

# A MODEL TO ESTIMATE GLUCOSE ABSORPTION IN PERITONEAL DIALYSIS: A PILOT STUDY

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## BACKGROUND:

- Peritoneal dialysis (PD) patients are exposed to high concentration of glucose in the dialysate.

Hyperglycemia

Hyperinsulinemia

Hyperlipidemia

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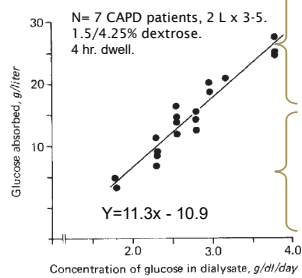
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## PD Patients Absorb about 100-300 g Glucose/day



- Long Dwell times & Fixed glucose concentration

- Glucose absorption was estimated 100 - 300 g.

Gordstein et al, KI, 1981 Apr;19(4):564-7

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## OBJECTIVE:

- Develop a model to estimate glucose absorption in contemporary peritoneal dialysis patient population.



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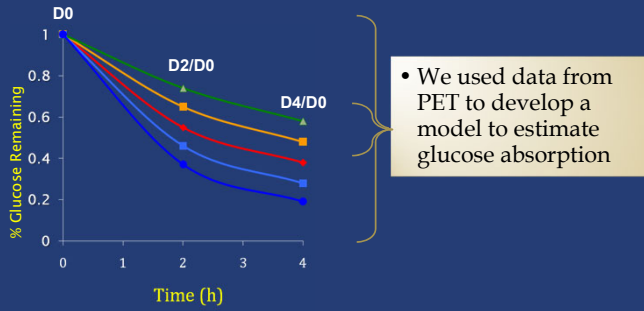
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## Dextrose Kinetics in PD



Mujais et al, Peritoneal Dialysis Int. 2001

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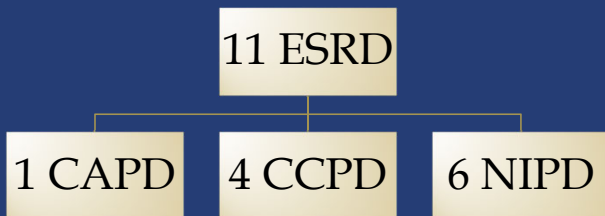
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## Patient Selection:



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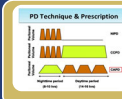
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## Methods:



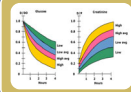
PD Prescription

Number of exchanges

Fill Volumes & Dwell times



Strength of Dextrose in Each bag



PET Data & Demographics

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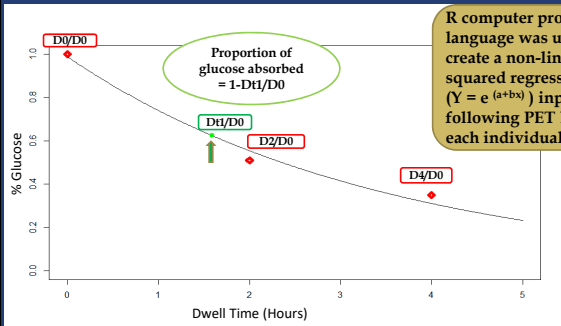
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## Estimation of glucose absorption using PET data:



R computer programming language was utilized to create a non-linear least squared regression model ( $Y = e^{(a+bx)}$ ) inputting the following PET Data for each individual patient.

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$$\text{Glucose Absorption} = \text{Glucose Exposure} \times (1 - Dt1/D0)$$

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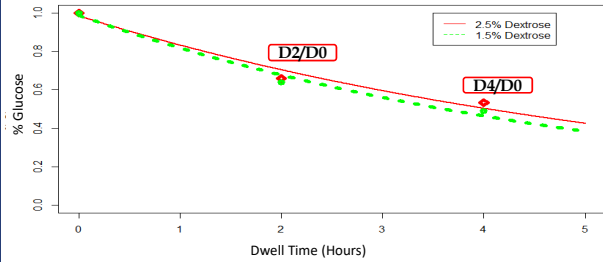
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## Rate of glucose absorption is independent of glucose concentration:

PET was performed in a patient using two different glucose concentrations of 1.5 % and 2.5 % dextrose dialysate.




