The association between glucose exposure and the risk of peritonitis in peritoneal dialysis patients

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INTRODUCTION

- Little *clinical* evidence is available on the association between glucose exposure and peritoneal host defense in peritoneal dialysis (PD) patients.
- It is unknown whether estimated glucose exposure is associated with an increased susceptibility to peritonitis in patients.

AIM

To present a novel method to quantify the exposure to glucose and to investigate the association with subsequent peritonitis.

METHODS

- A prospective single-centre cohort study
- Incident adult PD patients treated between 1990-2010.
- All treated with Baxter Healthcare solutions
- Data collection:
  - Baseline demographics
  - All peritonitis episodes
  - Day-to-day dialysis schemes from patients medical records
- Determination of glucose exposure within the first year on PD.
- Follow-up: from 1 year on PD until death, censoring or 5 years.

A NOVEL METHOD TO CALCULATE GLUCOSE EXPOSURE

The average exposure to glucose during 24 hours can be quantified using 3 assumptions:

- 1) Glucose absorption from the peritoneal cavity averages 60% after 4 hours
- 2) glucose absorption follows first order kinetics, which means that it becomes linear after logarithmic transformation
- 3) the geometric mean of glucose exposure in the middle of the dwell is the closest approximation of the average glucose exposure during the total dwell.

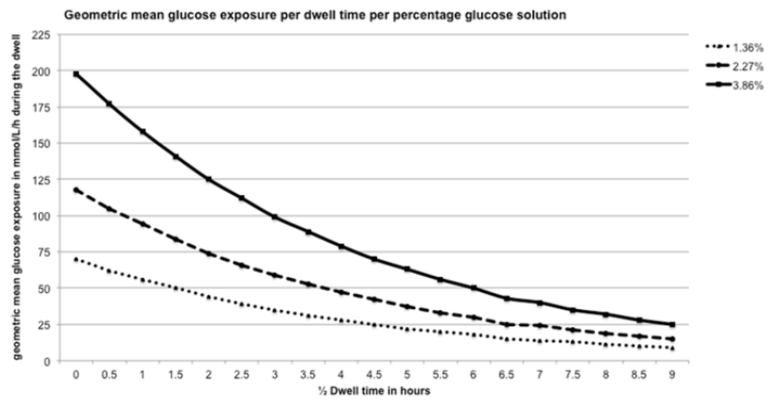
The following calculation can be made for the geometric mean glucose concentration of a 4 hr dwell: $\ln G_m = \ln(G_i) + (\ln(0.4G_i) - \ln(G_i))/2$.

- $\ln G_m$ = the natural logarithm of the geometric mean glucose concentration
- G_i = the initial glucose dialysate glucose concentration
- 0.4 = after 4 hours only 40% of the initial glucose concentration is present.
- Calculation of G_m for any dwell time can be done using $e^{\ln Gm}$.

<u>The average glucose exposure during 24 hours is the sum of all G_m values of each dwell multiplied by the fractional duration of the dwell per 24 hours.</u>

