

Adding Local Flavor to World Class Imaging¹

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Chicago, the host city for the annual meeting of the RSNA (Radiological Society of North America), is the quintessential place to obtain certain foods, among them deep dish pizza, the Italian beef sandwich, and the Chicago-style hot dog. Given some appropriate nutritional concerns about these items, it is important to realize that healthier alternatives are grown, produced, and sold regionally. Chicago has also for years been known as one of America's great restaurant towns. However, the French delicacy foie gras cannot be found on the menu of any of its five-star establishments, as the sale of this dish became illegal in 2006. Diagnostic imaging offers a unique perspective on the local Chicago cuisine.

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Introduction

One of the more enjoyable events to attend during the Scientific Assembly and Annual Meeting of the Radiological Society of North America (RSNA) is the Opening Session on Sunday morning. While many RSNA attendees have either yet to arrive in Chicago, are sleeping in late, or are just getting used to—and are afraid to venture outside in—Chicago’s continental climate in late November, those brave enough to make it to the Arie Crown Theater early Sunday morning (8:30 AM local Central time, 6:30 AM for those left-coasters who have yet to reset their watches) typically find the session to be informative, enjoyable, and very much worth the effort.

A long-standing tradition at the Opening Session is for the RSNA to give a few minutes of podium time to the local Chicago Radiological Society (CRS) president. The basis for this tradition has always been unclear to me, but I have my theories. The CRS is in fact an older organization (founded in 1913) than is the RSNA (founded in 1915), so maybe the idiom “age before beauty” is why we local radiologists are given this otherwise undeserved opportunity. In keeping with Chicago political customs and folklore, perhaps the early local radiologists used this opportunity as a “quid pro quo” for lending our city to the RSNA. Whatever the actual reason may be, as the 2006–2007 CRS president, I had the pleasure of addressing the Sunday morning audience at the Arie Crown this past RSNA.

The theme of the RSNA 2006 meeting was “Enhancing Professionalism.” I chose to directly ignore this edict, instead deciding to add a little local flavor to the meeting. People from outside the Midwest often find the manner in which we speak to be rather quaint and cute; the idea that a person would actually say precisely what he or she means is apparently considered novel to some. I say this not to be critical or judgmental, but simply to stress that my intent was to, indeed, add local flavor to the Opening Session.

Local Flavors

The local flavor that I believe is most associated with my city is deep dish—or Chicago-style—pizza. Although 8:30 AM may seem rather early to

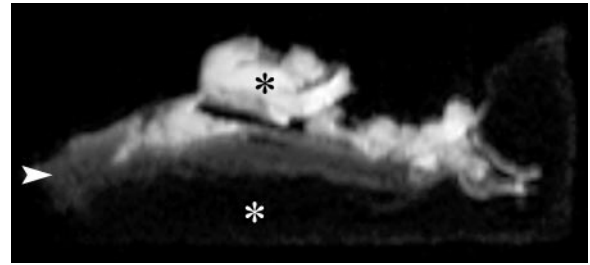


Figure 1. Chicago-style deep dish pizza. Uninfused sagittal T2-weighted MR image shows the high signal intensity of the water-rich tomato sauce and toppings (black *) on top of the medium signal intensity of the cheese (arrowhead), both sitting atop the near signal void of the crust (white *). Note the thickness of each layer as well as the fact that the tomato sauce and toppings are above the cheese, features that would not be seen on an MR image of a traditional pizza.