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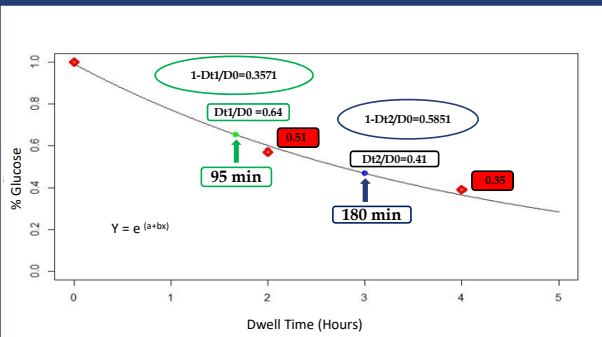
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## Patient on CCPD with 5 exchanges of 2.2 lit and LF of 2.2 Lit. Using 1.5% & 2.5% bags.




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Glucose Exposed is 195.35 g from cyclor and 49.94 g from LF



Glucose Absorbed from cyclor =  $0.3571 \times 195.35 = 69.75$  g  
 Glucose Absorbed from LF =  $0.5851 \times 49.94 = 29.21$  g  
 Total Glucose Absorbed =  $69.75 + 29.21 = 98.96$  g

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## RESULTS:

### Patient Characteristics and outcomes

Patient characteristics at PD initiation:

Age (y)	54 ± 24.0
Sex M/F	7/4
Ethnicity	
African American	6 (54.55%)
Hispanic	5 (45.45%)
Cause of Renal Failure	
Diabetes and Hypertension	5 (45.45%)
Hypertension	4 (36.36%)
Sickle cell	1 (9.09%)
Lupus	1 (9.09%)
Years on Peritoneal Dialysis	1 – 7 years

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## Results

Patient ID	Prescription	Glucose Exposure in grams/day	Glucose Absorption in grams/day
ID 1	CCPD 4X2L, LF 2L	108.8	57.18 + 19.66 = 76.85
ID 2	NIPD 4 x 2L	108.8	33.1
ID 3	NIPD 4 x 2L	181.6	68.29
ID 4	NIPD 4 x 2.2L	119.68	40.59
ID 5	NIPD 4 x 2.5 L	172.4	67.47
ID 6	NIPD 4 x 2.5 L	190.6	61.78
ID 7	NIPD 4 x 2L	181.6	53.28
ID 8	NIPD 4x2L	108.8	27.98
ID 9	CCPD 4X2L, MD 2L	108.8	37.74 + 14.4 = 52.21
ID 10	CCPD 5x2.2 L, LF 2.2 L	240.85	69.67 + 29.21 = 98.89
ID 11	CAPD 5 x2 L	54.4	41.34 + 69.00 = 110.35

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## Results

- Average glucose absorbed ----- 62.7 g/day
- Previous study glucose absorbed -----182 ± 61 g/day

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## Scenario-1

Patient ID	Membrane characteristics	Glucose Exposure g/day	Dwell time	Glucose absorbed g/day
Patient ID 3	High average	181.6 g	90 min	68.29 g
Patient ID 7	Low average	181.6 g	90 min	53.28 g



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## Scenario-2

Patient ID	Membrane characteristics	Glucose Exposure g/day	Dwell time	Glucose absorbed g/day
Patient ID 2	Low average	108.8 g	90 min	33.1 g
Patient ID 7	Low average	181.6 g	90 min	53.28 g



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## Scenario-3

Patient ID	Membrane characteristics	Glucose Exposure g/day	Dwell time	Glucose absorbed g/day
ID 11 (CAPD)	High Transporter	140.6 ± 4	240 min	110.35
ID 1 (CCPD)	High Transporter	140.6 ± 4	105 min & 180 min for LF	76.85



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## Scenario-4

Patient ID	Membrane characteristics	Glucose Exposure g/day	Dwell time	Glucose absorbed g/day
Patient ID 10	High average	245.04 g	100 min	98.89 g
Patient ID 11	High	145.2 g	240 min	110.35 g

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## Glucose Absorption:

Membrane Characteristics

Dwell Time

Glucose Exposure

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## Conclusions:

- I. Rate of glucose absorption is independent of glucose concentration in dialysate.
- II. Average glucose absorption is low.
- III. Glucose absorption depends on  
A. Membrane Characteristics, B. Glucose Exposure & C. Dwell time.
- IV. Patients with high glucose exposure can have low glucose absorption depending on the other two variables.

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## Limitations

- Small size.
- Actual glucose concentration in the effluent not measured

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## Future Directions

- ▣ Extend the study to include our entire cohort of > 150 patients
- ▣ Measure glucose in the effluent
- ▣ Develop a computer/ mobile application for easy use.

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## QUESTIONS ?

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