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Petition to the State Health Coordinating Council
Regarding Special Need for
Fixed Magnetic Resonance Imaging Equipment for Brunswick County
2016 State Medical Facilities Plan

July 29, 2015

Petitioner:		***Contact:***	
Name:	J. Arthur Dosher Memorial Hospital	**Name:**	Dan Porter, CFO
Address:	924 North Howe Street Southport, North Carolina 28461	**E-mail:**	danporter@dosher.org
		Phone:	910-457-3912

STATEMENT OF REQUESTED ADJUSTMENT

J. Arthur Dosher Memorial Hospital (Dosher), requests the following change to the *2016 State Medical Facilities Plan* (*SMFP*) to address a special need for Fixed Magnetic Resonance Imaging equipment (MRI) in Brunswick County:

- Modify the MRI Need Determination to reflect a special need in Brunswick County as follows :

  Add the following paragraph:

  > "In response to a petition from J. Arthur Dosher Memorial Hospital, an adjusted need determination for one fixed MRI replacement scanner in Brunswick County was approved. The applicant for the Brunswick Fixed MRI must be a licensed North Carolina acute care hospital with 24/7 emergency coverage that does not have current ownership of an MRI at the time the certificate of need application is filed. For purposes of the Special Need in Brunswick County, the Tiered Planning Threshold for a hospital replacement scanner is 1,716."

- Modify Table 9R as follows:

Table 9R: Fixed MRI Scanner Need Determination
(Scheduled for Certificate of Need Review Commencing in 2016)

It is determined that the service areas listed in the table below need additional fixed MRI scanner.

Service Areas	Replacement MRI Scanner Need Determination	Certificate of Need Application Due Date**	Certificate of Need Beginning Review Date
Brunswick County	1***	TBD	TBD

* *Need determination shown in this document may be increased or decreased during the year pursuant to Policy GEN-2 (see Chapter 4).*

** *Application due dates are absolute deadlines. The filing deadline is 5:30 p.m. on the application due date. The filing deadline is absolute (see Chapter 3).*

*** *Provided that in response to this need, a scanner should be located in a community acute care hospital with 24/7 emergency coverage that does not own, or whose parent company does not own fixed MRI equipment in this area.*

REASONS FOR THE PROPOSED ADJUSTMENT

BARRIER TO DOSHER MRI SERVICE

Designation of Contract Scanner as "Fixed"

As written, the Proposed *2016 State Medical Facilities Plan* (Plan) will prevent Dosher, a Critical Access Hospital, from owning a fixed MRI unit, even though Dosher has demonstrated capacity to support full time MRI service. Dosher offers MRI services by means of an 84-month lease with Alliance Imaging. That lease expires in April 2016. Without a change in the Plan, in order to continue offering MRI, Dosher has only one option, to contract with this out of state vendor for a "Grandfathered" MRI unit that is not subject to CON limitations. The arrangement is expensive, limits scheduling flexibility, and increases cost to payors.

"Critical Access Hospital" is a CMS designation for an acute care hospital with 25 or fewer beds that is located in a rural area, is approximately 35 minutes from the nearest other hospital, and offers 24/7 emergency care. Medicare and Medicaid reimburse for beneficiary service at these hospitals on the basis of their allowable costs. Other payors pay negotiated rates. Because the hospital provides essential services to an isolated area, Smithville Township voted to tax itself to underwrite hospital operations.

Table 9P in the Proposed 2016 SMFP shows 2.10 scanners for Brunswick County. The 0.10 scanner is a mobile owned by Alliance that serves a New Hanover Memorial Hospital physician practice one day a week in the northern part of the county. Novant Brunswick owns one fixed scanner. The remaining scanner is the Alliance scanner at Dosher. The Proposed Plan MRI methodology treats the leased Dosher scanner as if the lease were permanent and the scanner fixed, even though it operates part-time. By treating the Dosher scanner as a "fixed" rather than a part time or mobile unit, the Plan methodology moves Brunswick County to the threshold for a two-MRI scanner county.

By the Plan's methodology, two fixed scanners in the county means that the average number of adjusted scans per MRI must be 4,118 before the Plan shows need for an additional MRI scanner. The three locations in Brunswick County reported 5,338 adjusted scans in 2014. The methodology calculates the county average as 2,637 scans per Fixed equivalent scanner (5,338 divided by 2.10 equals 2,637). Thus the methodology shows no need for an additional scanner.

Alliance reported providing Dosher with only 1,104 hours of service for 2014[1]. Despite this limited schedule, Dosher successfully provided more than 1,200 adjusted MRI scans during that federal fiscal year. Present contract arrangements provide for only five-day service at an office four miles from the hospital, and do not guarantee full service on each service day. If no patients are scheduled in the afternoon, Alliance directs its staff to leave. If Dosher gets a call for service that afternoon, it must refer patients to another location, or work the patient into the schedule on a different day.

Because the vendor's techs are not hospital employees, the vendor can dismiss them at any time during the day and the hospital cannot call the techs back for emergency service, or assign them to other duties when the schedule has a void.

The 2016 Plan considers the Alliance scanner at Dosher "fixed" because it does not move to other locations, yet the contract allows Alliance to move the scanner at the end of the lease. Alliance's grandfathered arrangement allows the scanner to move anywhere in the state. The scanner at Dosher operates about one-third the time of a full-time scanner. The unit, it is, at best, only 30 percent available (1,104 hours / 3,432 hours required for a full time MRI)2. If the Dosher scanner were treated like other mobile units, the methodology would count it as 0.34, not 1.0 scanners.

If the plan considered the Alliance scanner at Dosher part-time, Brunswick County threshold would be the one-scanner threshold of 3,775 and the Plan would generate a need for one additional scanner in Brunswick County. The calculation is in Table 1 below. This approach, with the condition that the applicant be a community hospital that does not own an MRI scanner, is reasonable. If Dosher replaces the leased scanner, the number of scanners in the county will remain 2.10. Brunswick County will have two actual Fixed MRI's and one mobile. Notably, the Dosher lease with Alliance permits an exit if the Plan shows need for an MRI in the county.

[1] Alliance EIF, see Attachment D to this petition.

[2] 10A NCAC 14C .2701**.** 66 hours per week * 52 weeks per year = 3,432 hours

Table 1. Calculation of Brunswick County Need with Dosher MRI Treated as Part time/ Mobile

Location	2014 Adjusted Scans (a)	Fixed Equivalent Scanners at 3,775 Threshold (b)
Dosher	1,267	0.34
NHRMC	424	0.11
Novant	3,847	1
Brunswick County Total	**5,538**	**1.45**
Average Scans per Fixed Equivalent MRI units (c)		3,825
County Need Determination(d)		**1**

Note:

a. Data from Table 9P Proposed Plan

b. Threshold determined by Step 11, *Proposed 2016 SMFP* (pg163):

"Step 11: Determine the utilization threshold for the service area based only on the number of existing approved and pending fixed MRI scanners located in the service area as identified in Step 1: [emphasis added]

4+ fixed MRI scanners – 4,805 threshold
3 fixed MRI scanners – 4,462 threshold
2 fixed MRI scanners -4,118 threshold
1 fixed MRI scanner -3,775 threshold
0 fixed MRI scanners -1,716 threshold"

c. Total Brunswick Adjusted scans divided by total Brunswick Fixed Equivalent Scanners.

d. If c is greater than 3,775 show need for one scanner.

Treating the Alliance Dosher equipment as part-time/ mobile is reasonable. The Dosher equipment is not controlled by the location that bills for services; and the equipment can be relocated by its owner.

Unreasonable Threshold for Dosher Service Area

MRI is an essential non-invasive diagnostic tool, particularly for soft tissues and organs. When the State Health Coordinating Council (SHCC) adopted an MRI Tiered Threshold methodology in 2005, it graduated the average number of required weighted scans per scanner before triggering a need for another county scanner. The number of Fixed Scanners in the county provide basis for the graduation. In 2005, use rates for MRI were growing rapidly and the SHCC wanted a mechanism to both rationalize distribution of the technology and assure that community hospitals could obtain MRI scanners. For most hospitals and communities, the SHCC achieved its goal. Brunswick County is an exception.

Brunswick and Dosher are unique in many ways. The county's official population of 122,000 does not include the part time residents who are there from April through December. The county has geographic features that isolate the Southport area, where Dosher is located, from other parts of the county. The county is one of the fastest growing and its people are among the state's oldest.

The petition's reduced threshold is needed for reasonableness in this rural county. Even with the older and part time residents, the Dosher hospital service area will not likely generate either 3,775 or 4,118 adjusted MRI scans in three years. With part time service in 2014, Dosher provided 1,267 scans at a site four miles from the hospital that is effectively in service one third of the time. Data from DHSR Hospital License Renewal Forms in Attachment E show that Brunswick residents received 6,227 scans in 2014. Some outmigration will continue even with full time service at Dosher. Expecting Dosher to provide 1,776 adjusted scans, an increase of 40 percent when the service goes from one-third time to full time is reasonable.

GRANDFATHERED MRI ISSUES

More than two decades ago, before MRI was subject to CON approval, Alliance Imaging, now Alliance Radiology (Alliance) procured authorization for "grandfathered" status for 20 MRI units. These units can be mobile or fixed as long as Alliance operates the service. They can go anywhere in the state.

While not intended, the Proposed *2016 SMFP* holds Dosher hostage to a cost-escalating contract with that one vendor. The arrangement limits access and competition, increases cost, and poses quality challenges. The Proposed 2016 Plan offers solutions only in the case where Plan specifically identifies a need.

- Chapter 9, MRI Basic Assumption # 4 (pg. 146 in 2015) states that, "a facility that offers MRI services on a full-time basis pursuant to a service agreement with an MRI provider is not precluded from applying for a need determination in the North Carolina *2016 SMFP* to replace the existing contracted service with a fixed MRI scanner under the applicant's ownership and control."
- However, this Basic Assumption requires that the Proposed *2016 SMFP* first show a need in the MRI Service Area in question. Otherwise, there is no mechanism by which a hospital can successfully replace a contracted MRI service with a full-time owned fixed MRI service.

J. Arthur Dosher Hospital (Dosher), in Southport, has MRI service pursuant to a service agreement, because the vendor, Alliance, took advantage of the CON statute before 1993. Before March 1993, CON review did not apply to purchase of MRI equipment. Entities that could show intent to acquire equipment before 1993, received "grandfathered" status. Today, owners of those units can replace or locate them anywhere in the state, independent of CON restrictions. In 2008, the Agency permitted owners of these grandfathered units to park them in permanent structures, provided the vendors retain ownership of the equipment and staff the service; and in 2009, Alliance parked a unit at Dosher. Dosher does scheduling, billing and is responsible for contrast agents. Alliance provides equipment and MRI technical staff.

Attempts to negotiate a reasonable arrangement to purchase the MRI when the lease expires have yet to produce reasonable proposal. Proposals with reasonable costs restrict the equipment or the software that operates it, or keep the current location. The lease can be extended and it can transition to Dosher ownership if the SMFP shows need for an MRI in Brunswick County. Dosher is asking assistance with the transition.

New Hanover Regional Medical Center, Novant Brunswick Medical Center, and Wilmington Health Alliance, all of which benefit from Dosher referrals, support the request for a Dosher-owned MRI. Physicians support the request. (See Attachment F.) Only one party, the service vendor, opposes it.

The contract with Alliance provides that it will not oppose a Dosher CON application if the Plan shows a need.

BRUNSWICK COUNTY SERVICE AREA AND METHODOLOGY ISSUES

Brunswick County is the sixth largest county in the state, with a land area of 847 square miles. The county effectively functions as three hospital service areas, with the north orienting to Wilmington, southeast to Southport and southwest to Bolivia. New Hanover Regional MRI services the Leland area in the north; the MRI at Novant-Brunswick services Bolivia and parts southwest; and the MRI at Dosher services Southport and southeastern Brunswick County.

The Green Swamp and other flood prone low-lying areas make much of the western quarter of the county uninhabitable and at times impassable. The population generally follows three road systems: Highway 17 going through the west from South Carolina border to Wilmington. Highway 133 going from Wilmington to Southport and the southern beaches and Highway 211 connecting 133 and 17 along the south. Dosher serves the southeast and Novant Brunswick serves the southwest. A rural road system, and heavy military, shipping and tourist traffic can extend travel time between Dosher and the other two hospitals from 20 minutes to 90 in times of heavy traffic.

According to the NC Office of State Budget and Management, Brunswick is the second fastest growing North Carolina County, with only Mecklenburg growing faster between 2010 and 2014. OSBM data show Brunswick growing at a rate of 2.5 percent a year, adding 12,363 people between 2015 and 2019.