be thinking about pizza, it’s truly delicious any time of the day or night (and nothing makes a better breakfast than cold, leftover deep dish pizza). Unfortunately, a simple picture really cannot do Chicago-style pizza justice. As a diagnostic radiologist, however, I have access to expensive, state-of-the-art technology that allows me to visually display deep dish pizza to an audience of radiologic professionals in a manner that we may all better understand. This also provides me with the opportunity to give excellent examples of novel ways in which diagnostic imaging can be even further overutilized. Chicago-style pizza can be very well illustrated by using T2-weighted magnetic resonance (MR) imaging (Fig 1). The tomato sauce and toppings, because of their high water content, are of bright signal intensity. The cheese, which contains substantially less water, is rather gray by comparison. It is important to note that the toppings are above the cheese, which is not the layering order seen with a traditional pizza that is topped with cheese. The crust, because of its near absence of water, is nearly black and barely perceptible. However, a clever radiologist will note just how thick this band of very low signal intensity is, and hence the appropriateness of the term *deep dish*. I firmly believe that the structure—and flavor—of a Chicago-style pizza are better displayed with MR imaging than with human vision.

A culinary journey through Chicago—at one point in its history known as the “hog butcher to

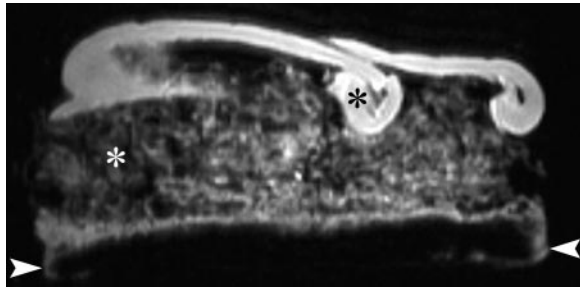


Figure 2. Italian beef sandwich with sweet peppers. Uninfused coronal T2-weighted MR image shows the bright signal intensity of the beef juices soaking into what would otherwise be the signal void of the Italian roll (arrowheads). Mostly because of these juices, the beef itself is of heterogeneous medium signal intensity (white *), with the water-rich, sliced, and sautéed green peppers appearing as bright crescents atop the entire sandwich (black *).

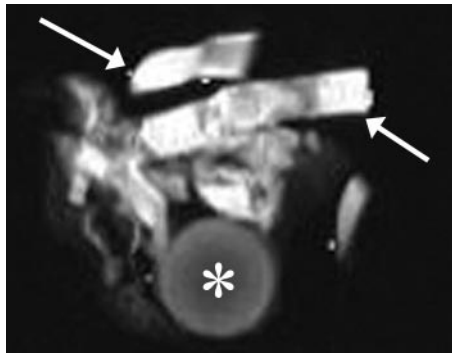


Figure 3. Chicago-style hot dog with everything. Uninfused axial T2-weighted MR image shows the mildly heterogeneous (more intense peripherally than centrally) signal intensity of the hot dog itself (*). It sits within the essential signal void of a poppy seed bun, with the standard water-rich toppings surrounding the “puppy” as irregularly shaped bands of bright signal intensity (arrows). Please note the absence of ketchup.

the world,” thanks in large part to local poet Carl Sandburg—would not be complete without the consumption of beef products. Thankfully, there are plenty from which to choose. One of my favorites is the Italian beef sandwich, with Chicago generally regarded as being the birthplace of this taste sensation. This local flavor starts with thinly sliced beef, wet roasted and marinated in a broth

containing garlic, oregano, and other spices, which is then served on a hard, sliced Italian roll. The bread does not remain hard for long, however, as it quickly absorbs—and is softened by—the beef juices. To be complete, the beef must be topped with sweet peppers, which are spiceless, grilled, green bell peppers. As with Chicago-style pizza, I believe that T2-weighted MR imaging best depicts how delicious the Italian beef sandwich is, especially the juices being absorbed by the Italian roll (Fig 2). My future research on this topic will focus on quantifying the rate of Italian roll “soakage” with dynamic MR imaging, and will perhaps also use MR spectroscopy and functional MR imaging in this important endeavor.

