The Initial PD Prescription

Is 4 bags is the Way to Go?

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MALAYSIA
Outline

• How to plan initial CAPD prescription?

• Incremental vs full dose PD
  o Effect on residual renal function

• Prescribing incremental dialysis
  o Who is a candidate for incremental dialysis
  o How to prescribe incremental dialysis
  o Drawbacks
Initial CAPD prescription
Dialysis adequacy

- Anemia management
- BP control
- Fluid and electrolytes hemostasis
- BMD management
- Good nutrition
- Adequate solute removal
## Current Patient Report

<table>
<thead>
<tr>
<th>Patient Name:</th>
<th>N</th>
<th>Collection Date:</th>
<th>11/02/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID Number:</td>
<td></td>
<td>Gender:</td>
<td>F</td>
</tr>
<tr>
<td>Birth Date:</td>
<td></td>
<td>Age:</td>
<td>20</td>
</tr>
<tr>
<td>Height (cm):</td>
<td>185.00</td>
<td>Weight (kg):</td>
<td>37.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Estimated GFR (mL/min):</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Protein Catabolic Rate (pCGR) (g/kg/day):</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td>Serum Concentrations:</td>
<td></td>
<td>Glucose (mmol/Liter):</td>
<td>5.40</td>
</tr>
<tr>
<td>Urea (mmol/Liter):</td>
<td>15.40</td>
<td>Albumin (g/L):</td>
<td>29.00</td>
</tr>
<tr>
<td>Creatinine (mmol/Liter):</td>
<td>1219.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 24 hour Dialysate and Urine Collection:

<table>
<thead>
<tr>
<th></th>
<th>Urea (mmol/Liter)</th>
<th>Creatinine (mmol/Liter)</th>
<th>Volume in (mL)</th>
<th>Volume Out (mL)</th>
<th>Net Volume (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialysate</td>
<td>15.40</td>
<td>941.40</td>
<td>7200</td>
<td>8406</td>
<td>1200</td>
</tr>
<tr>
<td>Urine</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Calculated Values:

- Estimated GFR (mL/min): 6.00
- Protein Catabolic Rate (pCGR) (g/kg/day): 1.23
- 1.20

### Weekly Clearances:

<table>
<thead>
<tr>
<th></th>
<th>Urea Clearance (L/week):</th>
<th>Weekly Kt/V</th>
<th>Creatinine Clearance (L/week):</th>
<th>Creatinine Clearance (L/week/1.73m²):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.43</td>
<td>2.43</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### PET Results:

#### Overweight Exchange:

<table>
<thead>
<tr>
<th>% Decrease</th>
<th>Volume Infused (mL):</th>
<th>Volume Drained (mL):</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>1800</td>
<td>2200</td>
</tr>
</tbody>
</table>

#### Four Hour Equilibration Test:

<table>
<thead>
<tr>
<th>% Decrease</th>
<th>Volume Infused (mL):</th>
<th>Volume Drained (mL):</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50</td>
<td>1800</td>
<td>2200</td>
</tr>
</tbody>
</table>

### Other Parameters:

- Membrane Transport Type: L
- Fluid Absorption (mL/min): 2.50
- Residual Dialysate Volume (mL): 295.08
- Creatinine Correction Factor: 0.846055000

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**RRF**

**Kt/V**

**Ultrafiltration**

**Membrane transport**
Optimizing peritoneal dialysis dose

Target urea clearance = \( \text{drain volume} \times D \times 7 \) 

\( \frac{\text{disbhn volume}}{P} \)

1. Volumes
2. Body weight
3. Schedule

Increase dialysis dose by increasing drain volumes

Number of exchange frequency

Schedule dwell times to maximise clearance

Problems arise for large body weights
Points to consider in planning CAPD prescription

- Amount of dialysis dose
- Volume of fluid instillation
- How many PD exchanges
- Dwell time
Dialysis dose...the more the better?

• More frequent PD or HD did not improve clinical outcomes

• More frequent and lengthy dialysis may even accelerate RRF decline

_Daurgidas et al, Kidney Int 2013;83:949-958_
Initial CAPD prescription

X bags exchanges is the Way to Go

..... incremental PD should be considered as initial PD prescription
Concept of Incremental Dialysis

FIGURE 1 The peritoneal dialysis dose is increased progressively as the residual kidney function decreases with time

Auguste et al, Seminars in Dialysis 2018;1-4
Incremental PD

Practice of starting PD at a lower dose that is typically prescribed for someone with residual renal function

Total solute clearance = Peritoneal/Dialysis clearance + Residual Renal Clearance
Benefits of Incremental PD

• Less onerous with less frequent exchanges

• Result of greater simplicity and less workload for the patient and caregiver

• Excellent opportunity to provide patients with an initial small dose of dialysis while continually addressing patient fears and misconceptions
Benefits of Incremental PD (2)

• Less costly than standard 4 PD exchanges

• CAPD with 3 dwells *cost 25% less* than 4 PD exchanges
Benefits of Incremental PD (3)

Less exposure of peritoneal membrane to glucose, GDPS and systemic glucose absorption
Incremental peritoneal dialysis: Effects on the choice of dialysis modality, residual renal function and adequacy

G Viglino¹, L Neri¹ and S Barbieri¹

¹Renal and Dialysis Unit, San Lazzaro Hospital Alba (CN), Italy

- The effects of Incremental Dialysis (Incr_Dial) on RRF and dialytic adequacy were assessed in 11 patients treated with 2 CAPD exchanges per day for a total of 106 months (mean±sd 9.7±6.5), and then treated with three CAPD exchanges per day for an additional 105 months (9.4±8.3). Median actuarial survival on CAPD-2 before requiring additional dose of dialysis was 8.1 months.