Table 2. Brunswick County Population Estimates

	July 2015	July 2016	July 2017	July 2018	July 2019
Brunswick County	121,581	124,672	127,761	130,853	133,944

Source: NCOSBM County Estimates 2010 -2109

With a median age of 49, it is among the top five oldest counties in the state. Its large tourist population associated with its long coastline, most of which is in the area Dosher serves, is not included in any state or US Census population counts. Yet they live in the county as much as nine months of the year.

Figure 1. Brunswick County North Carolina

Making MRI ownership possible for Dosher requires that the *2016 SMFP* include both a need in Brunswick County and an attainable and reasonable MRI threshold.

Even with the temporary seasonal residents, Brunswick County is too small for the MRI Methodology to generate a need to justify three fixed MRI scanners in the *2016 SMFP*, or in future SMFPs. It is certainly too small to justify 4,118 scans in the service area of a replacement scanner. Yet, without modification in this special need, the 2016 MRI Methodology and related Special Rules in 10A NCAC 14C .2703 (b)(3) and 10 NCAC 14C .2701(13) would mandate that performance standard. The Special Rules would change if the *2016 SMFP* wording changes.

If the *Proposed 2016 SMFP* includes a special need for an eligible hospital in Brunswick County, and does not reduce the required MRI threshold for this special need, the applicant would have to demonstrate that it could provide 4,118 scans in the third year of operation. This is not reasonable. The Methodology's lowest Tiered MRI Procedure Threshold is 1,716 weighted scans for a service area that has no fixed MRI scanner. Because of the Brunswick geography, the Southport area is like a county with no fixed MRI scanner. Without the current lease, Dosher would have no scanners. Thus, for this special need determination, a 1,716 threshold should apply for a scanner that is replacing a service agreement scanner at a community hospital that otherwise would have no scanner.

MISSED COST SAVINGS

Medicare and Medicaid pay for critical access hospitals on costs to serve Medicare and Medicaid beneficiaries. Commercial insurers pay negotiated rates. Under the cost-based payment arrangement, Medicare and Medicaid will pay less per scan as the number of scans increase. Moreover, if Dosher locates the scanner at the hospital instead of the outpatient center four miles away, the health care system would save an additional $650, the round trip cost to transport patients by ambulance to the current offsite MRI. Patients and payors would benefit from the proposed change. Dosher absorbs the inpatient and emergency cost.

An internal analysis of operating costs showed that if Dosher owned rather than contracted with Alliance for MRI services, it could break even with as few as 900 annual scans.

A comparison of direct costs based on Dosher's 1,180 scans in 2014, shows that, even with borrowing to finance the acquisition, Dosher would save $129 per scan, passing many of these cost savings to the payer.

Table 3. Cost per Scan Comparison at 2014 Dosher Volume

Alliance cost (**excludes** billing, scheduling, medical supplies, and building overhead)	$554
Estimated comparable Dosher cost **with** borrowing	$425
Savings	***$129***

Source: Dosher MRI pro forma analysis updated March 2015

Without a Special Need adjustment, Dosher will be held hostage to a single vendor and whatever charges and service arrangement that vendor chooses to impose. The present CON arrangement requires that the vendor control both equipment and staff. Thus, when the vendor decides to cancel service mid-day, because no patients are on the schedule for the afternoon, the hospital loses emergency coverage for the day. Moreover, the hospital cannot schedule convenient after hour procedures.

In order to align the MRI Chapter with the spirit of the MRI Basic Assumptions and the Basic Principles of the *SMFP*, the *2016 SMFP* should provide an option for Brunswick County to enjoy a cost-effective replacement of this particular service arrangement MRI equipment. Because of its unique geography, the 2016 Plan should permit both Brunswick County community hospitals to offer this critical diagnostic service.

STATEMENT OF ADVERSE EFFECTS ON PROVIDERS AND CONSUMERS IF THE ADJUSTMENT IS NOT MADE

The Proposed 2016 MRI Policy and Methodology adversely affect Dosher and people in its service area. They tie Dosher to an MRI services agreement that has inherent obstacles to providing good customer service. Alliance controls operations, including staffing and schedules. The MRI is not located on the hospital main campus, and is not easily accessible to the Dosher hospital campus. As a result, physicians and emergency providers direct many hospital service area patients out of the county rather than risk delays associated with obtaining an MRI scan. Of those who stay in the county, Dosher records show that last year, 40 patients had the $650 cost for emergency ambulance transport between hospital and the off-site MRI.

Without the proposed adjusted need determination, Dosher has only one option to replace the equipment: the vendor must agree to sell it. This would still require a CON. Without a change, residents of southeastern Brunswick must wait until calculations in a future *SMFP* show that Brunswick County needs three full time scanners within the county. Under the current Plan methodology, that event will not likely occur for years.

Failing to approve this petition for adjusted need determination would:

- Contradict the SMFP's "Basic Principles" of encouraging safety and quality, access, and value;
- Restrict choice in mechanisms for reducing MRI cost or upgrading equipment;
- Provide no opportunity to bring the MRI equipment inside the hospital, because service agreement vendor would ask the hospital to absorb the cost of the relocation, without the guarantee of permanent equipment;
- Perpetuate limit hospital direct supervision of and integration with MRI technology staff because of CON requirement that the owner of the grandfathered unit must provide the staff.
- Unintentionally cause an extra $650 per procedure cost for transport of hospital inpatients and emergency room patients by ambulance to and from MRI site, approximately four miles.
- Limit Dosher's control over options for increasing hours of service because vendor contracts require guaranteed service minima.
- Restrict hours of service for a unit the Plan deems as "fixed."

STATEMENT OF ALTERNATIVES CONSIDERED AND FOUND NOT FEASIBLE

OVERVIEW

Dosher considered and rejected:

- Status quo
- Waiting for the current methodology to show a need in the county
- A change in the Statewide methodology
- Dropping MRI service all together
- Acquire the "Grandfathered" unit

STATUS QUO

The status quo is cost prohibitive and less than optimal for patient care. The present arrangement limits service, because the scanner is located outside and geographically separate from the inpatients and emergency room patients. Although many MRI's are outpatient, MRI still performs an important role in emergency care.[3, 4] Dosher had 13,490 emergency room visits in 2014. Moreover, under current arrangements, when no patients are on the afternoon schedule by noon, vendor staff leaves. Same day afternoon patients must wait to the next day, or go out of the area.

Adding service hours under the current MRI lease arrangement requires the hospital to negotiate with the vendor. The contract scale is such that as volumes increase, all profits flow to the vendor. It was ideal for start-up, but not now, because the volume is sufficient to support a full time service. Cost to Dosher increases annually and the vendor provides no discounts associated with volume increases. New contract renewal offers either restrict the hospital to the 1.5 tesla narrow bore equipment with no software upgrades, or restrict the MRI to the existing location, or provide new equipment at the hospital at costs far in excess of what it would cost the hospital to operate the service on its own.

Status quo is not a reasonable alternative.

WAIT FOR THE CURRENT METHODOLOGY TO SHOW NEED AND APPLY

The graduated scale in the current *SMFP* MRI Methodology would require that Brunswick County go from 5,538 adjusted total scans in FY 2014 to 8,648 scans (2.10 * 4118 = 8,648)[5] to receive a need determination for a new MRI. That would require every MRI done on county residents to stay in the county. This is not reasonable. Even with its rapid growth and aging, Brunswick County's population will not reasonably produce this level of MRI demand for many years.

[3] Weber, Marc-André , Biederer, J, Heidelberg University Hospital Magnetom Flash,Siemens, 2/2013

[4] Vogel-Claussen, J et al, Comprehensive Adenosine Stress Perfusion MRI Defines the Etiology of Chest Pain in the Emergency Room: Comparison with Nuclear Stress Test. J Magn Reson Imaging, 2009Oct 30®:753-762.

[5] Brunswick County has 2.16 full time equivalent scanners according to the Proposed *2016 SMFP,* Table 9P

Furthermore, in this scenario, Dosher, or any applicant, would find it extremely difficult, if not impossible, to reasonably project the required number of scans to justify the equipment. The rules design support the Methodology, and would require Dosher to forecast 4,118 weighted scans in the third year of MRI operation. Dosher provided 1,267 weighted scans in 2014.

Clearly, even with better schedule and access, waiting is not a reasonable alternative. Alternatively, with a fixed MRI at the hospital operating more days and more hours, it is reasonable for Dosher to forecast 1,716 weighted scans by the third year. The modest growth required to meet the threshold will likely come from patients forced to use an alternative to MRI, or those who received service out of area.

REVISE THE STATE METHODOLOGY

Dosher requested a change in the State Methodology to permit hospitals that have fixed MRIs under service contracts, or suggested changes to permit hospitals that demonstrate capacity to generate 883 or more weighted MRI procedures to apply for a fixed MRI. At its June 3, 2016 meeting, the State Health Coordinating Council denied the request.

ACQUIRE THE GRANDFATHERED MRI

Dosher considered and explored the option of acquiring the grandfathered MRI from the current vendor, Alliance. With no contracting leverage, the hospital has no negotiating room and has been unable to find a contract it can accept.

DROP MRI SERVICE ALTOGETHER

Removing MRI services altogether would not only require ambulatory MRI patients to travel 30 to 90 minutes to an MRI in Wilmington or Bolivia, it would eliminate the possibility that Dosher could provide MRI services to inpatients and emergency patients. This option would create delays in care and increase costs. This is not a reasonable alternative.

PURSUE A SPECIAL NEED ADJUSTMENT

A special need adjustment for Brunswick County as described here is the only remaining way for residents of southeastern Brunswick County to have a permanent MRI scanner under hospital ownership.

EVIDENCE OF NON-DUPLICATION OF SERVICES

Because the proposed change involves substitution of equipment, the proposed change would not involve duplication of services in Brunswick County service area. Neither the applicant nor the contracted MRI service vendor would retain the replaced MRI unit in the service area.

The lapsed contract would provide important access options. It would put the grandfathered MRI unit back in play outside the affected service area. The grandfathered unit can respond to growing demand in larger markets anywhere in the state. A party seeking to take advantage of this scanner would do its own homework to justify the cost of the service contract. . In today's environment of heavy radiology oversight by review organizations, any party proposing a new MRI location will consider costs carefully.

Moreover, there are opportunity areas. MRI service areas match the acute care service areas in the Proposed *2016 SMFP*. According to the draft 2016 SMFP MRI tables, three MRI service areas, Bertie, Swain, and Stokes, have no MRI (Avery County is also listed as having no service but Alliance reports service to Cannon Memorial Hospital on its 2015 Equipment Information Forms). Each of these counties has a hospital without MRI service. One of the two new hospitals in Hoke County has no MRI. The MRI methodology also includes a number of multi-county service areas in which only one county contains all of the MRI service. As a result, there are 18 total counties in NC without MRI service.

Permitting replacement of this unique contracted grandfathered scanner would increase the statewide inventory of MRI equipment by only one, a change of less than one percent in the total inventory (1/261 = 0.38%). Consistent with rules for Replacement Equipment in 10A NCAC 14C .0303, the affected vendor of the replaced mobile unit would be required to remove the replaced equipment from the service area in question. The vendor would have the option to locate the equipment to a new service area. Because it is a grandfathered unit, the Alliance MRI at Dosher is not subject to CON limitations on location, and could relocate anywhere in the state.

EVIDENCE OF CONSISTENCY WITH NORTH CAROLINA STATE MEDICAL FACILITIES PLAN

BASIC GOVERNING PRINCIPLES

1. Safety and Quality

This basic principle notes:

> "*…priority should be given to safety, followed by clinical outcomes, followed by satisfaction.*
>
> *"…As experience with the application of quality and safety metrics grows, the SHCC should regularly review policies and need methodologies and revise them as needed to address any persistent and significant deficiencies in safety and quality in a particular service area*."

In the field of MRI, quality metrics are associated with the strength of the magnetic field, heat generated as magnetic strength increases and the heat impact on human tissue. Other metrics relate to assuring that the magnetic field associated with the MRI will not have an adverse impact on implants and other ferrous materials in the vicinity of the equipment.

Radiologists are studying appropriateness criteria and trying to develop metrics for such topics as exam appropriateness related to patterns of exam ordering, dose, adverse events, and communication time, and appropriateness of substituting x-ray or SPECT for MRI when MRI is not available.[6] Recent research favors MRI. Metrics for defining appropriate population utilization levels for MRI are under study, but the question of how much is appropriate remains unresolved.

Most of these relate to operation of the MRI. The one that emphasizes the importance of having MRI available to emergency rooms would support the arguments in this petition.

2. Access

This basic principle notes:

> "*…The first priority is to ameliorate economic barriers and the second priority is to mitigate time and distance barriers.*
>
> *"…The SHCC planning process will promote access to an appropriate spectrum of health services at a local level, whenever feasible under prevailing quality and value standards."*

The proposed changes would benefit a rural, publicly funded hospital and its service area, would promote economic efficiency, and enable the hospital to bring the MRI on the hospital main campus close to the inpatients and its emergency department.

