Gadolinium in MRI for CKD patients: nephrogenic systemic fibrosis

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An article published in 1996 demonstrated that gadolinium-based contrast media (GBCM) was not nephrotoxic. This led to a global switch from iodine-based contrast media to GBCM; that is to say, enhanced computed tomography was discarded in favor of enhanced magnetic resonance imaging for patients with reduced renal function.

However, a new skin disorder was later recognized in 1997 and officially reported in 2000. It was initially described as a scleromyxoedema-like cutaneous disease in dialysis patients. One year later, the disorder was named “nephrogenic fibrosing dermopathy”. But, its systemic involvement was subsequently found by autopsy. The more appropriate term of “nephrogenic systemic fibrosis (NSF)” was then recommended, which has become widely accepted since 2005. In 2006, the causative role of gadolinium for NSF was clearly identified. The FDA immediately issued a public health advisory warning regarding the association between NSF and GBCM.

NSF is a fibrosing disorder which predominantly occurs in patients whose estimated glomerular filtration rate is below 30 mL/min/1.73 M^2 or who are on dialysis. Clinically, these patients present with a thickening and hardening of the skin which is often associated with pain, muscle weakness, bone pain, and joint contractures leading to severe disability. These lesions typically occur on the lower extremities. The face and neck are usually spared. Its manifestations range from focal skin fibrosis to potentially fatal fibrosis of multiple internal organs.

The exact pathogenesis of NSF remains unknown, but is believed to be multifactorial. The only consistent association found in all patients with NSF is renal dysfunction consisting of either chronic kidney disease or acute kidney injury. NSF typically presents within 2 to 10 weeks after exposure to the GBCM. The estimated prevalence of NSF is around 2% to 6% after exposure to gadodiamide in patients with reduced renal function. Patients undergoing peritoneal dialysis are at greatest risk. NSF can be diagnosed by biopsy and histopathology. Recently, a clinicopathological system to aid in the diagnosis of NSF has been proposed.

Currently, there is no gold standard for the treatment of NSF. Clinical improvement has been reported with renal transplantation, but such results are not universal. It is important for individual hospitals to develop strategies to prevent NSF, including risk stratification of renal patients, alternative imaging tests, lowest amount and low risk GBCM, and considering hemodialysis therapy after exposure.