The best-known local beef product is almost certainly the Chicago-style hot dog, which—not surprisingly—is also best demonstrated with fluid-sensitive MR imaging (Fig 3). A truly delicious Chicago “puppy” is somewhat heterogeneous on a T2-weighted image. The periphery will—and should—be more intense than the center, this appearance clearly demonstrating how moist and juicy the dog is on the outside, correlating quite well with its visual appearance upon entering a wide-open mouth. The full complement of toppings for a Chicago-style hot dog are very specific (an Aunt Minnie if you will): yellow mustard, chopped onion, bright—nearly fluorescent—green relish (the exact processes involved in making an edible product of this color are, in my opinion, best left as one of life’s great mysteries), tomato wedges, pickle spears, celery salt, and sport peppers. At fluid-sensitive MR imaging, these toppings blend into a single, irregularly marginated layer of increased T2 signal, the lack of clear distinction between the individual ingredients proving that they indeed all belong together. All of this is then served on the essential signal void of a poppy seed bun. Although not frankly illegal, ketchup has no place anywhere on or near a Chicago-style hot dog. I personally shudder at the thought of what an MR image of a hot dog with ketchup would look like, and I trust that no self-respecting Institutional Review Board would ever approve of such research. Please remember that, when in Chicago, ketchup has no place on a “hot dog with everything.”

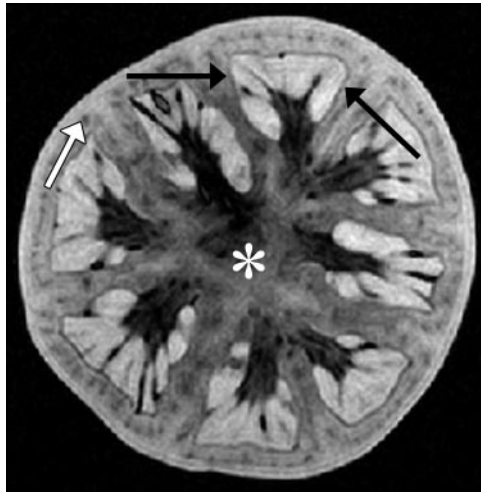


Figure 4. Ripe, red multilocular tomato. Uninfused axial T2-weighted MR image exquisitely depicts the relevant anatomy. This section contains eight separate fluid-rich locular cavities (black arrows). The more fibrous—and heterogeneously darker signal intensity—columella is at the center (*). Individual small rounded vascular bundles (white arrow) can be seen throughout the outer wall of the pericarp.

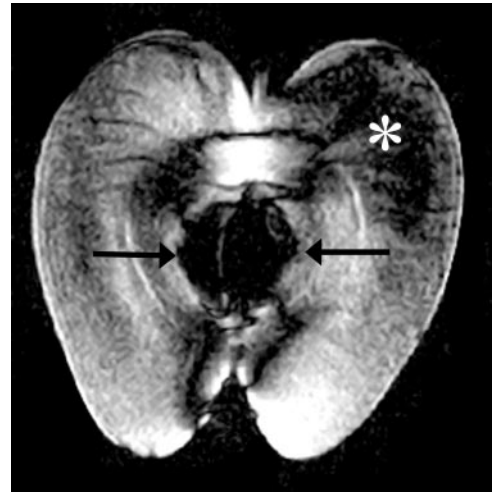


Figure 5. Gala apple. Uninfused coronal T2-weighted MR image shows heterogeneity of signal intensity within the cortex, with areas specifically having focal loss of the expected bright signal intensity (*). This finding perhaps results from a magnetic susceptibility artifact caused by iron within the apple's skin. The apple's core (arrows) is nearly void of signal, as it contains minimal water.

Health Considerations

Something that should quickly become apparent about these Chicago food items is that they are highly unlikely to be included as part of any traditional, healthy food pyramid. Furthermore, overconsumption of these local favorites inevitably leads to something I call the “Chicago body habitus.” *Men's Fitness*, a monthly magazine that promotes healthy lifestyles, annually publishes a list of the fattest and fittest cities in the United States. Although *Men's Fitness* does not have nearly as high of an impact factor as *Radiology* or *RadioGraphics* and its editors' insistence on using the word *fat* may be ill-advised in these politically correct times, it still makes darn fun reading. To the surprise of no one who lives within or near the 312 area code, *Men's Fitness* ranked Chicago as the United States' fattest city in 2006 (1). Those Chicagoans who are proud to be named number one in anything (ie, those constantly fighting the Second City moniker) will likely even boast that we are “number one with a bullet,” as we rose to

