‘New’ Technologies in Peritoneal Dialysis

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Progress in PD Technology
What lies ahead for PD?

- Low Sodium PD Solution
  - Phase III clinical trial

- Adapted APD
  - Recent introduction to market
LOW SODIUM PD SOLUTION
Volume Homeostasis is an IMPORTANT Predictor of Outcome

- Dietary Salt Intake
- Urinary Salt Excretion
- Peritoneal Salt Removal
- Salt Balance
Purpose of Low Sodium PD Solution

- To increase absolute sodium removal for a given glucose load

- To reduce the ‘gap’ between sodium and water removal – a consequence of sodium sieving via the aquaporin pathway
Increase in Peritoneal Na Removal – Single Exchange Kinetic Study

**Fig. 1.** Net fluid removed, calculated as drained volume minus instilled volume for a commercial dialysate with the same osmolality (CD1.5) and a commercial dialysate with the same glucose concentration (CD2.5) as a low sodium dialysate (LNaD). Net ultrafiltration volume was higher using CD2.5 (*P < 0.05) and LNaD (**) than using CD1.5.

**Fig. 4.** Sodium loss, calculated as total mass of sodium instilled minus that drained, for a commercial dialysate with the same osmolality (CD1.5) and a commercial dialysate with the same glucose concentration (CD2.5) as a low sodium dialysate (LNaD). Sodium loss was higher using CD2.5 (*P < 0.05) and LNaD (**) than using CD1.5.

CD1.5 – 1.5% glucose (Na 132; Osmol 348mOsm/L)
CD2.5 – 2.5% glucose (Na 132; Osmol 403mOsm/L)
LNaD – 2.5% glucose (Na 105; Osmol 348mOsm/L)
The effects of low-sodium peritoneal dialysis fluids on blood pressure, thirst and volume status

Simon Davies¹, Ola Carlsson², Ole Simonsen³, Ann-Cathrine Johansson⁴, Daniele Venturoli³, Ingrid Ledebo², Anders Wieslander², Cian Chan¹ and Bengt Rippe³

- Open-label, prospective interventional study (n=25)
- Study duration: 2 months
- Prevalent – median time on PD 28.5 months
- APD/CAPD 6/19
- Avg no. of 2.5% glucose exchanges per day: 1.3 vs. 2.21
- Replaced 1 exchange/day with Low-sodium solution

<table>
<thead>
<tr>
<th>Table 1. The composition with respect to Na and glucose concentrations, respectively, for Deltasol and Gambrosol³ trio</th>
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<tbody>
<tr>
<td><strong>Solution</strong></td>
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<tr>
<td>----------------</td>
</tr>
<tr>
<td>Sodium (mmol/l)</td>
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<tr>
<td>Gambrosol³ trio</td>
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<tr>
<td>Deltasol</td>
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<tr>
<td>Glucose (%)</td>
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- **Compensated Group (A):**
  - Maintain UF
  - Drop in nocturnal BP
  - More marked decrease in thirst
  - Improvement in fluid status
Current Status – Phase III Trial in Progress

• PI – Simon Davies

• Single-blind, parallel design RCT comparing low Na PDS vs. standard PDS (single-exchange; n=140)

• **Follow-up:** 8 months (6 months intervention/control; 2 months post-study observation)

• **Primary outcome measure:**
  • 24-hr mean SBP

• **Secondary outcome measures:**
  • RRF
  • Frequency of hyponatraemia
  • Assessment of changes in sodium removal
  • Assessment of decrease in total body water
  • Measurement of 24 hours peritoneal clearance
  • Office BP readings
ADAPTED APD
Optimize UF & Clearance

**UF**
- **Short Dwell** (maintain osmotic pressure gradient)
- **Low Volume** (Reduce IPP)

**Solute Clearance**
- **Long Dwell Time** (creatinine, phosphate, middle molecules)
- **Increased filling volume** (enhanced surface area)
Adapted APD Concept

Conventional APD night-time

Same total volume
Same treatment time
Same glucose concentration

Adapted APD night-time

Higher volumes
Longer dwell time

Individualised modeling of single cycles
THE BENEFICIAL INFLUENCE ON THE EFFECTIVENESS OF AUTOMATED PERITONEAL DIALYSIS OF VARYING THE DWELL TIME (SHORT/LONG) AND FILL VOLUME (SMALL/LARGE): A RANDOMIZED CONTROLLED TRIAL

Michel Fischbach,¹ Belkacem Issad,² Vincent Dubois,³ and Redouane Taamma³

**Group A**

12 L = 6 x 2 L
9 h = 540 min = 6 x 90 min

1.5% glucose concentration (balance)

\[ \text{C-APD} \]

45 days

**Group B**

12 L = (2 x 1.5 L) + (3 x 3 L)
9 h = 540 min = (2 x 45 min) + (3 x 150 min)

1.5% glucose concentration (balance)

\[ \text{aAPD named APD-A} \]

45 days
Statistically (but clinically) significant higher clearance of solutes with A-APD

- Urea: *p < 0.01*
- Creatinine: *p < 0.05*
- Phosphate: *p < 0.05*

Higher ultrafiltration and higher sodium removal with adapted APD

**Ultrafiltration**

- APD-C: 656 ± 275 mL/session
- APD-A: 743 ± 358 mL/session

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**Sodium removal**

- APD-C: 18 ± 49 mmol
- APD-A: 32 ± 52 mmol

* Significant p < 0.05

**p < 0.05**

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* Significant p < 0.01

**p < 0.01**

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Lower Blood Pressure with adapted APD

Systolic BP

Diastolic BP

Mean BP

MAP = PAd + PP/3

* Significant p<0.05

* significant p<0.05

* Significant p<0.01

Role of Adapted APD

• Alternative way of delivering APD

• Statistically significant but clinically ?significant benefit
  • Risk of carry-over effect

• No obvious ‘harm’
  • Cost of ‘machine’

• Also, be mindful of the studied population in the trial:
  • Relatively ‘new’ PD patients (<12 months)
  • Good RRF (mean GFR ~6, 24-hr UV 1.5L/day).

• Would be useful to know whether the response to therapy differed based on peritoneal membrane transporter status.
Summary

• Low Na PDS
  • Biologically plausible and may help to improve BP control in PD patients.
  • But, need to consider implication on:
    • Overall exposure to glucose (from correcting the osmolarity reduction)

• Adapted APD
  • Unlikely to revolutionize care of PD patients.
  • More data on outcome in patients in whom clearance/UF is suboptimal would be useful.
The END