

RENAL INJURIES INDUCED BY CHRONIC INTOXICATION WITH MICROCYSTINS

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Abstract: The microcystins (MCs) LR and YR are hepatotoxins produced by some species of freshwater cyanobacteria. Only a few reports on the acute nephrotoxicity of MCs have been published to date. Here we investigate the effects on rat kidneys of chronic administration of relatively low doses of MC LR and MC YR. Male Wistar rats were injected every second day for 8 months with MC LR (10 µg/kg i.p., n=5) and MC YR (10 µg/kg i.p., n=5). The control group was treated with vehicle, a mixture containing 0.8 % ethanol and 0.2 % methanol in 0.9 % saline (3.7 ml/kg i.p., n=5). We found that MCs could induce damage to the kidney cortex and medulla. The lesions mainly consisted of damaged and dilated tubuli filled with homogenous eosinophil material. We conclude that long-term exposure to relatively low doses of MCs poses a considerable risk for kidney injury.

Key Words: Microcystin LR, Microcystin YR, Chronic Toxicity, Kidney, Rat

INTRODUCTION

The microcystins (MCs) MC LR and MC YR belong to a family of more than 50 structurally similar toxins produced by some species of freshwater cyanobacteria. MCs are thought to act primarily on the liver, although in high doses they also possess nephrotoxic potential [1]. However, there are no data on the toxic effects of chronic exposure to MCs on rat kidneys. The objective of this study was therefore to evaluate the effects of chronic administration of relatively low doses of MC LR and MC YR on rat kidneys.

MATERIALS AND METHODS

Male Wistar rats (444 - 599 g) were treated every second day for 8 months with MC LR (n=5) and MC YR (n=5) in relatively low doses (10 µg MC LR/kg and 10 µg MC YR/kg i.p., respectively). The control group was treated with vehicle (n=5) (0.8 % ethanol and 0.2 % methanol dissolved in 0.9 % saline) at a volume of 3.7 ml/kg i.p. The MCs were obtained as described in detail previously [2]. The formalin fixed, paraffin embedded kidneys were cut on microtome (4 µm) and stained with haematoxylin and eosin (HE).

RESULTS AND DISCUSSION

As reported previously for the acute toxic effects of high doses of MCs [1], we found lesions that were suggestive of glomerular damage with leakage of proteins into the tubules. Numerous glomeruli were collapsed and filled with eosinophilic material. The tubuli of the outer and inner medulla were dilated with lumens filled with eosinophilic proteinaceous casts. Ballooning hydropic degeneration of the tubular epithelium was observed. In some of the tubuli, the tubular lining appeared necrotic and was desquamated toward the lumen of the tubuli. The interstitial tissue was infiltrated by inflammatory cells and therefore appeared edematous (Fig 1).

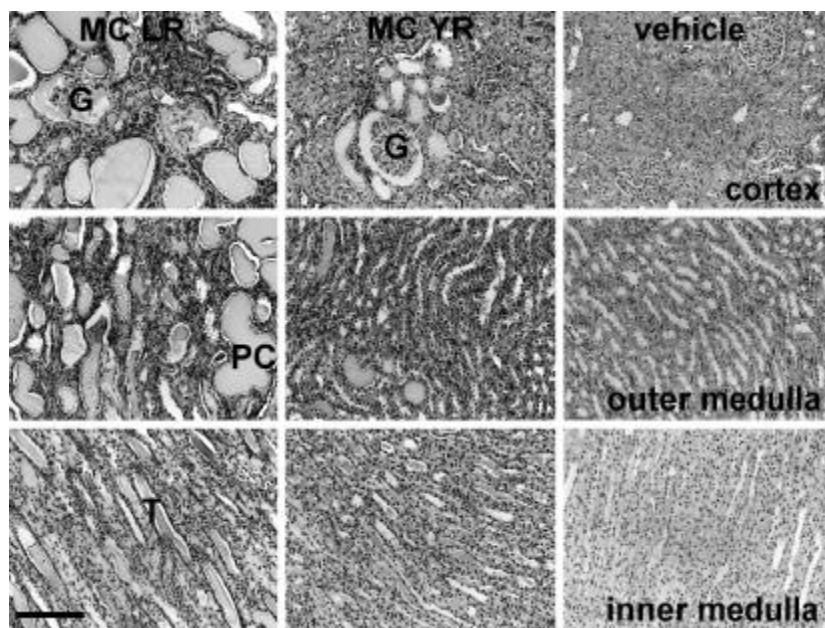


Fig. 1. The HE staining of the kidneys of rats that were treated with **MC LR**, **MC YR** or with **vehicle**, every second day over eight months. In the kidney cortex of the **MC LR**-treated group we observed collapsed glomeruli (**G**) and dilated tubuli (**T**) that were filled with proteinaceous casts (**PC**). Less pronounced pathological changes were also observed in the **MC YR** group. Bar = 200 μ m.

We conclude that long-term exposure to relatively low doses of MCs poses a considerable risk for kidney injury.

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