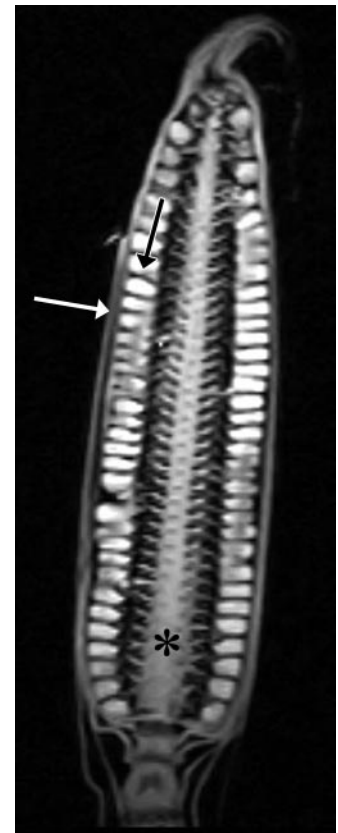


Figure 6. Corn on the cob. Uninfused sagittal T2-weighted MR image through the center of the corncob shows numerous well-circumscribed areas of increased signal intensity (black arrow) representing the individual corn kernels. The relatively fibrous inner cob (*) has comparatively less increased signal intensity. The entire corn ear is surrounded by a thick husk (white arrow).

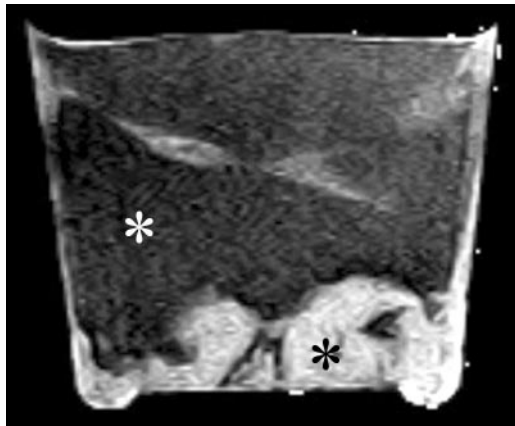


Figure 7. Six-ounce container of strawberry banana yogurt with fruit. Uninfused coronal T2-weighted MR image reveals the medium signal intensity of the yogurt itself (white *). The high-signal-intensity fruit, of which there is an obvious paucity, appears at the bottom of the container (black *).



Figure 8. Broccoli. Uninfused coronal T2-weighted MR image reveals the disgusting “tree-like” part (*) of this vile vegetable, as well as the equally unappetizing “leafy” portions (arrows).

the top spot, all the way from fifth place in 2005 (1). With this in mind, though, I do hope to encourage you to eat these classic Chicago foods in moderation, and there are indeed plenty of healthier alternatives available locally.

Tomatoes grow very well in our climate, and they are staples of most local gardens as well as fruit and vegetable stands. More important, the MR image of a tomato is beautiful, both for its

tissue contrast and exquisite detail (Fig 4). The anatomy and architecture of the tomato, down to the tiny peripheral vascular bundles, are superbly depicted.

