Intestinal Permeability to ⁵¹Cr-EDTA in Patients on Chronic Ambulatory Peritoneal Dialysis

M.J.	Marc J.	Zuckerman ^a
D.	David	Buchwald ^a
M.T.	Mark T.	Watts ^b

Departments of ^aMedicine and ^bPathology; Texas Tech University Health Sciences Center, El Paso, Tex., USA

Marc J. Zuckerman, MD, Division of Gastroenterology, Texas Tech University Health, Sciences Center, 4800 Alberta Avenue, El Paso, TX 79905 (USA)

Dear Sir,

Abnormal intestinal permeability may be present in some patients with renal disease and may have a role in either the pathogenesis or manifestations of disease. Although gastrointestinal symptoms and evidence of abnormalities of absorption have previously been reported in chronic renal failure, with current methods of patient management the frequency of significant structural or functional intestinal abnormalities is not clear [1-4]. Rostoker et al. [5] recently reported increased intestinal permeability to ⁵¹Cr-ethylenediaminetetraacetate (EDTA) in a significant proportion of patients with glomerulo-nephritis, many of whom did not have renal failure. Measurement of the intestinal permeation of ⁵¹Cr-EDTA was made by using a 24-hour urine collection after oral ingestion. We would like to report a novel way in which the barrier function of the intestine can be studied in patients with chronic renal failure on chronic ambulatory peritoneal dialysis (CAPD).

⁵¹Cr-EDTA is a water-soluble compound which normally permeates the gastrointestinal tract poorly, is not degraded or metabolized, and is completely excreted in the urine [6]. In addition to being used to measure glomerular filtration rate when given intravenously, the urinary excretion of orally administered ⁵¹Cr-EDTA as a test of intestinal permeability has been utilized to study the barrier function of the intestine. Increased permeability to ⁵¹Cr-EDTA has been demonstrated in several disorders associated with intestinal damage, including inflammatory bowel disease, celiac disease, nonsteroidal anti-inflammatory drug injury, and infectious diarrhea [7-9].

We conducted a study to determine the permeation of ⁵¹Cr-EDTA after oral administration by measuring the amount of ⁵¹Cr-EDTA excreted in both dialysate and urine over a 24-hour period in a series of patients on CAPD. CAPD patients (n=11) without gastrointestinal complaints consisted of 5 men and 6 women with a mean age of 36.5 years (18-62). They had a mean duration of CAPD of 1.8 years (3 months-5 years). The etiologies of chronic renal failure were glomerulone-phritis (GN) in 6, systemic lupus erythemato-sus (SLE) in 2, polycystic kidney (PKD) in 2, and nephrotic syndrome of unknown etiology in 1. Two patients (1 SLE, 1 PKD) had renal transplants. All patients on CAPD utilized a standard commercial dialysis solution (Dianeal; Baxter, Deerfield, Ill.). Patients performed 4 cycles daily with a peritoneal dialysis bag size of 2,000 ml. Normal controls (n=32) were healthy adult volunteers, consisting

of 24 men and 8 women with a mean age of 35.1 years (27-64). The control subjects were studied concurrently with the study patients. This study was approved by the Institutional Review Board of Texas Tech University Health Sciences Center and informed consent was obtained from all subjects prior to enrollment.

The ^{51}Cr -EDTA test protocol was based upon the previously described method of Bjarnason [7, 9]. A test solution of approximately 100 μCi ^{51}Cr -EDTA was administered and urine collected for the following 24 h. For patients on CAPD, the ^{51}Cr -EDTA test solution was administered immediately after the abdomen was drained of residual fluid. Dialysate was collected over the 24-hour period in the bags used for each cycle. The volume of collected dialysate was measured and aliquots of each of the 4 bags of dialysate per patient were analyzed in the same manner as for urine, then added together for a total

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dialysate excretion value. Urinary excretion (and dialysate excretion if applicable) of ^{51}Cr -EDTA was calculated as a percent of the administered dose. Total 24-hour excretion of ^{51}Cr -EDTA for CAPD patients was calculated as the sum of the urinary excretion and dialysate recovery.

The 24-hour excretion of ^{51}Cr -EDTA in both urine and dialysate is shown for CAPD patients in table 1. Total 24-hour ^{51}Cr -EDTA recovery (urine plus dialysate) was calculated to have a mean of 0.57% (0-1.24%). Normal control subjects had a mean 24-hour urinary excretion of ^{51}Cr -EDTA of 1.99% (0.59-3.48) [9]. There was significantly less recovery of ^{51}Cr -EDTA in the CAPD group ($p < 0.0005$). The mean 24-hour urine volume was 218 ml (range 0-900) and the mean 24-hour urine creatinine was 0.20 g (range 0-0.80). Urinary excretion of ^{51}Cr -EDTA could only be analyzed in the 5 patients with significant urine output. The mean 24-hour urinary excretion of ^{51}Cr -EDTA in these patients was 0.38% (0.16-0.74). ^{51}Cr -EDTA was recovered in the dialysate of 91% (10 of 11 patients), with a mean of 0.40% (0-0.96%). No correlation was seen between ^{51}Cr -EDTA excretion and time on peritoneal dialysis.

This study demonstrates that ^{51}Cr -EDTA can be recovered in dialysate after oral administration, a finding which may be useful in designing future studies on intestinal function in chronic renal failure. Total 24-hour excretion of ^{51}Cr -EDTA in CAPD patients, calculated by combining measures of urine and

Table 1. Results of the ^{51}Cr -EDTA test in CAPD patients

S/P transplant.

Nephrotic syndrome, unknown (UNK) etiology.

Mean urinary excretion in the 5 patients with significant urine output.

renal failure may be obtained by studying the differential recovery of other permeability probes along with ^{51}Cr -EDTA [10].

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dialysate excretion, was significantly lower than normal. It is likely that the low excretion of ^{51}Cr -EDTA was due to other variables which may affect recovery of the marker [10] rather than to decreased intestinal permeability. Dialysate clearance of ^{51}Cr -EDTA is probably low and may

be affected by peritoneal membrane function and length of the collection period for dialysate recovery. Additional information on intestinal function in

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