[6] Yeager, David, Quality Metrics – Forward-Looking organizations Are developing Their Own Performance Measures, Radiology Today, Vol 15 No7(12) , July 2014 http://www.radiologytoday.net/archive/rt0714p12.shtml

3. Value

This basic principle notes:

> *"The SHCC defines health care value as the maximum health care benefit per dollar expended.*
>
> *"…Cost per unit of service is an appropriate metric…*
>
> *"…At the same time overutilization of more costly and/or highly specialized low-volume services without evidence-based medical indication may contribute to escalating health costs without commensurate population-based health benefit."*

The proposed changes will have minimal impact on the statewide count of MRI technology, but will enable substitution of a less costly for a more costly service without placing unnecessary pressure on a health care provider to increase utilization.

CONCLUSION

The proposed changes are consistent with and support the Basic Principles that govern the *SMFP*.

ATTACHMENTS:

Attachment A

Comprehensive Adenosine Stress Perfusion MRI Defines the Etiology of Chest Pain in the Emergency Room: Comparison with Nuclear Stress Test

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Comprehensive Adenosine Stress Perfusion MRI Defines the Etiology of Chest Pain in the Emergency Room: Comparison With Nuclear Stress Test

Jens Vogel-Claussen, MD,[1,*] Jan Skrok, MD,[1] David Dombroski, MD,[1] Steven M. Shea, PhD,[2] Edward P. Shapiro, MD,[3] Mark Bohlman, MD,[1] Christine H. Lorenz, PhD,[2] Joao A.C. Lima, MD, MBA,[1,3] and David A. Bluemke, MD, PhD[1,4]

[1] Johns Hopkins University School of Medicine, Russell H. Morgan Department of Radiology and Radiological Science, Baltimore, Maryland
[2] Siemens Corporate Research, Inc., Imaging and Visualization, Princeton, New Jersey
[3] Johns Hopkins University School of Medicine, Department of Cardiology, Baltimore, Maryland
[4] National Institutes of Health, Department of Radiology and Imaging Sciences, Bethesda, Maryland
[*] Address reprint requests to: J.V.-C., Johns Hopkins University, Department of Radiology, Nelson Basement MRI 143, 600 N Wolfe Street, Baltimore, MD 21287. Email: jclauss1@jhmi.edu

Abstract

Go to:

Purpose

To compare standard of care nuclear SPECT imaging with cardiac magnetic resonance imaging (MRI) for emergency room (ER) patients with chest pain and intermediate probability for coronary artery disease.

Materials and Methods

Thirty-one patients with chest pain, negative electrocardiogram (ECG), and negative cardiac enzymes who underwent cardiac single photon emission tomography (SPECT) within 24 h of ER admission were enrolled. Patients underwent a comprehensive cardiac MRI exam including gated cine imaging, adenosine stress and rest perfusion imaging and delayed enhancement imaging. Patients were followed for 14 ± 4.7 months.

Results

Of 27 patients, 8 (30%) showed subendocardial hypoperfusion on MRI that was not detected on SPECT. These patients had a higher rate of diabetes ($P = 0.01$) and hypertension ($P = 0.01$) and a lower global myocardial perfusion reserve ($P = 0.01$) compared with patients with a normal cardiac MRI (n = 10). Patients with subendocardial hypoperfusion had more risk factors for cardiovascular disease (mean 4.4) compared with patients with a normal MRI (mean 2.5; $P = 0.005$). During the follow-up period, patients with subendocardial hypoperfusion on stress MRI were more likely to return to the ER with chest pain compared with patients who had a normal cardiac MRI ($P = 0.02$). Four patients did not finish the MR exam due to claustrophobia.

Conclusion

In patients with chest pain, diabetes and hypertension, cardiac stress perfusion MRI identified diffuse subendocardial hypoperfusion defects in the ER setting not seen on cardiac SPECT, which is suspected to reflect

microvascular disease.

Keywords: adenosine stress perfusion cardiac MRI, emergency room, chest pain, microvascular disease

The evaluation and triage of patients with chest pain is a common challenge for emergency room (ER) physicians. Fast and accurate assessment of myocardial ischemia in a patient presenting to the ER with chest pain is an essential component for further diagnostic and therapeutic decision making. Analysis of electrocardiograms (ECG) and cardiac enzymes are the first line tests to "rule out" acute myocardial infarction (1). In patients with a negative ECG, negative cardiac enzymes and an intermediate probability for coronary artery disease (CAD), nuclear stress perfusion tests (single photon emission computed tomography, SPECT) are well established means to evaluate for stress induced myocardial ischemia (2,3).

New technical developments over the past decade allow a comprehensive cardiac MRI examination, which includes myocardial perfusion, function, and viability assessment (4,5). Stress perfusion with MRI is an emerging noninvasive method for the evaluation of myocardial ischemia (6–9). Myocardial scar imaging with MRI aids in identifying small subendocardial myocardial infarctions that are not seen by cardiac SPECT (10). Furthermore, cardiac SPECT exposes the patient to 17–20 mSv of ionizing radiation (11) that is not present with MRI.

Some patients presenting to the ER with chest pain likely of cardiac origin may not have flow limiting stenosis of the coronary arteries, but instead have small vessel or other cardiac disease that could potentially be identified by MRI (12–14). Therefore, the aim of this study was to compare standard of care nuclear SPECT imaging with cardiac MRI for the evaluation of emergency room patients with chest pain and intermediate probability for coronary artery disease.

Materials and Methods

Go to:

Study Population

During a 12-month period, we prospectively and consecutively enrolled ER patients with chest pain, scheduled for a clinical cardiac SPECT who had negative cardiac enzymes and no signs of acute ischemia on ECG. The exclusion criteria were an internal pacemaker, defibrillator, positive cardiac enzymes, or contraindications for adenosine infusion. This study was approved by the institutional review board, and written informed consent was obtained from all patients.

Patients with a history of prior myocardial infarction and cardiac surgery were included in the study. All beverages containing caffeine were stopped at least 12 h before MRI examination.

Study Protocol

The MRI examination was performed within 24 h of presentation to the ER and within three hours of the nuclear SPECT stress test. During the MRI exam, blood pressure and ECG were monitored. Cardiovascular risk factors such as hypertension, diabetes mellitus, hypercholesterolemia, smoking, and family history of CAD were assessed. All patients were followed to assess for cardiac events for an average time period of 14 ± 4.7 months after noninvasive cardiac testing.

MR Imaging

Cardiac MRI was performed at 1.5 Tesla (T) (Siemens Avanto, Erlangen, Germany). A 6-element body matrix coil and 6 elements of a 24-element spine matrix coil were used for signal reception. For functional analysis, retrospectively ECG-gated steady state free precession (SSFP) cine MRI was performed in the short and long axis planes. The temporal resolution was 40 ms, with a slice thickness of 8 mm and 2-mm gap between slices on short axis images.

For the stress perfusion MRI, adenosine (Astellas Pharma US, Inc, IL) was infused intravenously at a rate of 140 (μg/kg per min over 6 min. At four minutes into the adenosine infusion, stress perfusion MRI was obtained with a Saturation Recovery (SR) SSFP sequence. Scan parameters per slice for the SR-SSFP perfusion images were repetition time/echo time (TR/TE) 2.4 ms / 1.0 ms, SR time 180 ms, flip angle 50°, FOV 36 × 27 cm, matrix 192 × 115, acquisition duration 150 ms, slice thickness 8 mm, and an acceleration factor of 2 (GRAPPA). Gadopentetate dimeglumine (Magnevist®, Bayer, Schering, Berlin, Germany) was injected at 5 cc/s followed immediately by a 20 cc of normal saline flush at 5 cc/s for the rest and stress perfusion MR images (0.075 mmol/kg each for rest and stress MR imaging, 0.15 mmol/kg total dose). Three evenly spaced short axis slices and one horizontal long axis slice were acquired with a temporal resolution of two ECG R-to-R intervals to cover the entire left ventricle for each patient. After 10 min, the perfusion examination was repeated to obtain rest perfusion images.

Following a delay of 5 to 10 min after rest perfusion imaging, gradient echo delayed enhancement (DE) MRI was obtained using an inversion recovery technique with nulling of the normal myocardium. Scan parameters per slice for the DE MRI were TR/TE 5.4 ms / 3.0 ms, flip angle 20°, field of view (FOV) 36 × 27 cm, matrix 256 × 160, slice thickness 8 mm with 2-mm spacing between each slice. Short axis images were acquired as well as one horizontal long axis image to cover the entire heart.

In addition, coronary sinus flow measurements were obtained at rest and during adenosine stress using breath hold two-dimensional (2D) phase contrast MR imaging as described by Koskenvuo et al in detail (15). The entire protocol was completed within 60 min.

SPECT Myocardial Perfusion Test

All patients underwent routine SPECT myocardial perfusion imaging using Tc^{99} sestamibi for rest and stress imaging. Of the 27 included patients, 13 underwent symptom-limited treadmill exercise testing (Bruce Protocol), 13 underwent a dobutamine stress protocol, and for 1 patient, adenosine stress protocol was used. Because the SPECT exam was part of the clinical routine, the type of stressor could not be influenced by the study team members. The SPECT exam is accepted as the clinical gold standard at our institution. Dobutamine was infused in incremental doses, starting at 5 μg/kg/ min for 3 min with increases to 10, 20, 30, and 40 (μg/kg/min until the stress end point was reached (e.g., target heart rate, chest pain with ECG changes, or hypotension). One patient received adenosine stress testing, with an identical stress regimen compared with the MRI stress protocol. Myocardial SPECT perfusion studies were performed using technetium 99m-sestamibi at rest and in the postexercise state according to widely accepted guidelines (16). The high-count rest scans were acquired as gated-SPECT studies (8 frames per cardiac cycle), and the left ventricular ejection fraction as well as end-diastolic volume were calculated.

Coronary Angiography

Patients with a positive SPECT and / or MRI stress test for reversible myocardial ischemia underwent conventional coronary angiography (n = 4) or coronary multi-detector computed tomography (n = 1) using a 256 detector scanner (Toshiba Aquilion, Japan). All angiography examinations were completed within 30 days (mean 15.5 ± 16.9 days) of the initial ER presentation.

MRI Analysis

Two experienced cardiac MRI physicians who were blinded to patient history (JVC and DD) evaluated all MRI studies separate from each other. If there was disagreement between the two readers, the cases were reviewed together and interpreted in consensus.

The analysis of the MRI perfusion examination was performed visually, as previously reported (17). We compared stress with rest perfusion to reduce the potential rate of artifacts. If a deficit was equally present at stress and rest, if it did not follow the subendocardial border, if ghosting artifacts could be seen or if it “blinked” bright and dark it was not regarded as an evident hypoperfusion, but as a potential artifact. Patients were classified according to

following criteria as previously described similarly by Pilz et al (13): (1) Patients with a reversible regional perfusion deficit in a coronary artery territory, lasting for more than six heart beats under adenosine stress, and without evidence of DE were classified as having significant obstructive CAD. (2) Patients with DE due to ischemic scar, history of coronary stent placement or coronary artery bypass graft without stress induced reversible perfusion deficit were categorized as "significant large vessel disease without reversible ischemia". (3) Patients with diffuse stress induced subendocardial hypoperfusion (<1/2 of the myocardial wall thickness) in at least two different coronary artery territories or circumferentially lasting for up to six heartbeats after the time of maximal signal peak intensity in the left ventricle were classified as having "small vessel disease" (13). (4) Patients without ischemic or nonischemic cardiac MR findings were categorized as "normal".

For the analysis, groups 1 and 2 were combined to a "large vessel disease" group. Additionally, other noncoronary findings that could explain the patients' chest pain were recorded.

Coronary sinus flow volumes in mL/min were calculated at rest and adenosine stress using dedicated flow software (Medis®, Netherlands). The coronary sinus was traced on the magnitude images. To compensate for the through-plane motion, a second region of interest was determined for each phase image on the myocardial tissue close to the vessel.

Coronary sinus blood flow (mL/min) was calculated by summing the flow per cardiac phase over the cardiac cycle and multiplying by the heart rate during the measurement. Coronary flow reserve was calculated by dividing the ratio of hyperemic to baseline coronary sinus flow.

SPECT Myocardial Perfusion Test

Cardiac SPECT studies were interpreted by an experienced nuclear medicine physician as part of routine clinical care for the patient. For this interpretation, the physician had access to the patients' medical records but not to the MRI results. Presence or absence of reversible or nonreversible stress induced perfusion deficits was recorded.

Statistical Analysis

Data are reported as mean ± standard deviation. The data were compared using Fisher's exact test or a two-tailed Wilcoxon signed rank test for matched pairs. In all cases, a P value < 0.05 was considered statistically significant. Interobserver agreement was measured using kappa statistics. Analyses were performed with commercially available statistic software (JMP®, SAS Institute, Cary, NC). The authors had full access to the data and take responsibility for its integrity.