EXAMPLE: GLUCOSE EXPOSURE CALCULATION

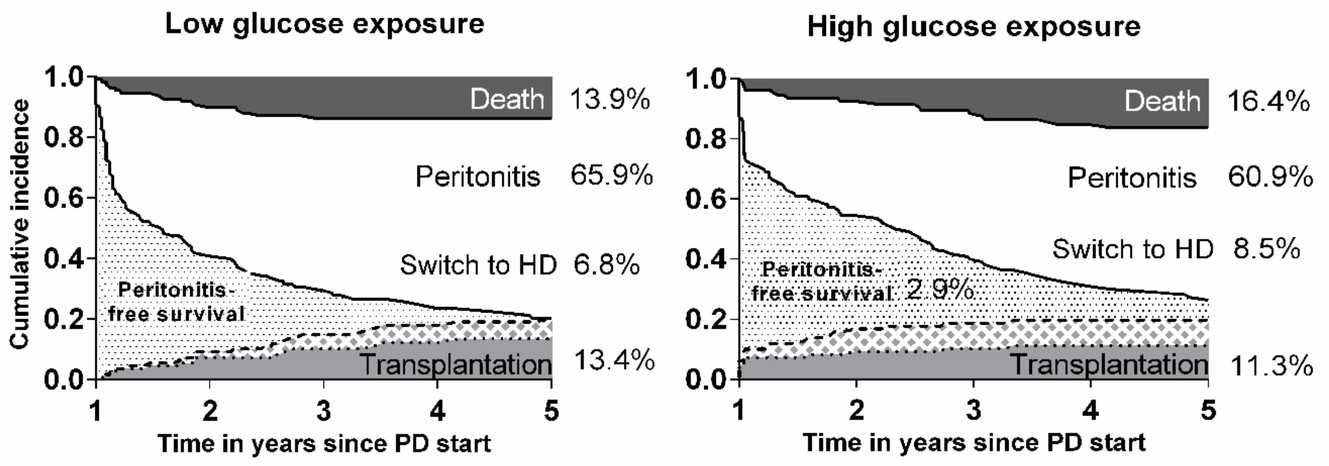
Patient A, treated with CAPD, has a dialysis scheme of 3 * 2 liters 2.27% glucose by day and 1 * 2 liters icodextrin overnight. The geometric mean glucose exposure is 74 mmol/L glucose exposure during the dwell. The glucose exposure values per dwell can be multiplied by the dwell time fraction per 24 hours:
(74 * (4/24)) + (74 * (4/24)) + (74 * (4/24)) + (0 * 8/24) = 37.0 mmol/L during 24 h



*This method can easily be applied to APD schemes as well.

RESULTS

Baseline characteristics	'Low exposure' Glucose exposure <44 mmol/L/ during 24h	'High exposure' Glucose exposure ≥ 44 mmol/L/ during 24h	*p*-value
Nr. of patients (%)	115	115	
Age (median (IQR))	54	57	0.93
Diabetes (%)	29	33	0.48
Davies comorbidity score (% severe)	9	8	0.85
Dialysis modality (%)			0.002
CAPD	73	89	
APD	27	11	
Serum β-2 microglobulin (mg/L)	20	23	0.03
Glucose exposure (mmol/L/24h)	27	51	<0.001



	HR (95% CI) glucose high vs. glucose low	HR (95% CI) per SD glucose	Qrt1: 0-27.0 mmol/L during 24h	Qrt2: 27.1-41.0 mmol/L during 24h	Qrt3: 41.1-51.4 mmol/L during 24h	Qrt4: 51.5-86.5 mmol/L during 24h
Crude	0.71 (0.51-0.99)	0.88 (0.74-1.05)	1.00	0.80 (0.50-1.28)	0.74 (0.46-1.18)	0.79 (0.50-1.26)
Adjusted model 1	0.72 (0.51-1.01)	0.90 (0.75-1.07)	1.00	0.77 (0.48-1.24)	0.76 (0.47-1.21)	0.82 (0.51-1.32)
Adjusted model 2	0.74 (0.53-1.03)	0.90 (0.76-1.07)	1.00	0.74 (0.46-1.19)	0.77 (0.48-1.24)	0.77 (0.48-1.24)
Adjusted model 3	0.81 (0.55-1.17)	0.98 (0.79-1.21)	1.00	0.88 (0.52-1.50)	0.97 (0.55-1.72)	0.97 (0.53-1.77)

Adjusted model 1: age, sex, primary kidney disease; Adjusted model 2: + DM and Davies score; Adjusted model 3: + Period effect.

1) No association between glucose exposure during the first year on PD and the subsequent time to peritonitis.
2) It could well be that the risk of peritonitis is determined by the balance between the harm of dialysis solutions to peritoneal host defense on one hand, and their bactericidal effects on the other hand.

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