- All patients used 25mmol/l bicarbonate/15mmol/l lactate-buffered, glucose-based dialysis solutions (Physioneal; Baxter Healthcare, Rome, Italy, SpA).

- 11 patients (males 7; mean age 66.1 ± 10.3 years; BMI in males: 30.1 ± 3.7; BMI in females:27.4 ± 2.7) had the following etiologies of ESRD:
  - 7 with diabetes, 2 with nephroangiosclerosis, 1 with glomerulonephritis, and 1 with adult polycystic kidney disease (APKD).
Incr-PD showed a slowing in the loss of GFR compared to pre-dialysis period.
Figure 4 | Trends in $Kt/V$ and PNA during incremental dialysis (11 pts treated with two and three exchange CAPD).

Viglino et al, Kidney Int 2008;73:,S52-55
Incremental peritoneal dialysis: a 10 year single-centre experience

Massimo Sandrini1  •  Valerio Vizzardi1  •  Francesca Valerio1  •  Sara Ravera2  •  Luigi Manili1  •  Roberto Zubani1,2  •  Bernardo J. A. Lucca2  •  Giovanni Cancarini1,2

- Incremental dialysis dose (incrPD) was defined as one or two dwell times per day on CAPD.
- Standard dialysis dose (stPD) was defined as 3–5 dwell times per day, 7 days a week, for CAPD and seven nights a week for APD.
- 29 (28 %) were in the incrPD group and 76 (72 %) in the stPD group (total 105 patients)
The results of this study suggest a protective role of incrPD on RRF which was stable in incrPD in the first 6 months whereas it significantly decreased in stPD. 

This stability could be the reason for a median duration of incrPD of 17 months, which can positively affect the patients’ quality of life on PD due to a lesser burden of dialysis procedures.

Patients on incrPD need a closer clinical follow-up to reduce the risk of under-dialysis.
**Fig. 1** Cumulative probability to be hospitalization-free in incrPD and stPD

**Fig. 2** Cumulative probability to survive in incrPD and stPD

Log-rank test: $p = 0.021$

Log-rank test: $p = 0.057$
Incremental Peritoneal Dialysis May be Beneficial for Preserving Residual Renal Function Compared to Full-dose Peritoneal Dialysis

Yeonhee Lee, Sung Won Chung, Seokwoo Park, Hyunjin Ryu, Hajeong Lee, Dong Ki Kim, Kwon Wook Joo, Curie Ahn, Joongyub Lee & Kook-Hwan Oh

Scientific Reports 9, Article number: 10105 (2019) | Download Citation

- Single centre, 2007-2015, follow up -6 years
- Retrospective, N=347 patients
- Excluded if urine <200mls/day at time initiate PD or previous HD
- Incr-PD (n=176): 1-2 PD bag exchange
- Full-PD (n=171): 3 or more PD bag exchange

Incr-PD associated with significantly lower risk of anuria

Similar peritonitis, technique survival, & mortality rates
<table>
<thead>
<tr>
<th>Author, year</th>
<th>Period of time</th>
<th>Study design</th>
<th>No. pts on incrPD</th>
<th>incrPD schedule</th>
<th>Initial GFR (ml/min)</th>
<th>Time on incrPD (patient-months)</th>
<th>Peritonitis rate (episode/patient-months)</th>
<th>Results/outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williams, 1999 [14]</td>
<td>NA</td>
<td>Pilot study</td>
<td>15</td>
<td>CAPD 1 dwell/day</td>
<td>9.8 ± 1.9</td>
<td>90</td>
<td>1/30</td>
<td>Adequacy (good)</td>
</tr>
<tr>
<td>Foggensteiner et al., 2002 [8]</td>
<td>1997-2000</td>
<td>Pilot, not randomized, prospective</td>
<td>39</td>
<td>CAPD 1 dwell/day</td>
<td>10</td>
<td>422</td>
<td>1/30</td>
<td>Adequacy (good)</td>
</tr>
</tbody>
</table>