Results

Go to:

Thirty-one patients were enrolled who were referred for SPECT stress test within 24 h after presentation with chest pain. Four patients (13%) were claustrophobic and did not complete the MRI exam. They were excluded from further analysis. The mean age of the remaining 27 patients (15 male) was 56.3 ± 13.2 years (Table 1). Five of 27 (19%) had a prior coronary revascularization procedure (one stent, four coronary artery bypass grafts).

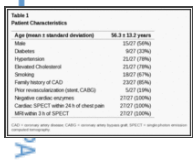


Table 1

Patient Characteristics

Image quality was sufficient for analysis in all patients, with reader consensus in 24/27 cases (kappa = 0.70). Of 27 patients, 8 (30%) showed diffuse subendocardial hypoperfusion with adenosine stress. Five of 27 patients (19%) had reversible large vessel ischemia on MRI (Fig. 1), confirmed by a ≥ 70% stenosis on angiography. One patient had both small and significant large vessel reversible ischemia.

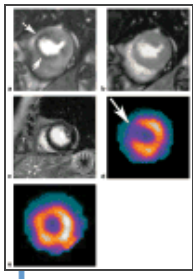


Figure 1

Short axis first pass adenosine stress perfusion MRI image shows a perfusion defect in the anterior-septal left ventricular wall (**a**, arrows), which is reversible at rest (**b**). Short axis delayed enhancement MR image shows no evidence of myocardial infarction **...**

All eight patients with subendocardial hypoperfusion on MRI (Fig. 2) were normal on cardiac SPECT. Of the five patients showing large vessel reversible ischemia on MRI, two patients also had corresponding transient ischemia on SPECT (Table 2). Of the three cases not detected by SPECT, two had a prior coronary artery bypass graft (CABG), one did not reach the target heart rate, and one had significant triple vessel disease (Table 2). Of 27 patients, 4 (15%) had an ischemic scar on MRI (Fig. 3). One patient had a small subendocardial scar that was not detected on SPECT.

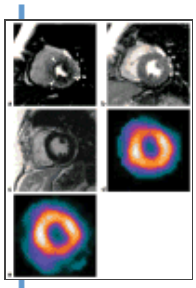


Figure 2

Short axis MR images (a–c) in a 53-year-old female with five traditional cardiac risk factors, chest pain, and negative cardiac enzymes show diffuse transient subendocardial hypoperfusion on the adenosine stress first pass perfusion image (**a**), **...**

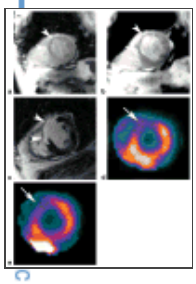


Figure 3

Short axis MRI images of a 75-year-old male patient with an old myocardial infarction and chest pain in the emergency room show thinning of the anterior septal wall with decreased first pass perfusion at adenosine stress (**a**), which persists at rest (**...**

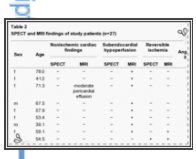


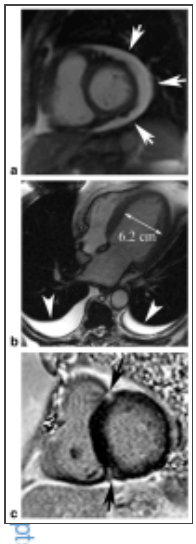
Table 2

SPECT and MRI findings of study patients (n=27)

Of 27 patients, 14 (52%) did not have small or large vessel disease on MRI and were also normal on SPECT. Of these 14 patients, 4 (29%) had nonischemic myocardial disease on MRI (Fig. 4), which was not detected on SPECT and may have contributed to the patients' chest pain: delayed enhancement at the right ventricular attachment site in a patient with pulmonary artery hypertension, moderate aortic regurgitation, mitral valve replacement with concomitant mitral valve stenosis, and alcohol related nonischemic cardiomyopathy (Table 2). One patient with subendocardial hypoperfusion also had a moderate pericardial effusion not identified at SPECT imaging.

Figure 4

Nonischemic cardiac findings identified on cardiac MRI in patients presenting with chest pain. **a**: Moderate pericardial effusion; (**b**) dilated nonischemic cardiomyopathy with absent LV scar (not shown), bilateral pleural effusions (arrowheads); (**c**) delayed **...**



Risk Factor Analysis

Patients with subendocardial hypoperfusion and the patient group with large vessel disease on MRI had a higher number of risk factors for cardiovascular disease (mean 4.4 and 4.0, respectively) compared with patients with a normal cardiac MRI (mean 2.5; $P = 0.005$ and $P = 0.03$, respectively). The group with large vessel disease (mean age, 58.9 ± 8.2 years) was significantly older compared with the group with normal MRI (mean age, 48.5 ± 8.9 years; $P = 0.01$).

Patients with subendocardial hypoperfusion had a significantly higher rate of diabetes ($P = 0.01$) and hypertension ($P = 0.01$) compared with patients with a normal cardiac MRI (Table 3). The majority (75%) of patients with subendocardial perfusion defects were women.

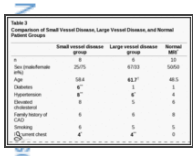


Table 3

Comparison of Small Vessel Disease, Large Vessel Disease, and Normal Patient Groups

Patients with subendocardial hypoperfusion had a significant lower coronary flow reserve (1.9 ± 0.44) assessed by coronary sinus flow measurements compared with patients with a normal perfusion MRI (3.0 ± 0.88; $P = 0.01$). The age of patients with normal MRI was not significantly different from that of patients with subendocardial hypoperfusion (48.5 ± 8.9 years versus 58.4 ± 13.8 years; $P = 0.17$).

Event Ascertainment

All patients were followed for an average period of 14 ± 4.7 months. During this time, there were no deaths, myocardial infarctions or strokes. One patient with a positive MRI stress test and negative SPECT for transient ischemia was found to have significant triple vessel disease on catheter directed angiography and underwent coronary artery bypass surgery 1 month after the initial admission. Three patients with chest pain, history of coronary artery bypass and reversible ischemia on MRI did not receive additional revascularization therapy, because the significant coronary artery disease was mainly affecting only coronary side branches on angiography.

During the follow-up period, 11 patients presented to the hospital with recurrent chest pain, but negative cardiac enzymes. All of these patients had abnormal findings on the initial cardiac MRI, including nonischemic findings, ischemic scar, subendocardial left ventricular (LV) hypoperfusion and transient ischemia (Table 2). None of the patients with a normal cardiac MRI had recurrent chest pain (n = 10; Table 2). Thus, patients with any abnormality on cardiac MRI (n = 17) were more likely to have recurrent chest pain than those with normal cardiac MRI (n = 10) ($P = 0.001$). Patients with subendocardial hypoperfusion on stress MRI were significantly more likely to return to

the ER with angina-like chest pain compared with patients with a normal cardiac MRI (4 of 8 patients, compared to 0 of 10 patients, respectively; $P = 0.02$). For recurrent presentations to the hospital with chest pain during the follow-up period, there was no significant difference between patients with (4 of 5 patients) or without (7 of 22 patients) reversible ischemia and/or myocardial scar on the initial SPECT exam ($P = 0.13$) (Table 2).

Discussion

Go to:

The results of this study suggest that cardiac MRI with stress evaluation may help define the etiology of chest pain in emergency room patients with a negative ECG, negative cardiac enzymes, and intermediate risk for ischemic heart disease. Patients with subendocardial hypoperfusion on MRI returned to the hospital more often with recurrent chest pain and had diabetes and hypertension more frequently compared with patients with a normal cardiac MRI. This same group of patients had a lower perfusion reserve measured by coronary sinus flow measurements compared with ER patients with a normal cardiac MRI and a normal cardiac SPECT examination.

Patients with angina pectoris but normal coronary arteries without coronary spasm have previously been described (18). There are 10% to 30% of patients diagnosed with ischemia who have normal angiograms, thought to be due to microvascular disease (19,20). In our study, 8 of 27 (30%) chest pain patients with negative cardiac enzymes in the ER showed diffuse subendocardial hypoperfusion on MRI. It seems likely that this could be caused by microvascular disease. In comparison, a multi center study in 159 women showed that coronary microvascular dysfunction was present in approximately half of women with chest pain in the absence of obstructive CAD (21).

Coronary microangiopathy, causing increased resistance in prearteriolar coronary vessels, consequently lowering myocardial perfusion and thus leading to impaired coronary flow reserve, has been suggested to be the underlying cause for the adenosine-induced diffuse subendocardial hypoperfusion (22,23). Pilz et al also reported adenosine-induced subendocardial hypoperfusion in the left ventricular myocardium, using first pass perfusion MRI (13). As in our study, patients with adenosine-induced diffuse subendocardial hypoperfusion had an increased frequency of hypertension or diabetes. Pilz et al showed that the subendocardial perfusion deficit as seen by cardiac MRI was highly correlated to lower coronary artery flow on catheter directed coronary angiography. In addition, in our study ER patients with diffuse stress induced myocardial hypoperfusion and chest pain had a lower perfusion reserve compared with symptomatic ER patients with normal first pass perfusion MRI.

In 222 participants of the MESA (Multi Ethnic Study of Atherosclerosis) study, coronary vasoreactivity was reduced in asymptomatic individuals with a greater coronary risk factor burden (24). In our study, patients with chest pain and adenosine-induced microvascular hypoperfusion also had significantly more traditional cardiovascular risk factors compared with the group without small or large vessel disease. The data suggest that the traditional risk factors not only affect the conductive coronary arteries but also myocardial microvascular vasoreactivity.

MRI findings of subendocardial hypoperfusion need to be carefully distinguished from hypoperfusion due to hemodynamically significant coronary artery stenosis. Both findings are seen only with adenosine stress perfusion. In general, perfusion defects due to coronary artery stenosis are more persistent and more focal than diffuse subendocardial perfusion defects. Both occur after the peak contrast bolus has reached the LV cavity at the time the myocardium starts to enhance. Dark rim artifacts typically start to occur earlier just before the peak bolus reaches the LV cavity. Dark rim artifacts may occur particularly with older perfusion sequences with lower spatial resolution, likely due to susceptibility differences between the blood pool and myocardium (25,26). Diffuse subendocardial hypoperfusion is located in the endocardium and is not confined to the blood pool/myocardial border as typically seen with dark rim artifacts. Dark rim artifacts are frequent (52% in our study) and are typically recognized on both resting and stress perfusion MRI studies and are usually more focal than subendocardial perfusion defects.

Three patients with CABG and reversible ischemia on MRI did not receive any additional revascularization therapy

in our study, as the coronary artery narrowing was affecting only coronary side branches on conventional angiography. In all three patients adenosine-induced regional reversible perfusion defects involved less than one-third of the myocardial thickness, but lasted longer than six heart beats. These perfusion deficits were not thought to be clinically significant for coronary revascularization; nevertheless, during the follow-up period, two of these patients presented to the hospital with recurring chest pain and negative cardiac enzymes. Dobutamine stress examinations may have higher specificity in this setting (27,28).

Compared with cardiac SPECT, PET, and CT, MRI does not expose patients to radiation, which is a strong motivation to further work on implementing cardiac MRI in the emergency room (29–31). Cardiac stress perfusion MRI has higher spatial resolution (2 mm in our study) compared with SPECT (10 mm) and PET (5–6 mm) (32), which is likely the cause for the detection of subendocardial perfusion defects on cardiac MRI in our ER patient cohort with normal SPECT exams.

Limitations

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A limitation of our study is that only a portion of our patients received conventional coronary angiography, because it was not routine clinical practice to perform catheter directed angiography after a negative SPECT examination. Patients in this category were instead followed for cardiovascular events. Nevertheless, reviewer agreement was high. Four patients (13%) were claustrophobic and did not complete the MRI exam, while all patients could tolerate the nuclear cardiac SPECT exam. Adenosine was used for all MRI cases but often different stress agents were used for the SPECT stress exam, which may have influenced the rate of discordant results. We acknowledge that this is a pilot study and future larger trials have to show if adenosine induced diffuse subendocardial hypoperfusion on first pass perfusion MRI is an independent predictor of future cardiovascular events.

In conclusion, chest pain patients presenting to the emergency room may have ischemic or nonischemic etiologies causing their pain. Cardiac stress perfusion MRI can identify subendocardial hypoperfusion that may represent microvascular disease in patients with chest pain and negative cardiac enzymes; these perfusion abnormalities are not otherwise detected on SPECT imaging. In our patient cohort, adenosine stress induced left ventricular diffuse subendocardial hypoperfusion found on MRI was associated with recurrent chest pain, diabetes, hypertension and decreased global myocardial perfusion reserve. It remains to be determined if patients with chest pain and adenosine-induced diffuse subendocardial hypoperfusion on MRI benefit from more aggressive cardiovascular risk reduction treatment.

