast & Lunch | • Carbohydrate rich meals |

Non-diet causes of intradialytic hypotension

• Rapid fluid shift
• Excessive dietary sodium & fluid intake
• Removal of fluid too quickly
• Incorrect dry weight
### Reduced dialysis clearance

#### Table 1. Difference in URR and spKt/V values between the hemodialysis sessions with and without food intake (n = 25).

<table>
<thead>
<tr>
<th>Variables</th>
<th>With food intake</th>
<th>Without food intake</th>
<th>t value *</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>URR (^a)</td>
<td>67.8 ± 6.1</td>
<td>72.1 ± 6.0</td>
<td>5.416</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>spKt/V (^b)</td>
<td>1.4 ± 0.2</td>
<td>1.6 ± 0.2</td>
<td>6.538</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* *Paired samples t-test.
\(^a\) URR = Urea reduction ratio (%). \(^b\) spKt/V = single-pool Kt/V.

- Significant reduction in URR and spKt/V
- Patients maintained adequacy levels
Adverse GI symptoms

• Data from a survey of dialysis staff (n=52)

• Multiple studies have demonstrated no adverse GI side effects with intradialytic oral intake (Rhee et al. Weiner et al, Strong et al)

• Adverse GI events not well defined

Kistler et al 2014
Adverse events with IDON in children

• Cross sectional quality improvement study of children on HD
  • Primary outcome: adverse events including hypotension, nausea, cramping
  • Secondary measure: child self-report feeling same, better, or worse
  • Exclusion criteria: unable to complete survey & contraindication to eat by mouth during HD

• Dialysis meals
  • Variety of options including protein bars, pizza, trail mix, sandwich wraps, pies
  • Limited to renal diet restrictions

• Surveys
  • Child pre-dialysis & post-dialysis
  • Dialysis nurse post dialysis

South et al 2018
Adverse events with IDON in children

- 8 patients completed 93 HD sessions
- Median 12.5 surveys per patient
- Nurse reported adverse events
  - 20% reported adverse events
  - 74% of adverse events occurred in 3rd hour of HD
  - Correlation with eating breakfast, eating >1 hour pre-dialysis, and feeling hungry

South et al 2018
Patient survey results

- 52% hungry pre-dialysis
- Majority felt better regardless of experiencing adverse events

South et al 2018
Aspiration risk

Death leads to lawsuit vs SVMC

Posted Thursday, November 17, 2011 9:23 am

KEITH WHITCOMB JR.

Staff Writer

BENNINGTON -- The daughter of a man who died in 2010 after choking on a sandwich while he was receiving dialysis treatment at Southwestern Vermont Medical Center is suing the hospital.
Aspiration risk

• Aspiration risk in those with swallowing dysfunction, neurological disorders, or unsafe to feed self.

• Majority of elderly dysphagia improperly diagnosed and lack timely treatment  
  (Kaspar et al 2012)
Infection risk and food safety

- Self-report from surveys as a concern
- Hygiene practices
- Infection risk
- Especially in units separate from hospital

Kistler et al 2014
Staff burden & clinic culture

• Other barriers reported
  • Enforcing a “no food policy” is challenging for staff
  • Clinic managers more likely to oppose meals vs other dialysis staff
  • Who is responsible for meal prep, delivery, and cleanup
  • Cost concern
  • Phosphorus binder administration

Table 1. Clinician Experiences With Six Commonly Cited Reasons to Restrict Eating During Hemodialysis Treatment

<table>
<thead>
<tr>
<th>Reason</th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postprandial hypotension (n = 53)</td>
<td>18 (34.0)</td>
<td>15 (28.3)</td>
<td>18 (34.0)</td>
<td>2 (3.8)</td>
</tr>
<tr>
<td>Gastrointestinal symptoms (n = 52)</td>
<td>14 (26.9)</td>
<td>23 (44.2)</td>
<td>15 (28.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Reduced treatment efficiency (n = 45)</td>
<td>42 (93.3)</td>
<td>2 (4.4)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Spills or pests (n = 46)</td>
<td>31 (67.4)</td>
<td>7 (15.2)</td>
<td>5 (10.9)</td>
<td>3 (6.5)</td>
</tr>
<tr>
<td>Choking (n = 46)</td>
<td>39 (84.8)</td>
<td>6 (13.0)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Infection control issues (n = 46)</td>
<td>42 (91.3)</td>
<td>2 (4.3)</td>
<td>2 (4.3)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

