ASN DIALYSIS ADVISORY GROUP

ASN DIALYSIS CURRICULUM
Home/ Intensive Hemodialysis

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Affiliations and Disclosures

• Dr. Chan has consulted with Baxter Global Inc and NxStage Inc
Objective

To discuss and review the emerging body of literature regarding the benefits and risks of home frequent/ intensive hemodialysis
Better Clinical Outcomes?

A. Survival
B. CVS outcomes
C. Solute(s) Removal
D. QOL
E. Pregnancy
F. Vascular Access and Safety
## Selected Survival Studies
(Frequent Hemodialysis Vs. Conventional Hemodialysis)

<table>
<thead>
<tr>
<th>Study</th>
<th>Countries, Follow-up duration</th>
<th>Intensive HD</th>
<th>In-Center HD</th>
<th>Relative mortality in HHD population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Johansen (2009)</td>
<td>USA, 3 years</td>
<td>94, nocturnal HD (5.7 days per week)</td>
<td>940 matched from USRDS</td>
<td>HR = 0.36</td>
</tr>
<tr>
<td>Johansen (2009)</td>
<td>USA, 3 years</td>
<td>43, daily hemodialysis (5.4 days per week)</td>
<td>430 matched patients from USRDS</td>
<td>HR = 0.64</td>
</tr>
<tr>
<td>Lockridge (2011)</td>
<td>USA, 287 patient years</td>
<td>87, nocturnal HD (40 hours per week)</td>
<td>87121 incident patients from USRDS</td>
<td>SMR = 0.53</td>
</tr>
<tr>
<td>Marshall (2011)</td>
<td>Australia, New Zealand, 72052 patient years</td>
<td>865, extended home HD</td>
<td>21184 from ANZDATA</td>
<td>HR = 0.53</td>
</tr>
<tr>
<td>Weinhandl (2012)</td>
<td>USA, 1.8 years</td>
<td>1873, daily NxStage HD</td>
<td>9365 from USRDS</td>
<td>HR = 0.87</td>
</tr>
</tbody>
</table>

The morbidity and mortality of intermittent hemodialysis

Multiple reports have documented the association between long interdialytic interval and morbidity / mortality of conventional HD patients.

Foley et al – NEJM 2011
Survival: Intensive Hemodialysis Versus Kidney Transplant

Tennankore et al JASN 2014

Survival data suggest:

Frequent HD is better than in-center HD

BUT:
• Not all frequent HD is equal
• Intermittency of HD OR Frequency of HD?
• Duration of HD is important
## Cardiovascular Outcomes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of Studies</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Ventricular Mass Index (g/m2)</td>
<td>23 studies, 524 patients</td>
<td>-31.2 (-39.8 to -22.5)</td>
</tr>
<tr>
<td>Left Ventricular Mass (g)</td>
<td>13 studies, 335 patients</td>
<td>-60.5 (-90.8 to -30.2)</td>
</tr>
<tr>
<td>Left Ventricular Mass (g) [in RCTs only]</td>
<td>3 studies</td>
<td>-13.4 (-19.5 to -7.4)</td>
</tr>
<tr>
<td>Left Ventricular Ejection Fraction (%)</td>
<td>4 studies, 137 patients</td>
<td>6.7 (1.6 to 11.9)</td>
</tr>
</tbody>
</table>

Susantitaphong et al AJ KD 2012
## Blood Pressure Outcomes

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Studies</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic BP (mmHg)</td>
<td>35 studies, (928 patients)</td>
<td>-14.1 (-17.2 to -11.0)</td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>35 studies, (928 patients)</td>
<td>-7.1 (-9.2 to -4.9)</td>
</tr>
<tr>
<td>Antihypertensive Medications</td>
<td>35 studies, (928 patients)</td>
<td>-0.8 (-1.2 to -0.5) number of medications</td>
</tr>
</tbody>
</table>

Susantitaphong et al AJ KD 2012
Cardiovascular data summary

Frequent HD
• BP control
• LV mass decreases

Remaining Questions:
• Does LVM change leads to improvement in survival?
• Implications for mechanistic pathways?
Weekly stdKt/V for different eKt/V and dialysis frequency / modality

Gotch FA 1998 (modified)
Effects of Frequent Hemodialysis on Measures of CKD Mineral and Bone Disorder

John T. Daugirdas,* Glenn M. Chertow,† Brett Larive, Andreas Pierratos,§ Tom Greene,‖
Juan Carlos Ayus,¶ Cynthia A. Kendrick,‡ Sam H. James,∗∗ Brent W. Miller,∗∗∗
Gerald Schulman,∗∗∗∗ Isidro B. Salusky,§§ Alan S. Kliger,‖‖ and the Frequent Hemodialysis
Network (FHN) Trial Group‖‖‖

![Graph showing the effects of frequent hemodialysis on phosphate binder classes](image)
Solute Removal and Outcomes...