Better quality of life with incrPD

Adequacy (good)
Exit-site infections (8 episodes)
Complications
Hospitalization (3 days/year)
Survival (patients and technique)
Adapted from: [10]
<table>
<thead>
<tr>
<th>Author, year</th>
<th>Period of time</th>
<th>Study design</th>
<th>No. pts on incrPD</th>
<th>incrPD schedule</th>
<th>Initial GFR (ml/min)</th>
<th>Time on incrPD (patient-months)</th>
<th>Peritonitis rate (episode/patient-months)</th>
<th>Results/outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neri et al., 2003</td>
<td>2000–2001</td>
<td>Preliminary experience</td>
<td>5</td>
<td>APD 3–4 sessions/week</td>
<td>7–9</td>
<td>84</td>
<td>none</td>
<td>Adequacy Peritonitis</td>
</tr>
<tr>
<td>Viglino et al., 2008</td>
<td>2004–2007</td>
<td>Retrospective</td>
<td>11</td>
<td>CAPD 2 dwells/day</td>
<td>7.3 ± 2.7</td>
<td>106</td>
<td>NA</td>
<td>RRF and adequacy (good)</td>
</tr>
<tr>
<td>Domenici et al., 2011</td>
<td>2000–2008</td>
<td>Retrospective</td>
<td>17</td>
<td>?</td>
<td>6.9 ± 1.1</td>
<td>480</td>
<td>1/48</td>
<td>Technique survival</td>
</tr>
<tr>
<td>Jeloka et al., 2013</td>
<td>2006–2011</td>
<td>Retrospective</td>
<td>13</td>
<td>CAPD 1 dwell/day</td>
<td>7.8 ± 2.6</td>
<td>244</td>
<td>1/56</td>
<td>Reduced rate of loss of RRF</td>
</tr>
<tr>
<td>Barràs Sans et al., 2016</td>
<td>2003–2012</td>
<td>Retrospective</td>
<td>46</td>
<td>CAPD 3 dwells/day</td>
<td>8.0 ± 3.2</td>
<td>1035</td>
<td>1/99</td>
<td>Adequacy (good)</td>
</tr>
</tbody>
</table>

Reduced rate of loss of RRF
Reduced dose of erythropoietin
A large database report on PD patients across all membrane transport were used, and urea kinetic modelling determination of possible incremental regimens performed for an individual membrane type

Results:

Patient with significant RRF at the start of dialysis may not need the full dose dialysis regimen compared to long term dialysis patient who may be anuric

However, therapy need to also focus on ultrafiltration as UF maybe not be adequate despite fullfil the creatinine clearance target
Drawback of Incremental Dialysis

• It *requires regular monitoring of residual renal function* as its rate of loss is unpredictable

• Patient who starts incremental prescription may find it *challenging to transition* to a more intensive prescription
How to Prescribe Incremental CAPD

Factors to Consider

• Patients lifestyle
• Patient body size
• Patient’s RRF
• Peritoneal membrane Type
• Volume/Ultrafiltration Requirements
• Solute clearance Requirements
Who is A Candidate for Incremental PD

• By definition *requires significant residual renal function* (GFR > 5 mls/min)
  o Not appropriate for patients with no residual renal function

• Requires clinical judgement:
  o Patient body size and dialysis requirements
  o Other metabolic control: bicarbonate level, potassium, phosphate level
  o Ability to achieve adequate volume control

• Patients who adherent to treatment and willing to convert to FULL dose PD/intensification of treatment when RRF falls

*Bargman et al, Blood Purif 2018; 45;218-223*
Incremental dialysis in special population

**Heart Failure**

In patient with cardiorenal syndrome, left EF improved significantly and 90% reduction in hospitalisation after PD initiation

Caurivaud el at, Perit Dial Int 2017
Incremental dialysis in special population

*Chronic Liver Disease*

- Require only 1-2 PD exchanges with good amount of ultrafiltration
- Difficult to control UF → May decompensate haemodynamic status
Incremental Dialysis Prescription

• The dose of PD prescription can be individualized

• Some patient can start 1 CAPD exchange per night

• If patient prefers dry abdomen at night, 2 daytime exchange may be performed

• 4 hours exchanges is recommended as opposed to 12 hours due to fluid absorption over long dwells
### Impact of larger CAPD volumes vs 4th exchange on Kt/V

<table>
<thead>
<tr>
<th>No. of exchanges</th>
<th>3</th>
<th>4</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kt/V</td>
<td>1.56</td>
<td>1.78</td>
<td>1.9</td>
</tr>
<tr>
<td>Dwell volume</td>
<td>2000</td>
<td>2000</td>
<td>2500</td>
</tr>
</tbody>
</table>
Incremental CAPD

Single overnight exchange: Glucose or icodextrin

Dry Night

Partially Dry Day

Utilised a 3-pore kinetic model to predict fluid and solute removal for different transport type

Single daily icodextrin exchanges over 8-16 hours with 2-2.5L bag

A single daily icodextrin tailored to augment urea, UF & Na removal.

Maybe reasonable initial therapy for some incident ESRD
Summary

• No strict and fast rule on standard 4 bags PD exchanges....*incremental dialysis is another approach*

• Transition of a patient from CKD to dialysis in a timely manner is an art
  - Preservation of residual renal function
  - Allow initial PD initial incremental PD exchange
  - Change PD prescription in a stepwise manner

• Incremental PD exchange:
  - Reduce treatment burden, reduce cost, reduce glucose exposure and preserve residual renal function
THANK YOU FOR YOUR ATTENTION