Acknowledgments

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Attachment B

Indications for 24 Hours / 7 Days Emergency MRI

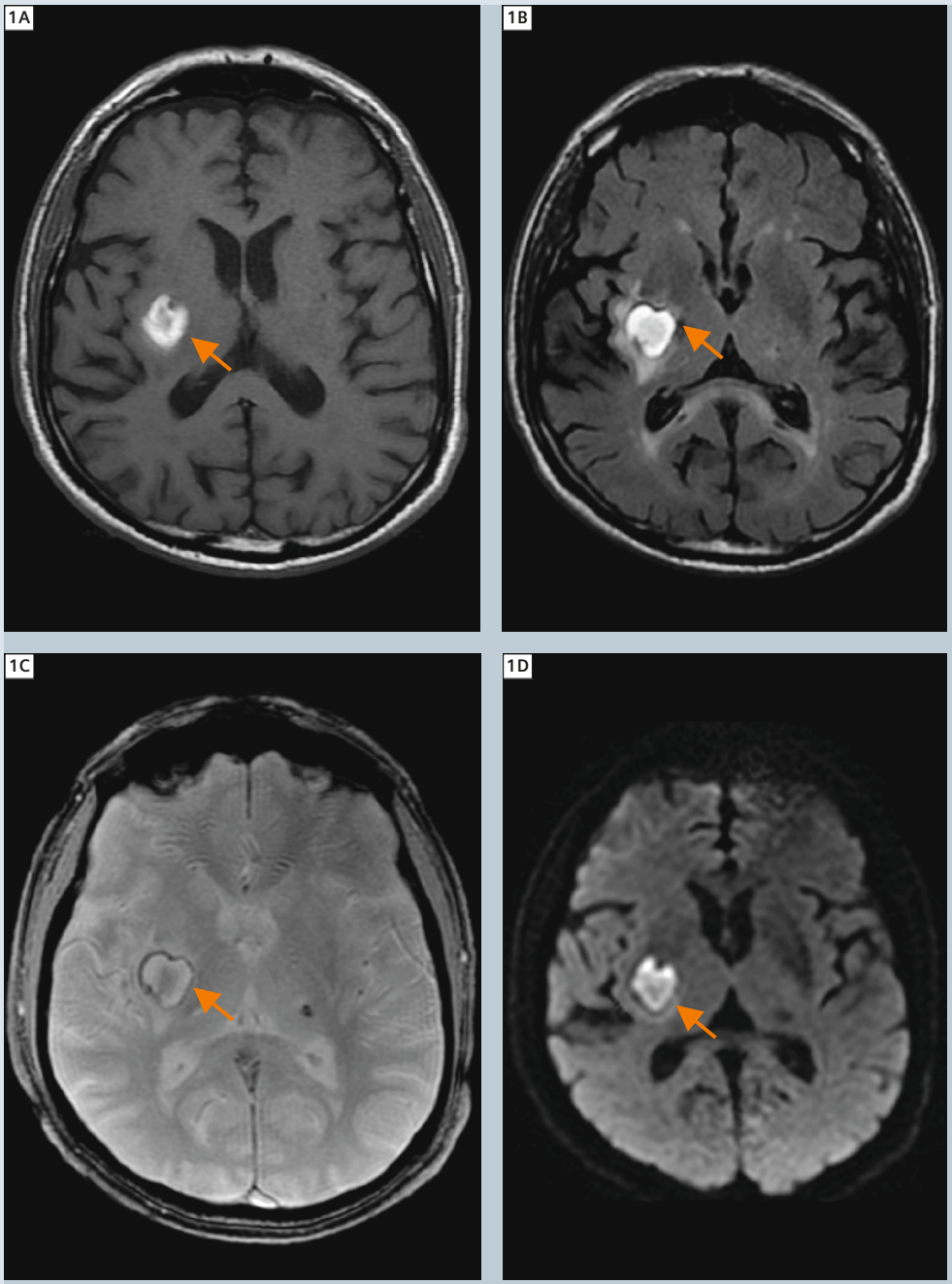
Indications for 24 Hours/7 Days Emergency MRI

Marc-André Weber, M.D., M.Sc.; Jürgen Biederer, M.D.

Heidelberg University Hospital, Diagnostic and Interventional Radiology, Heidelberg, Germany

Introduction

For many years MR imaging (MRI) has been considered a second-line procedure required for further diagnostic work-up after first-line imaging with x-ray, ultrasound or even computed tomography (CT) in the emergency room. However, the increasing performance of modern MR equipment and sequence design have broadened the range of indications, now making MRI the first-line imaging modality of choice for a number of clinical conditions. This is most obvious in neurovascular emergencies, but it also applies to a number of other indications. More and more, an 'emergency MRI' is being requested at night or during weekends. In most cases, the decision whether to perform it is taken according to the particular circumstances, such as the availability of sufficiently skilled staff and radiological expertise. The aim of this article is to suggest stratification criteria and to provide a list of clinical situations that might justify the performance of an MRI scan during night or weekend shifts based on the clinical relevance, i.e. immediate consequences. Conditions that do not require direct therapeutic intervention should not trigger an MRI scan outside the regular schedules. The limitation to only a small number of indications improves clinical decision-making and facilitates the preparation and training of the staff for these situations. The following suggestions have been developed at University Hospital Heidelberg in cooperation between the Department of Diagnostic and Interventional Radiology (Head: Hans-Ulrich Kauczor, M.D.), the Orthopedics and Trauma Surgery Clinic, the Spinal Cord Injury Center, the Vascular Surgery Clinic, the Department of Anesthesiology, and the Center

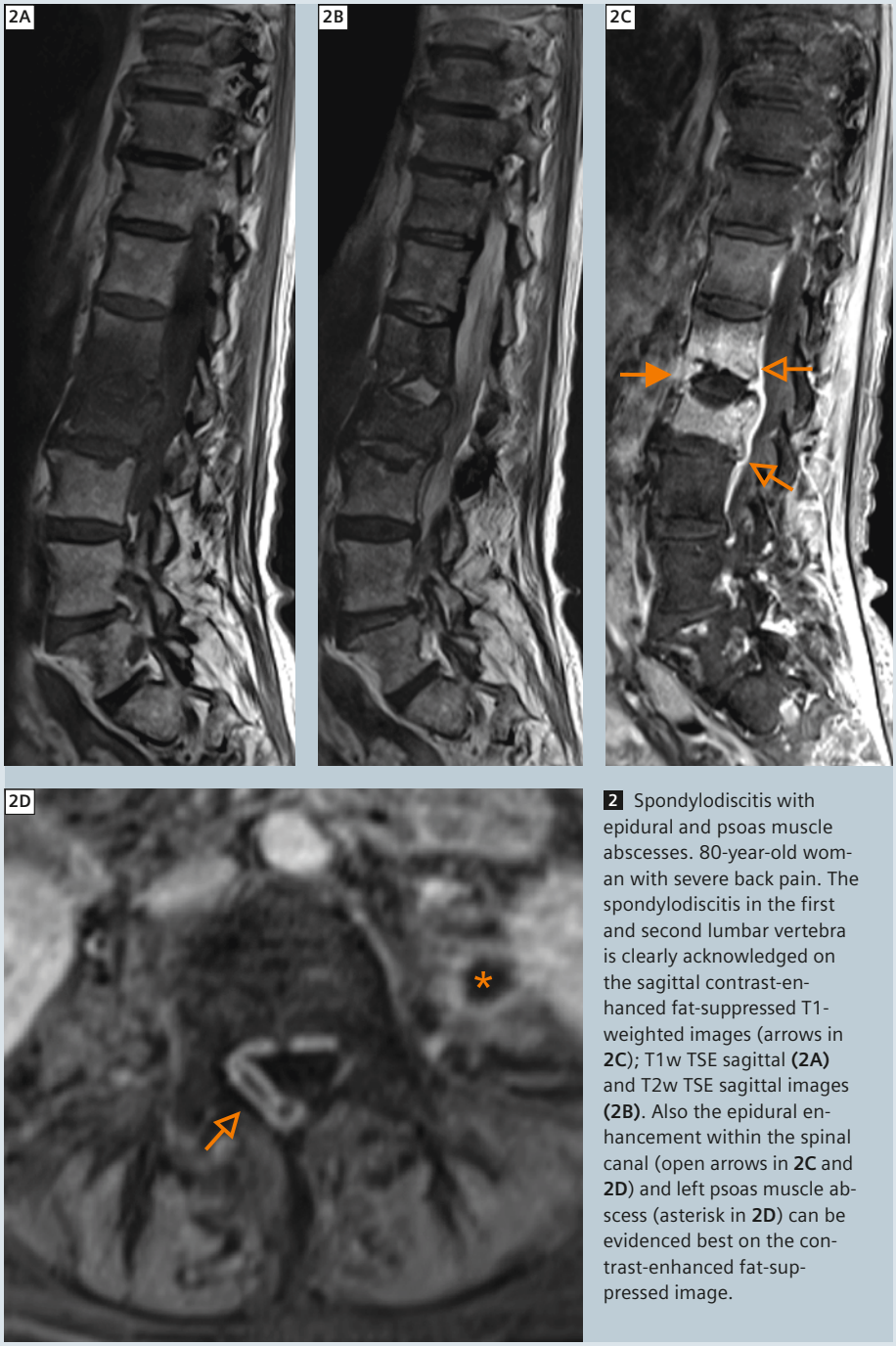


1 Intracranial hemorrhage in the right basal ganglia with small perifocal edema (arrows). 74-year-old man presenting with left sided hemiparesis since waking up 6 hours before. **(1A)** Axial unenhanced T1w, **(1B)** axial FLAIR, **(1C)** axial T2*w, **(1D)** axial diffusion-weighted image (*b*-value of 1000 s/mm²).

for Pediatric and Adolescent Medicine. Of course, the following suggestions are subject to ongoing discussion and refinement. The Department of Diagnostic and Interventional Radiology is the central service provider at the University Hospital Heidelberg in the field of diagnostic general radiological imaging and interventions. More than 91,000 examinations in out-patients and more than 71,000 in in-patients are performed annually, covering all indications and organ systems, with more than 210,000 imaging procedures every year. It should be noted that the following suggestions have been developed for a general radiological department. Dedicated neuroradiological departments may therefore develop additional suggestions regarding brain imaging.

List of indications for emergency MRI at the Department of Diagnostic and Interventional Radiology in Heidelberg

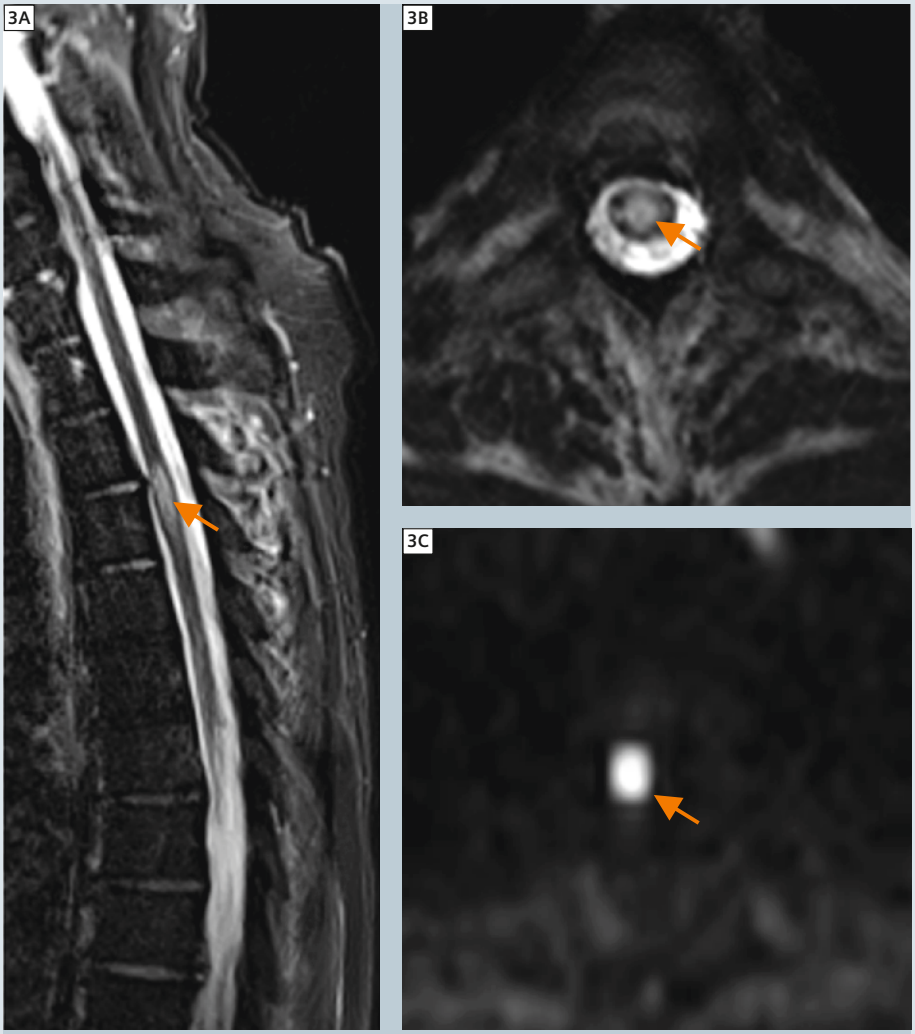
The list of indications differentiates between emergencies requiring immediate MRI (Category A, urgent care required as soon as possible day and night) and urgent cases with high priority but no need for immediate intervention (Category B, to be performed within 12 hours, e.g. next day). It was also considered important to define a third category (Category C) for situations that do not require an immediate MRI scan since equally diagnostic alternatives are available. Although such examinations may sometimes be urgently requested, it is strongly recommended to resist and to preserve the resources of the emergency MRI staff. This list represents the current stage of management and is intended to be regularly updated.