Frequent HD will enhance remove of uremic toxins
• Extent by which this may be accomplished depends on the molecule
• Frequency and duration are important
• Surrogate marker versus Outcomes?
## Quality of Life

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<tr>
<th>Parameter</th>
<th>Studies</th>
<th>Effect Size (CI)</th>
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<tr>
<td>Physical Component Score – RAND 36</td>
<td>FHN – Daily Trial (n = 245)</td>
<td>2.9 (0.8, 5.1)</td>
</tr>
<tr>
<td>Physical Component Score – RAND 36</td>
<td>FHN – Nocturnal Trial (n = 87)</td>
<td>0.6 (-3.4, 4.7)</td>
</tr>
<tr>
<td>EuroQol 5-D index</td>
<td>Culleton et al (n = 52)</td>
<td>0.05 (-0.07, 0.17)</td>
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</table>

Quality of Life Summary

Heterogeneous results from observational and RCTs

Overall, there seems to be an improvement of perceived physical health but not necessarily overall quality of life

Other studies have indicated an improvement in Kidney-Disease related quality of life

• E.g. Recovery time from dialysis
Pregnancy Outcomes

22 pregnancies in the Toronto Pregnancy and Kidney Disease Clinic Registry (2000 to 2013)
Compared with 70 pregnancies from the American Registry for Pregnancy in Dialysis Patients (1990 - 2011)

Primary Outcome = Live Birth Rate
• Intensive HD = 86.4%
• Comparator = 61.4%

\[ P = 0.03 \]
Pregnancy Outcomes

Secondary Outcomes

• Duration of Pregnancy
  • 36 weeks – Intensive HD
  • 27 weeks – Comparator

\[ P = 0.002 \]

Pregnancy complications were few and manageable

Pregnancy may be safe and feasible in women with ESRD receiving intensive HD
# Adverse Events

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<tr>
<th>Studies</th>
<th>Population</th>
<th>Variables</th>
<th>Risk</th>
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<tr>
<td>FHN trial group (2010, 2013)</td>
<td>RCT, 245 patients</td>
<td>First vascular event (repair, loss or access-related hospitalization)</td>
<td>HR 1.90 (1.11–3.25), P = 0.017</td>
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<td>FHN trial group (2011, 2013)</td>
<td>RCT, 87 patients</td>
<td>First vascular event (repair, loss or access-related hospitalization)</td>
<td>HR 1.81 (0.94–3.48), P = 0.076</td>
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<tr>
<td>Jun et al. (2013)</td>
<td>Retrospective observational study, 286 patients</td>
<td>Survival free of vascular access-related events (infections and interventions) Vascular access-related events</td>
<td>Unadjusted KM curve: shorter survival for intensive group, P &lt; 0.001 HR 2.85 per dialysis session (1.14–7.15), P = 0.04</td>
</tr>
</tbody>
</table>

Modified from Tennankore et al NDT 29: 1342 – 1349, 2014
# Buttonhole Infection

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<th>Variables</th>
<th>Risk</th>
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</thead>
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<tr>
<td>Van Eps et al. (2010)</td>
<td>Retrospective observational study, 235 patients</td>
<td>Septic dialysis-related events: BH in NHD compared with CHD</td>
<td>IRR 3.0 (1.04–8.66), P = 0.04</td>
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<tr>
<td>Nesrallah et al. (2010)</td>
<td>Retrospective observational pre–post study</td>
<td>Rates of S. aureus bacteremia: Pre/post topical mupirocin</td>
<td>OR 6.4 (1.3–32.3) P = 0.02</td>
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<td></td>
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<td>Post-mupirocin compared with CHD patients</td>
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<td></td>
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<td></td>
<td>2–0.03/1000 AVF-days versus 0.005/1000 AVF-days</td>
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Modified from Tennankore et al NDT 29: 1342 - 1349, 2014
Other Considerations

1. FHN nocturnal trial suggests that residual kidney function (urine output) may be impacted by frequent hemodialysis.

2. Additional RCT data will also be available in this area (e.g. ACTIVE)
Summary

Data suggest that augmented hemodialysis modifies:

• Survival
• CVS endpoints
• Solutes removal
• Pregnancy outcomes

Adverse signals:

• Dialysis access
  • Vascular Access Infections
• Perception of burden