Contrast Agent Use in the Age of NSF (Nephrogenic Systemic Fibrosis)

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After this lecture the attendee should be able to:

- Assess the risk of NSF based on the patients's history
- Understand the different contrast media classes and their implicit risk for NSF
- Understand the postulated pathogenesis of NSF

Target audience: – "Clinicians and registered technicians

In 2006 reports were published linking the use of gadolinium contrast agents with a hitherto little known condition, nephrogenic systemic fibrosis (NSF) [1]. The condition was termed nephrogenic systemic fibrosis once it was determined that the fibrosis not only affects the skin (where adjacent to joints it can lead to contractures) but also internal organs such as muscles, including the diaphragm and heart and leads to an increased mortality of patients [2]. The cause, however, remained obscure. The association with the use of gadolinium contrast agents was first proposed by Thomas Grobner, a renal physician who noted that a cohort of his dialysis patients with NSF had undergone contrast enhanced MRI studies prior to its development [1]. Since then other groups have confirmed this association, finding a NSF incidence of up to 5% in patients with severe renal failure (eGFR < 15ml/min) administered gadolinium based contrast agents (GBCAs) [3]. Studies have also found positive association between the total cumulative dose of GBCA received and the development of NSF [3]– indicating a form of dose-response relationship, i.e. those patients exposed to higher doses or repeat examinations were more likely to develop NSF. However, the great majority of dialysis patients given gadolinium contrast do not develop NSF [3]. Recent data suggest that the chemical properties of the contrast media are a major factor for the development of NSF with the least likelihood of NSF with macrocyclic substances. But not only the amount and the chemical properties are important co-factors for the development of NSF but also a so-called "pro-inflammatory" status of the patient such as recent surgery or inflammatory disease.

Since the awareness about NSF rose in the radiology community the number of reported new NSF cases has plunged to virtually zero. This implies that the measures taken (minimization of contrast agent dose, switch to macrocyclic substances and critical appraisal of the indication for imaging) by radiologists and referring physicians seem suitable to contain NSF. Nevertheless, patients should not be withheld from necessary MR-examinations. If necessary a switch to non contrast-enhanced techniques should be considered (MRA, DWI) while contrast-enhanced CT should only be preferred in patients not on hemodialysis due to the high risk for contrast-induced nephropathy in patients with a poor renal function.

1. Grobner T. Gadolinium--a specific trigger for the development of nephrogenic fibrosing dermopathy and nephrogenic systemic fibrosis? *Nephrol Dial Transplant.* Apr 2006;21(4):1104-1108.

2. Cowper SE, Bucala R, Leboit PE. Nephrogenic fibrosing dermopathy/nephrogenic systemic fibrosis--setting the record straight. *Semin Arthritis Rheum.* Feb 2006;35(4):208-210.

3. Collidge TA, Thomson PC, Mark PB, et al. Gadolinium-enhanced MR imaging and nephrogenic systemic fibrosis: retrospective study of a renal replacement therapy cohort. *Radiology.* Oct 2007;245(1):168-175.