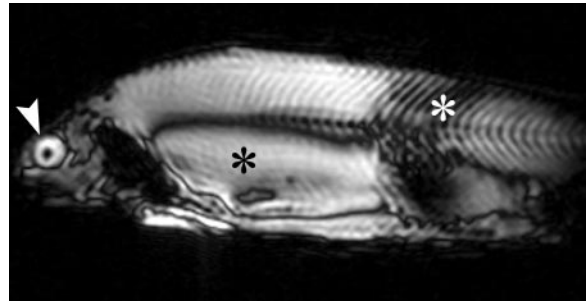
Apples are also plentiful in the Chicago area, with many orchards in the surrounding suburbs and outlying areas. Unfortunately, apples do not image nearly as well as do tomatoes (Fig 5). The water-rich contents of the inner cortex are less intense and more heterogeneous on T2-weighted MR images than would be expected. As the skin of the apple is known to contain many vitamins and minerals (including iron), perhaps this poor image quality is the result of a mild magnetic susceptibility artifact. I have not yet been able to prove my hypothesis as a direct cause-and-effect relationship. Nonetheless, I propose modifying the well-known adage to “an apple a day keeps the radiologist away,” as the MR image of an apple is really quite disappointing.

Many of you have likely heard the term *corn belt*. If you were not already aware of this, Chicago sits near the corn belt’s geographic center. Even nonfarmers like me are well aware of the phrase “knee high by the Fourth of July,” which describes the expected height of a cornstalk come Independence Day. Fortunately, corn is not only abundant locally, but—like tomatoes—it provides high-quality MR images (Fig 6).

Wisconsin—“America’s Dairyland” as their license plates proclaim—is literally a 90-minute drive north of here (60 minutes if you trust your radar detector and know where the speed traps are). Milk products are therefore very easy to obtain. Yogurt is one of the healthier dairy products, and it also images rather nicely (Fig 7). Unfortunately, on review of the MR image of yogurt, it quickly becomes apparent just how little fruit is actually in the container.

“I do not like broccoli. And I haven’t liked it since I was a little kid and my mother made me eat it. And I’m president of the Chicago Radiological Society, and I’m not going to eat any more broccoli.” Yes, that quote was stolen—I mean modified—from one famously given by the first President Bush (2), but I do completely share his sentiments. For better or worse though, broccoli is considered healthy, grows well in this climate, and images beautifully (Fig 8).

Figure 9. Rainbow trout. Uninfused sagittal T2-weighted MR image reveals the bright signal intensity of the fish musculature (black *). The fish is not perfectly linear with respect to the imaging plane, and the more peripheral scales (white *) become visible dorsally near the tail. Similarly, toward the head, the right eye (arrowhead) is seen. Removal of the fish's head before serving is advised but by no means required.



The Arie Crown Theater is literally a few feet away from Lake Michigan. It is the second largest of the five Great Lakes, and together they account for 20% of the fresh surface water on the planet Earth. Not surprisingly, freshwater fish is very easy to obtain locally. If you choose to ignore the relatively high mercury content found in all fish in the Great Lakes, they can be considered healthy eating as well. I personally prefer freshwater fish to be served without the head, but the eyes do image nicely (Fig 9).

Haute Cuisine

Chicago is one of the great restaurant cities in the United States, with many five-star dining establishments. Those RSNA meeting attendees who purchase a computed tomographic (CT) scanner, an MR imaging unit, or some other expensive hardware at the meeting might be taken by sales representatives to one of our finer eateries. Although there will surely be many wonderful menu items from which to choose, one particular French delicacy—foie gras—cannot be obtained legally within the city limits. You may be unaware of this prohibition, but the Chicago City Council made the purchase and sale of foie gras illegal as of August 2006. The literal French translation of this dish's name is “fatty liver,” with foie gras specifically being the fattened liver of a duck or goose. The “donor” animal must be force-fed to cause the necessary fatty hepatic metamorphosis, and

some people consider this process to represent animal cruelty.

A headline in the *Chicago Tribune* summed up the irony of the Chicago City Council's actions quite well: “City that winked at Prohibition now bans foie gras” (3). For those of you who are from other countries or too young to remember, Prohibition was a time in America's history (1920–1933) during which the U.S. Constitution declared the manufacture, transportation, and sale of alcoholic beverages to be illegal. Thanks in great part to a local citizen of that era, Al Capone, the taps never stopped flowing in Chicago's taverns during Prohibition. Capone and his associates ran a sophisticated smuggling operation, bringing in ethanol-enhanced beverages from Canada and elsewhere, which then quickly found their way throughout the region and were served in numerous “speakeasies.”