Kistler et al 2014
Summary evidence against eating

- Studies support concern for postprandial hypotension and reduced dialysis clearance.
- Meal and patient specific factors can impact hypotension.
- Elderly at risk for aspiration and hypotension.
- Adverse events occur in a small percentage of patients. Many report feeling better with dialysis meals.
- Other barriers not well documented in the literature and based primarily on surveys or media reports.
Evidence to support eating
Improved nutrition indicators

- Albumin
- Prealbumin
- Reduced inflammatory markers (TNF-a, IL-6)
- Improvement in lean mass (research based markers)
High protein vs low protein meal

- RCT of 110 HD hypoalbuminemic patients into high protein vs low protein meal
- Primary outcome: increase serum albumin >.02 and maintain serum phosphorus 3.5-5.5mg/dL.
- Duration: 8 weeks meal given in 1st 60 minutes of dialysis

Low protein: 180ml fluid, 27 calories, <1g protein, 21mg calcium, 14mg phosphorus, 167mg sodium, 115mg potassium + usual phosphorus binders

High protein: 120ml fluid, 861 calories, 53gm protein, 309mg calcium, 462mg phosphorus, 676mg sodium, 669mg potassium + Lanthanum carbonate
High protein vs low protein meal

• No adverse events reported for allergic reactions or aspiration.
• Patients with high protein meal reported higher satisfaction with high-protein meals.
• Some reports dislike of cold temperature of meals.
High protein vs low protein meal

HP group had significantly higher iPTH post intervention
LP group had significant increase in iPTH pre and post intervention
Inflammatory markers

• High protein group had no increase in TNF-a, IL-6, or CRP
• Low protein group had significant increase in TNF-a (p<0.001) and IL-6 (p<0.001) when comparing pre vs post study
• 6-month intervention 1 can nepro (237ml, 475kcal, 16.6gm protein) during each HD session
• Loss patients due to refusal to ingest supplement/poor compliance (37%), diet (13%), or left the unit (10%)
• BMI and EDW increased but were not statistically significant

Calgar et al 2002
Protein balance

- Mini meal q 30 min x 3 hours
  - 386 calories
  - 7.7gm protein

- 2 protocols
  - Non-dialysis day fasting vs feeding protocol (n=6)
  - Dialysis meals fasting vs feeding (n=3)

*Significance from 0
+Significance feeding vs fasting
#Significance HD+ vs HD-
Protein balance continued

• Dialysis meals restored whole protein balance and reduced protein breakdown to half what it was when fasting during dialysis
• Protein enriched meal resulted in a 57% increase in plasma essential amino acids and 26% increase in nonessential amino acids
• Meals including protein and calories appear to be effective to prevent dialysis-induced protein losses from amino acid clearance
• < 50% daily value protein may be adequate
IDON vs IDPN

<table>
<thead>
<tr>
<th></th>
<th>Fluids (ml)</th>
<th>Calories</th>
<th>Protein (g)</th>
<th>Lipids (g)</th>
<th>Carbohydrate (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDPN</td>
<td>525ml</td>
<td>1090</td>
<td>59</td>
<td>26</td>
<td>197</td>
</tr>
<tr>
<td>IDON</td>
<td>474ml</td>
<td>1090</td>
<td>57</td>
<td>48</td>
<td>109</td>
</tr>
</tbody>
</table>
### Table 5. Components of whole-body protein metabolism