2 Spondylodiscitis with epidural and psoas muscle abscesses. 80-year-old woman with severe back pain. The spondylodiscitis in the first and second lumbar vertebra is clearly acknowledged on the sagittal contrast-enhanced fat-suppressed T1-weighted images (arrows in **2C**); T1w TSE sagittal **(2A)** and T2w TSE sagittal images **(2B)**. Also the epidural enhancement within the spinal canal (open arrows in **2C** and **2D**) and left psoas muscle abscess (asterisk in **2D**) can be evidenced best on the contrast-enhanced fat-suppressed image.

Category A Indications for an immediate emergency MRI

1. Cerebral and neurovascular emergencies (Fig. 1; e.g. acute cerebral ischemia or herniation syndromes in children): minimal protocol: T2-weighted TSE, dark-fluid imaging, diffusion-weighted imaging (DWI), time-of-flight (TOF) angiography, NO routine intra-venous (i.v.)-contrast medium administration.
2. Acute traumatic and non-traumatic syndromes with paraplegia and apparent neurologic deficits (such as paresis, sensory disturbances, disturbances in bladder or rectum function) that raise suspicion of a lesion of the myelon or the cauda equina. Examples include: Clinically suspected spondylodiscitis with epidural abscesses (Fig. 2; clinical relevance: immediate surgery indicated for epidural abscesses); acute spinalis



3 Spinalis anterior syndrome. 53-year-old man with acute paraplegia at level Th5 after surgical endovascular repair on an aortic dissection Stanford type B. At level of third thoracic vertebra there is swelling of the myelon with edema (arrows) on T2-weighted images (**3A**: STIR sagittal, **3B**: T2w SPACE) and restricted diffusion on the image with a *b*-value of 1000 s/mm² (arrow in **3C**).

anterior syndrome (Fig. 3); suspicion of epidural hematoma following spinal anesthesia or spinal surgery; suspected spinal cord contusion; clinical relevance: surgical decompression if edema of the spinal cord is detected). Minimal protocol: T2w TSE fat-saturated sagittal, T1w SE sagittal, T2w TSE transversal (non-fat-saturated) findings-centered. Optional: Diffusion-weighted imaging in case of suspected spinal ischemia. In case of suspected epidural abscess MRI with i.v.-contrast medium required.

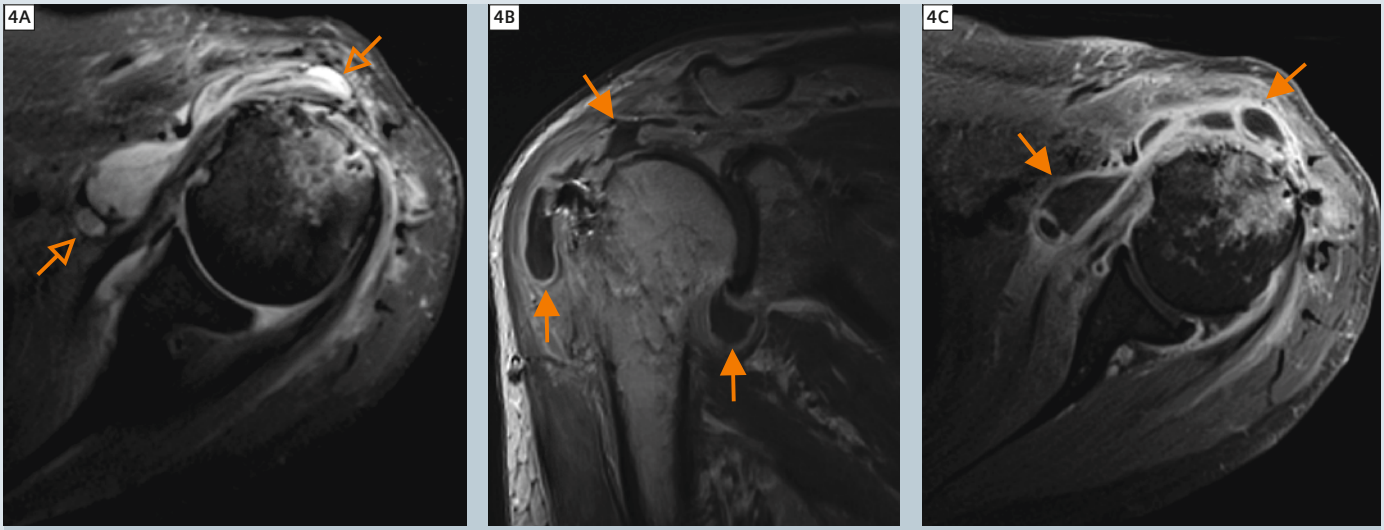
3. Strong clinical suspicion of septic arthritis (Fig. 4; clinical relevance: early joint lavage to prevent chondrolysis indicated). MRI with i.v.-contrast medium required.
4. Strong clinical suspicion of osteomyelitis in children. MRI with i.v.-contrast medium required.
5. Acute pulmonary artery embolism in pregnant women or very young patients (Fig. 5; pulmonary artery embolism protocol based on free breathing TrueFISP images. I.v.-contrast-enhanced TWIST perfusion and high spatial resolution MR angiography (MRA) only to be used, if exclusion of small peripheral emboli would be clinically relevant).

Category B Indications for an MRI within 12 hours include:

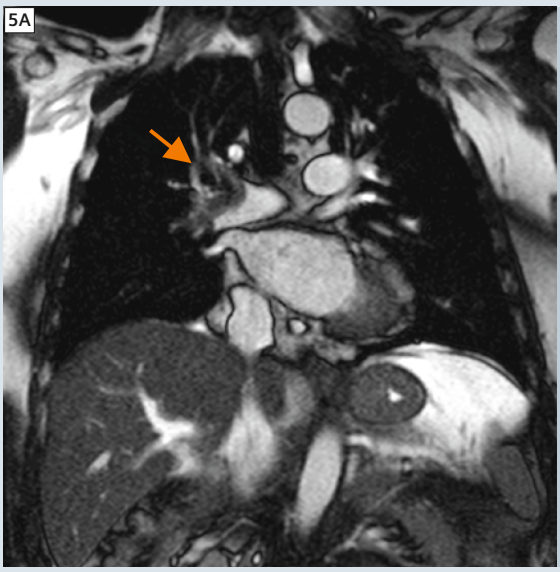
1. Spinal emergencies without neurological symptoms, e.g. to exclude spondylodiscitis or a ligamentous affection following a trauma of the spine, suspicion of a discoligamentous injury according to CT findings (use standard spine MR protocols).
2. In conventional radiography inconclusive findings or suspicion of occult fractures to prevent exposure to radiation in CT (especially in childhood).

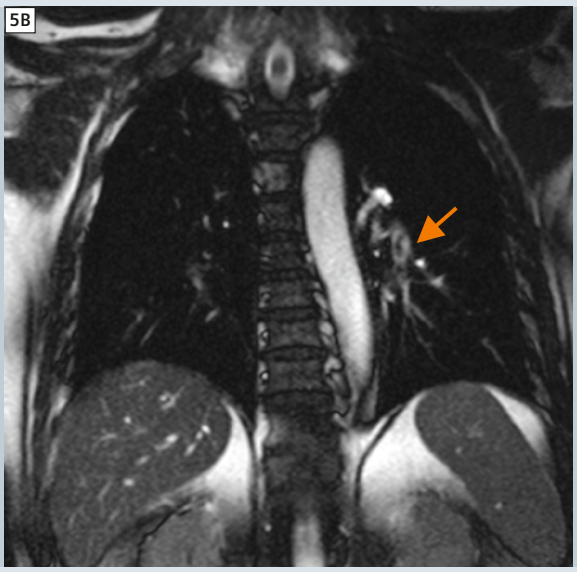
Category C Indications that do NOT justify an emergency MRI (=> e.g. CT as alternative emergency modality or MRI the next working day):

1. Run-off MRA for arteriosclerosis or acute occlusion of the lower limb (CT angiography as an alternative).
2. Suspicion or follow-up of intracranial hemorrhage (CT as an alternative) unless classified as neurovascular emergency according to Category A 1.
3. Suspicion of cerebral metastasis (CT with contrast medium as an alternative).
4. Urgent MRI requests due to organizational issues of the referring clinical partner or because of the patient's wish.



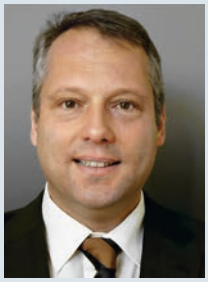
4 Septic arthritis of the shoulder joint in a 69-year-old man following shoulder arthroscopy and supraspinatus muscle refixation. The joint effusion is appreciated on the axial T2-weighted fat-saturated images (open arrows in **4A**). The strong synovialitis (arrows) is clearly evidenced on the contrast-enhanced coronal **(4B)** and axial **(4C)** MR images (**4B** without and **4C** with fat saturation).





5 Acute pulmonary embolism in both pulmonary arteries shown on T1/T2-weighted coronal TrueFISP images (arrows; this examination was obtained in a 64-year-old patient with renal insufficiency and suspected pulmonary embolism, being referred for non-contrast-enhanced MRI).

Contact
Marc-André Weber, M.D., M.Sc.
Professor of Radiology
Heidelberg University Hospital
Diagnostic and Interventional Radiology
Im Neuenheimer Feld 110
69120 Heidelberg
Germany
MarcAndre.Weber@med.uni-heidelberg.de



Contact
Jürgen Biederer, M.D.
Professor of Radiology
Heidelberg University Hospital
Diagnostic and Interventional Radiology
Im Neuenheimer Feld 110
69120 Heidelberg
Germany
Juergen.Biederer@med.uni-heidelberg.de

Attachment C

Quality Metrics – Forward Looking Organizations are Developing Their Own Performance Measures

July 2014

Quality Metrics — Forward-Looking Organizations Are Developing Their Own Performance Measures
By David Yeager
Radiology Today
Vol. 15 No. 7 P. 12

A move to value-based care is one of the most highly anticipated changes wrought by the Affordable Care Act, but it's also one of the most poorly defined terms in health care today. That absence of value's definition is one reason why value-based care still largely is on the drawing board. Another is that the technology tools to measure value still are being developed.

To date, radiology has been on the periphery of the value-based care movement. While that's not likely to change soon, eventually it will, so the question becomes what do radiology departments and practices need to do to be ready?

Vijay M. Rao, MD, FACR, a professor and the chair of the department of radiology at Thomas Jefferson University Hospital in Philadelphia, says the sheer number of potential performance measures is daunting. For example, the consulting company The Advisory Board Company lists nearly 300 radiology-specific measures.

Perhaps of most interest to radiology departments and practices, though, is the Centers for Medicare & Medicaid Services' (CMS) Physician Quality Reporting System (PQRS), which started as a voluntary program but will begin assessing penalties in 2015. The PQRS includes numerous measures for radiology. The CMS also collects some radiology data for its Hospital Outpatient Quality Reporting program, which feeds the publicly available Hospital Compare website. With all of these competing guidelines, it's hard to know which metrics to track.

Identifying Measures
"It's not an easy topic," says Rao, who spoke about quality metrics in May at the Jornada Paulista de Radiologia Conference in São Paulo, Brazil. "Quality metrics have to be picked very carefully by a radiology group or a department so they can accurately measure them and then make a difference at the end of the day."

Teri Yates, founder and principal consultant of Accountable Radiology Advisors, who advises several companies in the health care industry on radiology-related matters, agrees that developing quality metrics will be a crucial task for radiology groups. Although accountable care organizations (ACOs) currently are prioritizing high-value targets such as diabetes and heart disease, and many ACOs still are paying radiology on a fee-for-service basis, she says now is the time to start proactively tracking quality metrics.

To do that, health care organizations need to assess the data and technical resources that are available to them. They also need to be specific about which clinical questions they want answered. In the era of Big Data, it's easy to focus on the trees and miss the forest.

