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LETTER TO THE EDITOR

# Changes in renal function during acute spinal cord injury: implications for pharmacotherapy

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Rodriguez-Romero *et al.*[1] draw our attention in their recent article on the importance of studying the renal function of paraplegic patients immediately after sustaining a traumatic spinal cord injury. They have used a rat as an experimental model to study this as they state that: 'There are reports that show decrease of glomerular filtration rate (GFR) in patients with chronic cord injury. Information on GFR during early stages of SCI is scarce and wrongly based on creatinine measurements which are faulty because they are affected by muscle mass catabolism occurring during this stage of SCI.'

While I would agree that knowledge of renal function in patients with an acute injury of the spinal cord is important, I disagree with their statement that such studies in the early stages of SCI in patients are scarce. While studies based on serum creatinine are faulty, this does not apply where the trouble is taken to perform a full creatinine clearance test. I would draw their attention to the research carried out nearly 60 years ago by Doggart and Silver[2] and Doggart *et al.*,[3] in which we compared urea clearance and creatinine clearance following the procedure outlined below:

This was a research procedure with the authors personally collecting the urine specimens and carrying out the majority of the estimations in a research laboratory. Such standards of collection and estimation cannot be obtained in a routine laboratory, especially if the tests are carried out infrequently. In all 28 patients were studied, 10 of these patients were acute paraplegics and were examined within 72 h of suffering an injury to their spinal cord. Another 18 patients were chronic paraplegics and were studied between 14 months and 20 years after injury to their spinal cord or developing chronic disease of the nervous system. The acute cases did not suffer from renal tract disease secondary to pyelonephritis and their urine was sterile. The chronic cases showed a variety of renal conditions. Eleven had amyloidosis, others calculosis, hydronephrosis and hypertension. Repeated clearance studies at daily intervals by both techniques were carried out to determine the reproducibility of the results, and to assess the value of the clearance studies in determining the prognosis of the patient.

We found that the creatinine clearance was normal in the acute stages of spinal injury, even on repeated estimations over several days. Grabber and Sevitt[4] used the creatinine clearance as a measure of GFR in oliguric patients following severe burns, and presented evidence to show that the ratio creatinine clearance/inulin clearance is the same in a variety of conditions, including surgical shock after trauma. The creatinine clearance, therefore, gives reproducible and useful results in the acute stage following injury.

We followed up this work in 1962–1964 by studying a further 52 patients, 49 of them during the first 10 days following injury.[5] They were all patients who had suffered an acute traumatic injury of the cord and were admitted early after injury to the National Spinal Injuries Centre. The creatinine clearance was determined on 24 h specimens. A total of 35 patients had at least one determination; 23 had serial determinations. Again we found that the creatinine clearance was substantially normal in all these cases.

These studies were carried out on 24 h specimens of urine. The errors in the creatinine clearance usually arise from failure of collection of an accurate specimen. It is still recommended in the Oxford Textbook of Medicine in the United Kingdom that while isolated estimations of serum creatinine can give rise to errors because of excessive catabolism in the early stages, the creatinine clearance does not suffer from these differences and is a reproducible measure of renal function provided that accurate collections are made. At Stoke Mandeville, such accurate collections were made because of the technique of intermittent catheterization carried out by the staff.

I note that the authors also carried out a test of tubular function on the rats immediately after spinal injury. We carried out an assessment of distal tubular function, where we studied the oliguria first described by Gordon Holmes, and subsequently observed by many clinicians, where there were dramatic changes in fluid balance and marked pulmonary oedema.[6]

In order to investigate this further, we studied a water load test in which the patients drank a litre of water.[7] This test was carried out on 20 acute paraplegic patients soon after injury. It included measurement of serum osmolality to confirm absorption of ingested water. An impaired response to the water load was obtained in 17 tests: 12/13 between 1 and 5 days after onset of the cord lesion and 5/14 more than 2 weeks after injury. We showed that the water was absorbed but was not excreted, which is an indication of the secretion of anti-diuretic hormone that was acting upon the distal tubule of the kidney of patients with spinal injury. When the acute state passed and the patients were studied again, the distal tubular function was normal.

Although it is appreciated that it is inappropriate to carry out studies of drug metabolism and excretion on recently injured patients, there is still information in the literature on the function of the kidney immediately after injury. These studies illustrate that there is information on the GFR and the secretion of anti-diuretic hormone immediately after spinal injury.

## CONFLICT OF INTEREST

The author declares no conflict of interest.

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