Strictly as a scientist and radiologist, I was very interested in studying foie gras. I was fortunate to make connections with one of Al Capone's great-great grandsons, who—for research purposes only of course—procured for me some of the forbidden fowl liver from the black market. Because of the aforementioned legal concerns, I and my research team ran a covert operation during which we gained access to my medical center's radiology department literally in the middle of the night to image this contraband. At T1-weighted MR imaging (Fig 10), foie gras does appear to have increased signal intensity, a finding that suggests but does not definitely prove the presence of fat. Desiring a more quantitative evaluation, we then

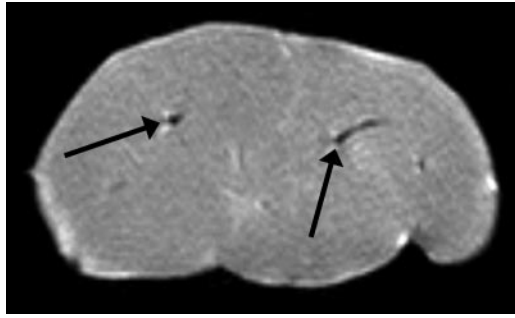


Figure 10. Foie gras. Uninfused axial T1-weighted MR image reveals diffusely increased signal intensity suggestive of, but not diagnostic for, the presence of fat. Signal voids are present within the hepatic vasculature (arrows).

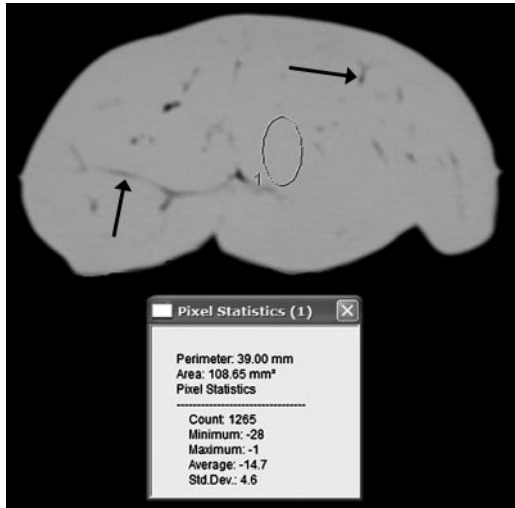


Figure 11. Foie gras. Uninfused axial multidetector CT image helps confirm fatty hepatic metamorphosis, as the attenuation within the oval ROI ranges from -28 to -1 HU (mean, -14.7 HU). There is very low attenuation in the portal vasculature (arrows), as there is no blood within this goose liver following force-feeding and procurement.

snuck the illicit material into our 64-channel multidetector CT scanner and performed a non-contrast study (Fig 11). Results of the region-

of-interest (ROI) analysis confirmed the average Hounsfield unit measurement to be less than 0, verifying the presence of fat. Therefore, whether you believe that foie gras is delicious or cruel, there can be no doubt that the force-feeding process works and that foie gras is indeed fatty liver.

Conclusions

As the RSNA 2006 meeting is now long over, I hope that my remarks can serve as a local food guide for those of you planning to attend the 2007 meeting. The theme for this year's RSNA meeting is "Connecting Radiology," which is an equally poor umbrella under which to place my lecture topic. Thankfully for the RSNA, I will not have the honor of speaking at the 2007 Opening Session. However, I will be attending the meeting, and I plan on doing two shows nightly. Please be sure to tip your wait staff.

Disclosures: I live and practice in the Chicago suburbs, where the sale, purchase, consumption, and imaging of foie gras remain entirely legal at this time. In addition, no leasing fees were paid in the course of obtaining images for this article.

Acknowledgment: I thank Debbie "Sure I Can Scan That For You, Dr. K" Krieter, RT(R)MR, for her willingness and ability to provide the highest quality images of both patients and food.

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