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Pancreatectomy Abolishes the Renal Hemodynamic Response to a Meat Meal in Man

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Dear Sir,

According to Brenner et al. [1], the hyperfiltration response which follows intravenous amino acid administration [2–4] of ingestion of a meat meal [5, 6] may be due to a circulating hormone or some other intermediate effector among which glucagon may be a good candidate.

We report on the absence of the hyperfiltration response to a meat meal in man after total pancreatectomy. This finding points to the role of a factor of pancreatic origin in the genesis of the renal hemodynamic response to protein load.

We studied a 45-year-old man, weighing 72 kg, who, because of severe acute pancreatitis, had undergone total pancreatectomy 4 years earlier. After surgery he had strictly adhered to an appropriate protocol of insulin administration and to a dietary regimen providing 40 g of protein and 2,000 cal/day. Protein intake was controlled before the study on 3 consecutive days by means of urea generation rates. At the time of the study, plasma creatinine was 0.99 mg/dl, creatinine clearance 84 ml/min × 1.73 m², blood urea 48 mg/dl, and fasting blood glucose 1.55 g/l. Microalbuminuria was absent.

The patient was studied before (3 clearance studies (C_1–C_3) and after a meat meal MM 5 clearance studies (C_4–C_8) at 30, 60, 90, 120 and 180 min). Each clearance lasted 30 min with the exception of C_8 lasting 60 min. The meat meal provided 2 g of protein/kg body weight in the form of cooked red meat. All data measured in C_1–C_3

Table 1. Effects of a meat meal in a pancreatectomized man

	Baseline	Time after meat meal				
		30 min	60 min	90 min	120 min	180 min
GFR, ml/min · 1.73 · m²	75	73	81	82	84	
RPF, ml/min · 1.73 · m²	422	360	382	390	392	408
FF	0.19	0.20	0.19	0.20	0.20	0.20
$U_{NA} \cdot V$ μM/min	208	288	258	371	357	228
C_{Na}, ml/min · 1.73 · m²	1.22	2.09	1.77	2.06	2.8	1.9
C_{Na}/GFR · 100	1.49	2.79	2.42	2.54	3.43	2.27
UK · V, μM/min	143	108	86	139	126	76
CK, ml/min · 1.73 · m²	24.7	25.7	20.5	27.5	28	19
CK/GFR · 100	30	34.2	28.9	34	34	23
C_{Li}, ml/min · 1.73 · m²	20.5	18.7	28	27	28	27
GFR – C_{Li}	63	56	45	54	54	57
C_{Li}/GFR	0.25	0.25	0.38	0.33	0.34	0.32
1 – C_{Li}/GFR	0.75	0.75	0.61	0.66	0.66	0.68
$(C_{Li} - C_{Na}) \cdot P_{Na}$, μM/min	2641	2299	3850	3448	3358	3395
$(C_{Li} - C_{Na})/C_{Li}$	0.94	0.89	0.94	0.92	0.90	0.93
Ht, %	44	44	44	44	44	44
RVR, mm Hg/min/ml	15.6	17.4	15.7	16	15.7	14.7
PRA, ng/ml/h	1.21	1.29	1.16	1.30	1.10	1.35
Aldosterone, pg/ml	57	58	62	55	64	63
C peptide, ug/ml	0	0	0	0	0	0
Glucagon, pg/ml	180	210	126	118	109	143
Blood glucose, g/l	1.55	1.60	1.58	1.50	1.50	1.62
Amino acids, μM/l	3600	3819	4200	4500	4906	6421

were averaged and the data considered as baseline values prior to protein load. During the study, the patient received 1.5 U/h of regular insulin. We measured glomerular filtration rate (GFR) by inulin, renal plasma flow (RPF) by *p*-aminohippurate, the delivery of tubular fluid from the proximal straight tubules by lithium clearance (C_{Li}), sodium and potassium clearance (C_{Na}, C_K), absolute and fractional Na and K excretion ($U_{Na} \cdot V$, $U_K \cdot V$, $C_{Na}/GFR \cdot 100$, $C_K/GFR \cdot 100$), hematocrit (Ht), plasma concentrations of C peptide, glucagon, renin, aldosterone, glucose, and total amino acids. We calculated the absolute rate of proximal reabsorption of isotonic fluid ($GFR - C_{Li}$) by C_{Li}-derived formulae, the proximal fraction reabsorption ($1-C_{Li}/GFR$), the fractional clearance of lithium (C_{Li}/GFR), the absolute $(C_{Li}-C_{Na}) \cdot P_{Na}$ and fractional $(C_{Li}-C_{Na})/C_{Li}$ distal sodium reabsorption and the renal vascular resistance (RVR) according to the formula $MAP \cdot (1-Ht)/RPF$, where MAP is the mean arterial blood pressure.

The results of this study are summarized in table I and show that: (1) GFR and RPF following a meat meal did not exceed baseline values; (2) inhibition of proximal isotonic reabsorption took place; (3) stimulation of distal sodium reabsorption occurred; (4) plasma amino acid concentration increased over time, and (5) glucagone of gastric/pancreatic origin (7) was not affected by the meat meal.

The data also indicate that after pancreatectomy no hyperfiltration response follows a meat meal in subjects on low-protein alimentation, which points to the lack of a circulating hormone/effector of pancreatic origin [8]; the initial depression of GFR and RPF which followed the meat meal is supported by data obtained in adults and children with diabetes mellitus [9, 10].

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