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-HD</th>
<th>During HD</th>
<th>Post-HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB protein synthesis (mg/kg FFM per min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>3.62 ± 0.7</td>
<td>4.33 ± 0.6</td>
<td>3.99 ± 0.6</td>
</tr>
<tr>
<td>IDPN</td>
<td>3.92 ± 0.5</td>
<td>6.15 ± 0.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.21 ± 0.5</td>
</tr>
<tr>
<td>PO</td>
<td>4.04 ± 0.5</td>
<td>8.41 ± 1.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.24 ± 0.6&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>WB proteolysis (mg/kg FFM per min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>3.59 ± 0.3</td>
<td>4.08 ± 0.2</td>
<td>4.07 ± 0.5</td>
</tr>
<tr>
<td>IDPN</td>
<td>3.62 ± 0.3</td>
<td>1.72 ± 0.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.99 ± 0.8</td>
</tr>
<tr>
<td>PO</td>
<td>3.79 ± 0.4</td>
<td>2.71 ± 1.2</td>
<td>7.05 ± 0.7</td>
</tr>
<tr>
<td>Net WB protein balance (mg/kg FFM per min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>0.04 ± 0.5</td>
<td>0.25 ± 0.5</td>
<td>0.08 ± 0.5</td>
</tr>
<tr>
<td>IDPN</td>
<td>0.30 ± 0.3</td>
<td>4.43 ± 0.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.22 ± 0.4</td>
</tr>
<tr>
<td>PO</td>
<td>0.25 ± 0.4</td>
<td>5.71 ± 1.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>−0.81 ± 0.8&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Data are means ± SEM. FFM, fat-free mass; WB, whole-body.

<sup>b</sup><i>p < 0.05 versus control.</i>

<sup>c</sup><i>p < 0.05 versus IDPN.</i>
IDON vs IDPN

Kistler et al 2018
IDON vs IDPN

- IDPN and IDON can promote protein anabolism during HD treatment
- IDON continues to promote protein anabolism after the HD treatment
Oral supplementation & exercise

- Increase in weight and muscle strength observed for entire cohort over time.
- Authors noted participants were younger than majority of elderly dialysis patients and have less muscle mass loss.

Dong 2011
Patient satisfaction and adherence

- Prospective open study 85 adults
- Consume 1 can Nepro (240ml, 475 kcal, 16.6g protein) immediately before or after each HD session
- Administered Kidney Disease Quality of Life-Short Form Version 1.3
- Group receiving nutrition supplement were able to maintain their score for physical domain where control group declined (p = 0.1).

Scott et al 2009
Reduced mortality

• 2 large retrospective matched-cohort studies of US adult dialysis centers using food or oral supplement
• 9-35% relative risk reduction in all-cause mortality
• 9-34% greater survival in those treated with supplements when compared to matched controls
• Supplements had greatest effect on mortality in those with lowest baseline albumin level (<3.2mg/dL)

Reduced mortality

- 30ml prostat (100kcal, 15gm protein) 3x weekly during dialysis
- 14-35% relative reduction in mortality associated with supplement use
- No indication of harm

Weiner et al 2014
Improved adherence

- No studies
- Article referencing possible benefits
  - In center meals could be better nutrition quality than meals prepared or purchased elsewhere
  - Improved adherence to phosphorus binders, fluid and salt restrictions
  - Provide opportunity for increased diet education

Kalantar-Zadeh et al 2012
Intradialytic meals on supplement and intralipid use

- 12 pediatric hemodialysis patients allowed to order meals and eat on dialysis
- Intradialytic meals can maintain serum albumin & nPCR while reducing reliance on other forms of nutritional support

<table>
<thead>
<tr>
<th></th>
<th>Before intradialytic meals</th>
<th>13 months of meals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>3.11 ± 0.39 g/dL</td>
<td>3.46 ± 0.4 g/dL</td>
</tr>
<tr>
<td>nPCR</td>
<td>1.05 ± 0.21</td>
<td>1.0 ± 0.07</td>
</tr>
<tr>
<td>Enteral supplements usage</td>
<td>86%</td>
<td>50%</td>
</tr>
<tr>
<td>Intralipids</td>
<td>57%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Wong et al 2016
Summary of evidence in favor

• IDON can improve serum albumin and reduce mortality risk in adults
• IDON promotes positive whole-body protein synthesis during and after an HD treatment
• May have positive impact on inflammatory markers
• IDON usage may reduce usage of alternative intradialytic nutrition options
• Improved adherence to diet with dialysis is possible, but not supported with literature
Cost of intradialytic nutrition
## Cost comparison

