Scleroderma-like syndrome triggered by Gadolinium

Sir,

We read with interest the report by Grobner [1] of five end-stage renal disease patients who developed nephrogenic fibrosing dermapathy (NFD) following gadolinium exposure. We also observed a 48-year-old male dialysis patient with a similar complication after MR-angiography. The patient had been dialysis-dependent for 6 years as a consequence of membranoproliferative glomerulonephritis. He suffered from widespread atherosclerotic disease (coronary heart disease and peripheral arterial disease), and had needed repeated angioplastics.

For investigation of a new claudication, MR-angiography of the lower limbs, using gadodiamide, was performed. The procedure was chosen instead of a direct angiography, because the patient wanted to circumvent possible complications of arterial punctures.

When he was dialysed the day after the examination, he complained of burning sensations and reddening of the lower and upper extremities. In the subsequent weeks, the skin became indurated and shiny, and the joints of the affected limbs became stiff.

Systemic sclerosis was considered, but the clinical appearance was also interpreted as a myxoedema by one colleague. Further evaluation could confirm neither systemic sclerosis (no auto-antibodies, oesophageal motility undisturbed) nor a thyroid dysfunction. On presentation to an academic dermatology department, the clinical diagnosis of systemic sclerosis was nevertheless made, based on the skin appearance alone. A deep-skin biopsy from an affected area, taken from the anterior part of the left thigh, showed fibrosis of the dermis extending to the subcutis. Adjacent muscle tissue and vessels were free from inflammation—a dense immunostaining for CD34 as a marker of fibrocytes was absent, and the diagnosis of NFD was discarded.

Pulse injections of 250 mg methylprednisolone brought a well-tolerated and improved the symptoms, constantly. The skin became smoother and less painful and the mobility of joints increased. The improvement was satisfactory not earlier than 9 months after the MR-angio and 3 months of imurek-treatment. The patient has now received a renal transplant and his condition has further improved.

We are convinced that our patient suffered this complication as a consequence of the gadolinium exposure. Since the skin appearance was indeed reminiscent of a myxoedema, we regard ‘scleromyxoedema-like illness of renal disease’, coined by others for NFD [2], an appropriate descriptive term.

In contrast to Grobner’s report, the onset of symptoms was immediate in our patient and the histology of the affected skin was not as suggestive for NFD as in his cases. Finally, our patient seems to have responded to systemic immunosuppression, which had failed in Grobner’s patients. Therefore, presentation of this gadolinium-related syndrome may be more heterogenous than suggested in Grobner’s article [1], and needs further characterization.

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Dialysis-Center Lindau
Friedrichshafener Str. 82
D-88131 Lindau
Germany
Email: info@dialyse-lindau.de

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Mathematical modelling of the course of chronic renal failure

Sir,

Nephron loss, in the course of chronic renal failure (CRF), causes an increase in the single nephron glomerular filtration rate (SNGFR) in the remaining nephrons, with a magnitude roughly correlating with the extent of nephron loss [1]. This compensatory hyperfiltration, although minimizing GFR loss in the short-term, has proven detrimental in the long-term due to its damaging effects on remnant glomeruli [2]. Considering the importance of serial monitoring of GFR in assessing disease activity in CRF, we developed a mathematical model to predict GFR based on the number of surviving nephrons. A general scheme is presented below.

Consider each nephron as a differential element $dt$ (after sorting all nephrons at time $t=0$ in an ascending order of SNGFR) in the remaining nephrons, with a magnitude roughly correlating with the extent of nephron loss $\Delta t$. This compensatory hyperfiltration, although minimizing GFR loss in the short-term, has proven detrimental in the long-term due to its damaging effects on remnant glomeruli. Let $N(t)$ be the number of surviving nephrons at time $t$. We will then have $\text{GFR}[N(t)] = \frac{f_{\text{max}}}{d_t(t)}$, where $f_{\text{max}}$ is the critical value of $f_{\text{max}}$, which causes a uniform increase in SNGFR throughout the whole kidney [3,4]. Let $N(t)$ be the number of surviving nephrons at time $t$. We will then have $\text{GFR}[N(t)] = \frac{f_{\text{max}}}{d_t(t)}$. Having considered the simplest physiologically plausible case of