"One of the big challenges that I see as we try to move down this path of analytics is we have so much data available to us. [But] do we have anybody who works for us who understands how to define quality, find the data in the systems, analyze it, and then knows what to do with it?" Yates says. "Organizations need a very strong vision at the beginning of what questions they are trying to answer and what good performance really looks like."

Rao says studying the life cycle of a radiology image can help identify a radiology department's or practice's most important metrics. She says that at every step of that cycle, there are opportunities to develop specific quality measures. Important areas of interest can be divided into "buckets" to make the process more manageable. She says measures of physician competence, patient satisfaction, operational efficiency, patient safety, and study appropriateness can provide valuable information, and she recommends choosing two or three measures from each bucket.

Appropriateness Criteria
Rao believes appropriateness criteria in particular will become highly important as value-based care works its way into medical practice. She says identifying which studies offer the best clinical value will put radiologists in a position to significantly affect care quality, but that's easier said than done. "Tracking some of these measures is really difficult. We need to develop tools," she says. "We need to identify which key performance indicators we want to track and then use the tools to collect the data, manage the data, and drive improvement."

There are four important areas that Yates believes represent quality in radiology. The first is exam appropriateness. Yates says clinical decision support can help determine exam appropriateness, but radiology practices and departments that don't use decision-support tools also can track variations in exam ordering among referring providers that suggest an atypical pattern. Additionally, they can look at more specific parameters, such as the number of patients who are having multiple CT scans in a short period of time without any clear clinical indication.

Yates says safety metrics such as radiation dose and adverse events also are important as well as measurements of report and interpretation accuracy. Peer review and medical outcomes audits, such as those used in mammography, are useful for measuring accuracy. Finally, she says communication metrics, such as turnaround time, critical results reporting, and consultations, should be tracked, too.

Yates adds that making the data user friendly is equally important. She says downloading information to a spreadsheet, which is sometimes done, isn't the best way to communicate information. Commonly used scorecards, or thumbnail sketches of relevant data points, are a

better option—but not optimum because they're drawn from historical data. Dashboards that provide real-time feedback on items such as turnaround time, for example, are the most effective way to monitor quality metrics. Yates believes dashboards will become increasingly popular tools.

Normalizing Data
With data being housed in various systems across the medical enterprise, normalizing data and integrating clinical systems is a must for developing and tracking quality measures. Unfortunately, that's often not the case. Gary Wendt, MD, MBA, a professor of radiology and the vice chair of informatics at the University of Wisconsin-Madison says effective data integration should be on the mind of anyone who's in the market for a new PACS. "Can your vendor either supply you with the tools to seamlessly integrate all of the data you need or will they actually develop something that's tailored to you?" he says. "If they at least provide you with the tools, you can develop something on your own. If the tools aren't even available, you're sort of out of luck."

Wendt says facilities' lack of system integration hampers the development of quality metrics in many ways. For example, most peer review systems aren't linked to a PACS, which means users need another workstation, another login, and another system to collect data. He says radiology departments and groups need a quality assurance and quality improvement system within their PACS to access quality metrics.

The University of Wisconsin uses a university-developed program that allows automatic quality assurance of certain exam types and protocols. The program also allows the radiology department to perform functions, including the following:

• collecting data as protocols are updated to validate the protocols;

• performing quality assurance reviews on technologists to ensure that they're correctly performing exams; and

• evaluating turnaround times on resident preliminary reads.

Without a single interface, those types of functions would be too cumbersome to be useful.

"I don't think you can start collecting that much data by using separate systems," Wendt says. "If you have to log in to a separate system to do every different function, it's practically unworkable."

Tracking Complications
Allen J. Rovner, MD, a radiologist at Aultman Hospital in Canton, Ohio, agrees with Wendt. Aultman Hospital is a 808-bed facility and a level 2 trauma center that uses Montage Search & Analytics to track various quality metrics. He says that prior to implementing Montage, staff already were tracking standard quality measures such as turnaround times for standard reports, critical results reports, certain types of procedures, and technologists arriving when called in. They also were tracking complications for certain procedures such as headaches following myelograms, pneumothorax following thorocentesis, and bleeding following a biopsy.

Now, Rovner says, they're beginning to use the data-mining software to take a deeper look at certain clinical details. One project currently under way is tracking hip fractures that aren't identified on initial X-rays. Rovner says the graying population in the region Aultman Hospital serves is driving up the incidence of hip fractures. Because many people are brought in late in the evening, it can be difficult to determine how to manage a patient with hip pain and a negative X-ray, especially if there isn't an MRI technologist on site.

"So what's the next step? Well, you can keep them overnight in the ER, but the ER's way too busy, and they don't have the time or the beds or the manpower to monitor people," Rovner says. "We've decided that we're going to look at the issue of what the risk is for patients who come in and have a negative X-ray and what our risk is as a health care provider. Sometimes they have an undisplaced fracture and they can walk on it, and they are, unfortunately, triaged home. That can be a big problem."

Aultman Hospital also is looking at utilization criteria. Rovner says the current trends to lower radiation dose and eliminate unnecessary studies are here to stay, and the Affordable Care Act will accelerate these trends. Aultman Hospital is working with its emergency department physicians to get a better handle on appropriate study utilization. Rovner says data-mining software makes it much easier to follow patients and monitor outcomes.

Additionally, Aultman Hospital has been looking for discrepancies in reports and soon will begin looking for instances of pulmonary emboli in CT angiograms. Aultman physicians have noticed a significant number of pulmonary embolisms in younger patients who had CT angiograms and wanted to keep tabs on the trend. Rovner says this is one example of how analytics can improve the quality of care, but he believes the possibilities for better care are vast.

Tear Down the Silos
Rovner says advanced analytics software allows physicians to do longitudinal studies with a mouse click. On the horizon, he sees the possibility of improving overall population health but doing that requires cooperative data mining. Sharing data among institutions and organization would allow access to a large enough patient population to accurately assess outcomes and develop relevant guidelines.

Rovner says cooperative data mining wouldn't be technically challenging, but current privacy regulations make it difficult. He says physicians currently are operating in data silos to patients' detriment. To improve care, Rovner says it would be helpful for physicians to know how other physicians are treating patients; the more complex the medical condition, the more important data sharing becomes.

"We've reached an age where the technology is there—the software, the computer power, the networking, it's all available. We should be able to aggregate our clinical experience," Rovner says. "I really think it's time for medicine to get into the data world."

Increased data sharing also may help radiology prove its value in a more measurable way. Because patient care is highly complex, it's difficult to determine how radiology affects overall outcomes. The most common strategy is to look at the cost of an exam, but Yates points out that noninvasive radiology exams can eliminate the need for more invasive—and typically expensive—procedures. She says to begin quantifying radiology's value, performance indicators will be important, but people in the health care system also will need to take a look at how radiology affects the care cycle.

Yates says she has advised one of her clients, Medicalis Corporation, to take a closer look at this question, and the company has developed a few reports to track certain measures. One report focuses on radiology's impact on emergency operations and highlights variations in ordering patterns. Another tracks turnaround times on studies required for patient discharge. Although these sorts of efforts are in the early stages, Yates says more work must be done in this area to put radiology in its proper health care context and improve overall care.

"Clearly, radiology impacts what happens with the rest of the patient experience, but determining how it affects the care cycle is a very advanced frontier," Yates says. "It's very complex, but it's the right thing to do."

*— David Yeager is a freelance writer and editor based in Royersford, Pennsylvania. He primarily writes about imaging IT for **Radiology Today**.*

Attachment D

Alliance Healthcare Services: Registration and Inventory of Medical Equipment Form, FY 2013

DE 3/6/15 JC

Registration and Inventory of Medical Equipment
Fixed Magnetic Resonance Imaging Scanners
January 2015 SIGNA 465

Instructions
This is the legally required "Registration and Inventory of Medical Equipment" (G.S. 131E-177) for fixed magnetic resonance imaging (MRI) scanners. Please complete all sections of this form and return to the Medical Facilities Planning Branch by **Friday, January 30, 2015**.

1. Complete and sign the form
2. Return the form by one of two methods:
   a. Email a scanned copy to DHSR.SMFP.Registration-Inventory@dhhs.nc.gov
   b. Mail the form to Kelli Fisk, Medical Facilities Planning Branch, 2714 Mail Service Center, Raleigh, NC 27699-2714.

Note: Fixed equipment operated in a facility licensed under a hospital should be reported on that hospital's license renewal application, and not duplicated on this form.

If you have questions, call Kelli Fisk in the Medical Facilities Planning Branch at (919) 855-3865 or email DHSR.SMFP.Registration-Inventory@dhhs.nc.gov.

Section 1: Contact Information

1. Full legal name of corporation, partnership, individual, or other legal entity that acquired the equipment by purchase, donation, lease, transfer, or comparable arrangement:

   Alliance Healthcare Services
   (Legal Name)

2. Address of the corporation, partnership, individual, or other legal entity that acquired the equipment:

   100 Bayview Circle, Suite 400
   (Street and Number)

   Newport Beach (City) **CA** **92660** (State) (Zip) **(800) 544-3215** (Phone Number)

3. Chief Executive Officer or approved designee who is certifying the information in this registration form:

   Melissa VanOostrom (Name) **Manager Operations** (Title)

   1233 Front Street Suite A Raleigh, NC 27612
   (Street and Number) (City) (State) (Zip)

   910-340-1494 (Phone Number) **mvanoostrom@allianceimaging.com** (Email)

4. Information Compiled or Prepared by: **David French**
   (Name)

   (336) 349-6250 (Phone Number) **djfrench45@bellsouth.net** (Email)

Section 2: Equipment and Procedures Information

Time Period for Report: ☒10/01/2013 – 9/30/2014 ☐ Other time period: _____

(Please make additional copies of pages of this form as needed.)

	Scanner Number	Scanner Number
Manufacturer/Tesla	**GE**	
Model Number	**Signa HDe 1.5T 8 Ch**	
Open or Closed Scanner	**closed**	
Serial or I.D. Number	**301201444481 Signa 465**	
Date of acquisition	**December 2008 (replacement unit with declaratory ruling obtained)**	
Purchase price (if purchased)	**NA**	
Certificate of Need Project ID	**Grandfathered Installed Unit**	
Certificate Holder, as listed on Certificate of Need	**Alliance Imaging Inc.**	
If Leased or Rented, Name Owner of Equipment	**NA**	
Service Site Information: Please include **all** of the information requested for each location.	**Arthur Dosher Memorial Hospital** **4222 Long Beach Rd** **Oak Island, NC 28461** **Brunswick**	
Inpatient Procedures*: - with Contrast or Sedation - without Contrast or Sedation Outpatient Procedures*: - with Contrast or Sedation - without Contrast or Sedation **Total Number of Procedures**	Inpatient: with: 33 w/out: 8 Total: 41 ✓ Outpatient: with: 333 w/out: 730 Total: 1063 ✓ **Total:** 1104 ✓	
Put a check by the days per week, and write in the number of hours per day, the scanner is in operation.	NA – installed unit	
Total number of hours in operation for report period	**1104 hrs**	

*An **MRI procedure** is defined as a single discrete MRI study of one patient (single CPT coded procedure). An MRI study means one or more scans relative to a single diagnosis or symptom. **The total number of procedures should be equal to or more than the total number of patients reported on the MRI Patient Origin Table on page 5 of this form.**

Name of entity that acquired the equipment (from page 1) **Alliance Healthcare Services**

Section 3: MRI Procedures by CPT Code by Service Site

Please write the number of procedures provided by CPT Code during the time period of this report. Report separately for each service site. Make additional copies of pages 3 and 4 as needed. The total number of procedures should equal the total number of procedures reported on page 2 of this form.

