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## NEXT ISSUE

**1.5T Open Bore MRI coming to Raleigh Radiology's Blue Ridge Facility.**  
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*Dear Colleague,*

*RaleighRad Note strives to provide clear, concise summaries of current topics in diagnostic imaging. We hope it will assist you in choosing accurate, cost-effective imaging for your patients. Your confidence in our practice through referrals is always appreciated. Please feel free to call one of our physicians for consultation at any time.*

*Thank you,  
Cynthia S. Payne, MD*

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*A Raleigh Radiology physician is available 24/7 at Rex Hospital.*

## Nephrogenic Systemic Fibrosis (NSF)

Nephrogenic Systemic Fibrosis (NSF) is a systemic fibrosing condition which affects some patients with significant renal disease following gadolinium contrast exposure. Magnetic resonance imaging has an otherwise excellent safety profile with advantages including avoidance of ionizing radiation and contrast induced nephropathy, as well as a low risk of allergic reactions. However, because of concern regarding the connection between gadolinium contrast and NSF, the U.S. Food and Drug Administration has issued a warning for all gadolinium contrast agents with recommendations to avoid contrast if possible in patients with significant renal disease.<sup>1,2</sup>

This potentially devastating disease initially involves the skin and subcutaneous tissues of the extremities with later involvement of the trunk and typically spares the head and neck.<sup>3</sup> Signs and symptoms consist initially of edema and erythematous plaques progressing to skin thickening and fibrosis with contractures of the extremities.<sup>3</sup> There may also be involvement of other tissues including the dura, lungs, myocardium, kidneys, and musculature.<sup>4-6</sup> NSF can be progressive, leading to disfiguring fibrosis, systemic disease, and even death.<sup>3</sup>

There have been approximately 225 cases reported to date.<sup>7</sup> Nearly all cases involve patients with stage 4 or 5 renal disease, glomerular filtration rate less than 30 mL/min, who have been exposed to gadolinium contrast.<sup>8</sup> Most patients were on dialysis.<sup>9</sup> Other patients with moderate renal disease typically have acute renal insufficiency and other risk factors such as recent hepatic or renal transplant or hepatorenal syndrome.<sup>10</sup> NSF has rarely been seen in patients without documented gadolinium exposure, though the etiology in these cases is uncertain.<sup>8</sup>

Gadolinium is thought to be the trigger for NSF.<sup>1,11</sup> Via a process called transmetallation, gadolinium is released from the gadolinium contrast chelate and can then bind to other molecules in human soft tissues inciting a fibrotic response.<sup>1,11</sup> The gadolinium contrast agents are all nearly exclusively renally excreted, leading to increased concentration in patients with renal failure.<sup>7</sup> →

There is thought to be an increased risk of NSF with higher doses and higher cumulative doses.<sup>12</sup> Not all patients with severe renal disease exposed to gadolinium develop NSF. Other risk factors include recent thrombotic events and surgery among others, though the exact contribution of these is uncertain.<sup>1, 4, 13</sup>

Raleigh Radiology has taken a proactive approach to this serious condition. As prevention is key, any patient over 60 or with suspected or known renal disease should have recent creatinine so that an estimated glomerular filtration rate can be obtained. This allows risk stratification based on the level of renal disease.<sup>14</sup> The National Kidney Foundation provides an online calculator for estimation of GFR. ([http://www.kidney.org/professionals/KDOQI/gfr\\_calculator.cfm](http://www.kidney.org/professionals/KDOQI/gfr_calculator.cfm)) For stage 3 patients, those with a GFR of 30 to 60mL/ min, the risk is not entirely certain. In cases of acute renal insufficiency or failure, it is favored to postpone imaging with contrast if possible as these patients may be at similar risk to more severe chronic renal failure patients.<sup>14</sup> Otherwise, a half dose of contrast is utilized. For stage 4 or 5 patients, contrast is avoided if possible.<sup>14</sup> These cases should involve a discussion between the radiologist and ordering clinician, and a nephrology consult. If it is determined that contrast is necessary, half dose contrast is utilized. All of these patients should be informed of the risk of NSF prior to contrast administration.<sup>14</sup>

Treatment options are limited and prevention is the goal.<sup>9</sup> The main treatments include restoration of renal function and supportive care with otherwise limited information regarding other therapies.<sup>4, 9</sup>

In light of these concerns, it is important to recognize that noncontrast MR imaging studies provide valuable information, particularly in neuroimaging. Also, hemodialysis patients can receive iodinated contrast, so a combination of noncontrast MRI and contrast enhanced CT may be utilized to obtain the necessary information.

NSF is a devastating and potentially fatal disease. Continued study is necessary to prevent further cases, understand the mechanism of the disease, and identify potential therapies.

#### KEY POINTS:

- NSF is a severe, systemic fibrosing disorder
- Affects some patients with renal disease, typically severe, who are exposed to gadolinium contrast
- Treatment options are limited, so prevention must be the goal
- Ordering MRI exams “contrast as needed” gives the radiologist leeway to protocol the exam and may prevent unnecessary phone calls to the ordering physician.

#### Ordering an MRI in a patient with renal disease or over age 60:

- We need a recent creatinine to calculate an estimated GFR. Our practice calculates GFRs using the following resource:  
[http://www.kidney.org/professionals/KDOQI/gfr\\_calculator.cfm](http://www.kidney.org/professionals/KDOQI/gfr_calculator.cfm)
- Risk stratify patient based on level of renal disease
- Avoid gadolinium contrast if possible in patients with significant renal disease or acute renal disease
- Identify confounding factors such as recent hepatic or renal transplant or hepatorenal syndrome
- Discuss case with radiologist if any questions or concerns

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 Raleigh, NC 27612  
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 F 919-787-4870

### Clayton MRI

300 Guy Road, Suite 102  
 Raleigh, NC 27520  
 T 919-877-5400  
 F 919-877-5480

### Cedarhurst

1212 Cedarhurst Drive  
 Raleigh, NC 27609  
 T 919-877-5400  
 F 919-877-5480

### Wake Forest

839 Durham Rd, Unit A  
 Wake Forest, NC 27587  
 T 919-877-5400  
 F 919-877-5480

### Cary

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 Cary, NC 27518  
 T 919-781-1437  
 F 919-787-4870

### Brier Creek location Coming in 2009

### Rex Hospital

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 Raleigh, NC 27607  
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