<table>
<thead>
<tr>
<th></th>
<th>Enteral Supplement</th>
<th>Meal</th>
<th>IDIL</th>
<th>IDPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Delivery</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Administration</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cleanup</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Additional labs</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Labor</td>
<td>Foodservice Tech, Dietitian</td>
<td>Foodservice Tech, Dietitian</td>
<td>Pharmacy Dietitian, Nursing MD/APRN</td>
<td>Pharmacy Dietitian, Nursing MD/APRN</td>
</tr>
<tr>
<td>Energy/protein</td>
<td>$$-$$$</td>
<td>$$-$$$</td>
<td>$$$</td>
<td>$$$$</td>
</tr>
<tr>
<td>Overall cost</td>
<td>$$-$$$</td>
<td>$$-$$$</td>
<td>$$$</td>
<td>$$$$</td>
</tr>
</tbody>
</table>
## Cost considerations

### All patients or select patient populations at higher risk
- Malnourished
- PEW
- Food insecure

### Risks to feed
- Medical complications
- Lawsuits

### Risks not to feed
- Malnutrition
- PEW
- Increased medical costs with poor nutritional status

### Alternative treatments costs
- Medications such as appetite stimulants, antidepressants, anti-inflammatory meds
- Vitamins/mineral supplements
To eat or not eat during hemodialysis?

**Pros:**
- Meals during dialysis can be provided safely with appropriate patient selection and monitoring.
- Meal costs do not exceed costs of other nutrition intervention treatments and sometimes may be less.
- Intradialytic meals can help maintain or improve nutritional status in patients with markers of inadequate nutrition intake.
- Intradialytic meals have many potential positive benefits to patient health.
- Pediatric patient’s report feeling better with dialysis meals.

**Cons:**
- Intradialytic hypotension and reduced dialysis clearance can occur with meals during dialysis.
- Meal and patient specific factors can impact hypotension including age, medical status.
- Adverse events occur in a small percentage of patients.
- Majority of literature in adults, pediatric studies lacking.
Worldwide practices
Survey of dialysis units at ISRNM

- Survey of 73 respondents
- 6 continents
- Zero North American clinics allowed eating
- Reasons to allow eating
  - Increased energy provision
  - Teaching opportunities
  - Improved glucose control
  - Difficulty enforcing a no eating policy

Figure 1. International practices for patient eating patterns during hemodialysis treatment.

Kistler et al. 2014
United States Practices
Survey of large US dialysis company

• 2011 surveyed for opinions and practices related to in-center food consumption within a large US dialysis organization 2011

• Found a need for education
  • Safety practices
  • Type & quantity of foods
  • Timing of food consumption
  • Practical instructions
  • Food safety tips
  • Kidney friendly foods
  • Quality protein sources & amounts.

• Sent resources to address education needs
• Resurveyed in 2014
• Increased acceptance of meals on dialysis

Figure 1. | Comparison of clinic practices for eating during hemodialysis treatment in 2011 and 2014.

Benner et al 2016
What is your facility’s practice?

- Can patients consume food during dialysis?
- Are meals provided during treatment? Before? After?
- What rules & regulations are in place for meals?
- Are binders provided or brought from home?
- How many have patients experience adverse events?
Children's Mercy Dialysis Meals

- Patient must be able to consume foods safely
- No outside food or drinks
- Ordered from room service used by inpatients
  - May order as desired
  - Set standard meal delivery days & times
  - Delivered by foodservice staff
- Limit 0-3 meals per treatment
  - Each meal = 1/3 daily limit for sodium, potassium, phosphorus
  - Protein goals individualized as needed
- Oral supplements also available and provided as needed
- All staff participate in tray disposal
- Adjustment of dialysis fluid removal based on fluid quantity consumed
- Intradialytic hypotension is monitored by techs & RNs, meals may be discontinued or held for treatment based on blood pressure.
Considerations for intradialytic oral nutrition

- Assess clinic culture and acceptance
- Provide education
- Evaluate resources available and types of meals to provide
- Develop a protocol
- Evaluate patient safety to consume meals
- Individualize patient care needs and adjust as needed
References

- Franch 2016 Peanuts or pretzels changing attitudes about eating on dialysis clin j am soc nephrol 11: 747-749 2016