Service Site Name: **Arthur Dosher Hospital, Brunswick**

CPT Code	CPT Description	Number of Procedures
70336	MRI Temporomandibular Joint(s)	
70540	MRI Orbit/Face/Neck w/o contrast	1
70542	MRI Orbit/Face/Neck with contrast	
70543	MRI Orbit/Face/Neck w/o & with contrast	4
70544	MRA Head w/o contrast	18
70545	MRA Head with contrast	
70546	MRA Head w/o & with contrast	
70547	MRA Neck w/o contrast	1
70548	MRA Neck with contrast	
70549	MRA Neck w/o & with contrast	18
70551	MRI Brain w/o contrast	34
70552	MRI Brain with contrast	
70553	MRI Brain w/o & with contrast	168
7055A	IAC Screening	
71550	MRI Chest w/o contrast	1
71551	MRI Chest with contrast	
71552	MRI Chest w/o & with contrast	2
71555	MRA Chest with OR without contrast	2
72126	Cervical Spine Infusion only	
72141	MRI Cervical Spine w/o contrast	94
72142	MRI Cervical Spine with contrast	
72156	MRI Cervical Spine w/o & with contrast	21
72146	MRI Thoracic Spine w/o contrast	10
72147	MRI Thoracic Spine with contrast	
72157	MRI Thoracic Spine w/o & with contrast	13
72148	MRI Lumbar Spine w/o contrast	173
72149	MRI Lumbar Spine with contrast	
72158	MRI Lumbar Spine w/o & with contrast	62
72159	MRA Spinal Canal w/o OR with contrast	
72195	MRI Pelvis w/o contrast	2
72196	MRI Pelvis with contrast	
72197	MRI Pelvis w/o & with contrast	6
72198	MRA Pelvis w/o OR with contrast	
73218	MRI Upper Ext, other than joint w/o contrast	4
73219	MRI Upper Ext, other than joint with contrast	
73220	MRI Upper Ext, other than joint w/o & with contrast	7
	Subtotal for page	**641**

Name of entity that acquired the equipment (from page 1) **Alliance Healthcare Services**

Section 3: MRI Procedures by CPT Code by Service Site continued

Service Site Name: **Arthur Dosher Hospital, Brunswick**

CPT Code	CPT Description	Number of Procedures
73221	MRI Upper Ext, any joint w/o contrast	**169**
73222	MRI Upper Ext, any joint with contrast	**1**
73223	MRI Upper Ext, any joint w/o & with contrast	**8**
73225	MRA Upper Ext, w/o OR with contrast	
73718	MRI Lower Ext other than joint w/o contrast	**23**
73719	MRI Lower Ext other than joint with contrast	
73720	MRI Lower Ext other than joint w/o & with contrast	**23**
73721	MRI Lower Ext any joint w/o contrast	**201**
73722	MRI Lower Ext any joint with contrast	
73723	MRI Lower Ext any joint w/o & with contrast	**7**
73725	MRA Lower Ext w/o OR with contrast	**1**
74181	MRI Abdomen w/o contrast	**7**
74182	MRI Abdomen with contrast	
74183	MRI Abdomen w/o & with contrast	**21**
74185	MRA Abdomen w/o OR with contrast	**2**
75557	MRI Cardiac Morphology w/o contrast	
75561	MRI Cardiac Morphology with contrast	
75554	MRI Cardiac Function Complete	
75555	MRI Cardiac Function Limited	
75563	MRI Cardiac Velocity Flow Mapping	
77058	MRI Breast, unilateral w/o and/or with contrast	
77059	MRI Breast, bilateral w/o and/or with contrast	
76125	Cineradiography to complement exam	
76390	MRI Spectroscopy	
76393	MRI Guidance for needle placement	
76394	MRI Guidance for tissue ablation	
76400	MRI Bone Marrow blood supply	
7649A	MR functional imaging	
7649D	MRI infant spine comp w/ & w/o contrast	
7649E	Spine (infants) w/o infusion	
7649H	MR functional imaging	
N/A	Clinical Research Scans	
	Subtotal for page	**463**
	Total Number of Procedures (both pages)	**1104**

Total Number of Procedures for All Service Sites: 1104

Section 4: Patient Origin Data by Service Site

Please provide the county of residence for each patient who received MRI services during the time period of this report. Provide patient origin data separately for each service site. Make additional copies of this page as needed. The total number of patients receiving services should be equal to or less than the total number of procedures reported on page 2 of this form.

Service Site Name: **Alliance Healthcare Services installed at Dosher Hospital**

County in which service was provided: **Brunswick - Alliance does not collect patient origin data**

Patient County	Number of Patients	Patient County	Number of Patients	Patient County	Number of Patients
1. Alamance		37. Gates		73. Person	
2. Alexander		38. Graham		74. Pitt	
3. Alleghany		39. Granville		75. Polk	
4. Anson		40. Greene		76. Randolph	
5. Ashe		41. Guilford		77. Richmond	
6. Avery		42. Halifax		78. Robeson	
7. Beaufort		43. Harnett		79. Rockingham	
8. Bertie		44. Haywood		80. Rowan	
9. Bladen		45. Henderson		81. Rutherford	
10. Brunswick		46. Hertford		82. Sampson	
11. Buncombe		47. Hoke		83. Scotland	
12. Burke		48. Hyde		84. Stanly	
13. Cabarrus		49. Iredell		85. Stokes	
14. Caldwell		50. Jackson		86. Surry	
15. Camden		51. Johnston		87. Swain	
16. Carteret		52. Jones		88. Transylvania	
17. Caswell		53. Lee		89. Tyrrell	
18. Catawba		54. Lenoir		90. Union	
19. Chatham		55. Lincoln		91. Vance	
20. Cherokee		56. Macon		92. Wake	
21. Chowan		57. Madison		93. Warren	
22. Clay		58. Martin		94. Washington	
23. Cleveland		59. McDowell		95. Watauga	
24. Columbus		60. Mecklenburg		96. Wayne	
25. Craven		61. Mitchell		97. Wilkes	
26. Cumberland		62. Montgomery		98. Wilson	
27. Currituck		63. Moore		99. Yadkin	
28. Dare		64. Nash		100. Yancey	
29. Davidson		65. New Hanover			
30. Davie		66. Northampton		101. Georgia	
31. Duplin		67. Onslow		102. South Carolina	
32. Durham		68. Orange		103. Tennessee	
33. Edgecombe		69. Pamlico		104. Virginia	
34. Forsyth		70. Pasquotank		105. Other (specify)	
35. Franklin		71. Pender			
36. Gaston		72. Perquimans		**Total Number of Patients**	**1104**

Name of entity that acquired the equipment (from page 1) **Alliance Healthcare Services**

Section 5: Reimbursement/Payment Source

Please provide the source of reimbursement/payment for MRI procedures. Total procedures should equal the total number of procedures reported on page 2 of this form.

Primary Payer Source	Number of MRI Procedures
Self Pay	
Medicare & Medicare Managed Care	
Medicaid	
Commercial Insurance	
Managed Care	
Unreimbursed Care (Indigent/Charity)	
Other (Specify)	
Total	NA

Alliance does not bill patients.

Section 6: Certification and Signature

The undersigned Chief Executive Officer or approved designee certifies the accuracy of the information contained on all pages of this form.

Signature *Melissa Van Oostrom*

Print Name **Melissa VanOostrom**

Date signed **January 22, 2015**

Please complete all sections of this form and return to the Medical Facilities Planning Branch by **Friday, January 30, 2015.**

1. Complete and sign the form
2. Return the form by one of two methods:
   a. Email a scanned copy to DHSR.SMFP.Registration-Inventory@dhhs.nc.gov
   b. Mail the form to Kelli Fisk in the Medical Facilities Planning Branch, 2714 Mail Service Center, Raleigh, NC 27699-2714.

If you have questions, call Kelli Fisk in the Medical Facilities Planning Branch at (919) 855-3865 or email DHSR.SMFP.Registration-Inventory@dhhs.nc.gov.

Attachment E

Data: Location Brunswick County Residents Received Hospital and Freestanding MRI Scans, FY 2013

Table 1. Location Brunswick County Residents Received Hospital MRI Scans in 2013

Procedure Location	Procedure County	Number of Brunswick County Residents Receiving MRI Tx	% of Total Txs
Novant Health Brunswick Medical Center	Brunswick	2536	40.73%
New Hanover Regional Medical Center	New Hanover	2165	34.77%
J. Arthur Dosher Memorial Hospital	Brunswick	1018	16.35%
University of North Carolina Hospitals	Orange	197	3.16%
Duke University Hospital	Durham	121	1.94%
Columbus Regional Healthcare System	Columbus	42	0.67%
Duke Raleigh Hospital	Wake	21	0.34%
Carolinas Medical Center	Mecklenburg	12	0.19%
WakeMed Cary Hospital	Wake	10	0.16%
FirstHealth Moore Regional Hospital	Moore	9	0.14%
Watauga Medical Center	Watauga	9	0.14%
WakeMed	Wake	8	0.13%
Rex Hospital	Wake	7	0.11%
North Carolina Baptist Hospital	Forsyth	5	0.08%
Carolinas Medical Center-NorthEast	Cabarrus	5	0.08%
Duke Regional Hospital	Durham	5	0.08%
Randolph Hospital	Randolph	4	0.06%
Novant Health Forsyth Medical Center	Forsyth	4	0.06%
Cape Fear Valley Medical Center	Cumberland	4	0.06%
Park Ridge Health	Henderson	4	0.06%
High Point Regional Health System	Guilford	3	0.05%
Novant Health Charlotte Orthopedic Hospital	Mecklenburg	3	0.05%
Southeastern Regional Medical Center	Robeson	3	0.05%
Frye Regional Medical Center	Catawba	2	0.03%
CaroMont Regional Medical Center	Gaston	2	0.03%
Novant Health Matthews Medical Center	Mecklenburg	2	0.03%
Sampson Regional Medical Center	Sampson	2	0.03%
Vidant Medical Center	Pitt	2	0.03%
Carolinas Medical Center-University	Mecklenburg	2	0.03%
Carteret General Hospital	Carteret	1	0.02%
Cleveland Regional Medical Center	Cleveland	1	0.02%
Nash General Hospital	Nash	1	0.02%
Carolinas Medical Center-Lincoln	Lincoln	1	0.02%
CarolinaEast Medical Center	Craven	1	0.02%
FirstHealth Richmond Memorial Hospital	Richmond	1	0.02%
Halifax Regional Medical Center	Halifax	1	0.02%
Iredell Memorial Hospital	Iredell	1	0.02%

Procedure Location	Procedure County	Number of Brunswick County Residents Receiving MRI Tx	% of Total Txs
Lake Norman Regional Medical Center	Iredell	1	0.02%
Lenoir Memorial Hospital	Lenoir	1	0.02%
Annie Penn Hospital	Rockingham	1	0.02%
Mission Hospital	Buncombe	1	0.02%
Wayne Memorial Hospital	Wayne	1	0.02%
Novant Health Huntersville Medical Center	Mecklenburg	1	0.02%
Novant Health Presbyterian Medical Center	Mecklenburg	1	0.02%
Novant Health Rowan Medical Center	Rowan	1	0.02%
Scotland Memorial Hospital	Scotland	1	0.02%
The Outer Banks Hospital	Dare	1	0.02%
Transylvania Regional Hospital	Transylvania	1	0.02%
Maria Parham Medical Center	Vance	1	0.02%
Total Brunswick Co Residents that received MRI Tx		***6,227***	100.00%

Source: 2014 Hospital License Renewal forms

Table 2. Location Brunswick County Residents Received Freestanding MRI Scans in 2013

Service Site	Location	Number of Brunswick County Residents Receiving MRI Tx	% of Total Txs
Delaney Radiologists	New Hanover	827	44.3%
OrthoWilmington PA	New Hanover	440	23.6%
Greenville MRI	Pitt	200	10.7%
Greensboro Orthopaedics	Guilford	197	10.5%
Durham Diagnostic Imaging-Independence Park	Durham	86	4.6%
Wake Radiology Chapel Hill	Orange	50	2.7%
Carolina Imaging of Fayetteville	Cumberland	11	0.6%
Wake Radiology Raleigh MRI Center	Wake	8	0.4%
Coastal Diagnostic Imaging	Onslow	4	0.2%
Novant Health Imaging Piedmont	Forsyth	4	0.2%
Triangle Orthopaedic Associates	Wake	4	0.2%
Valley Regional Imaging	Cumberland	4	0.2%
Baldwin	Mecklenburg	3	0.2%
Carolina Neurosurgery and Spine Associates	Mecklenburg	2	0.1%
Coastal Carolina Health Care	Craven	2	0.1%
Columbus Regional Diagnostics	Columbus	2	0.1%
Cornerstone Imaging	Guilford	2	0.1%
OrthoCarolina Spine Center	Mecklenburg	2	0.1%
Raleigh Neurology Associates	Wake	2	0.1%
Raleigh Radiology at Wake Forest	Wake	2	0.1%
Watauga Medical Center	Watauga	2	0.1%
Carolinas Imaging Services-Southpark (prev. Morrocroft)	Mecklenburg	1	0.1%
Concord	Cabarrus	1	0.1%
Durham Diagnostic Imaging - Henderson	Vance	1	0.1%
Durham Diagnostic Imaging at Triangle Medical Park	Durham	1	0.1%
Frye Care Outpatient Imaging Center	Catawba	1	0.1%
MRI of Eastern Carolina	Pitt	1	0.1%
MRI Specialists of the Carolinas - Belmont	Gaston	1	0.1%
Novant Health Imaging Southpark	Mecklenburg	1	0.1%
Open MRI and Imaging of Asheville	Buncombe	1	0.1%
OrthoCarolina - Ballantyne	Mecklenburg	1	0.1%
Physicians East	Pitt	1	0.1%
Raleigh Radiology Brier Creek	Wake	1	0.1%
Raleigh Radiology Cedarhurst	Wake	1	0.1%
Triangle Orthopaedic Associates	Durham	1	0.1%
Total		**1,868**	

Source: EIF reports to DHSR