Enrollment volume effect on risk factor control and outcomes in the SAMMPRIS trial

David Chiu, MD
 Richard P. Klucznik, MD
 Tanya N. Turan, MD
 Michael J. Lynn, MS
 Charles D. McCane, BA
 Lawrence B. Katz, PhD
 Azhar Nizam, MS
 Colin P. Derdeyn, MD
 David Fiorella, MD, PhD
 Bethany F. Lane, RN
 Jean Montgomery, RN
 Scott Janis, PhD
 Marc I. Chimowitz,
 MBChB

Correspondence to
 Dr. Chiu:
dchiu@tmhs.org

ABSTRACT

Objective: The role of physician experience and patient volumes on the outcome of surgical or endovascular procedures has been well-studied but there are limited data on how these factors affect the outcome of medical therapy.

Methods: In the stenting and medical cohorts of the Stenting and Aggressive Medical Management for the Prevention of Recurrent Ischemic Stroke (SAMMPRIS) trial, we compared Kaplan-Meier (K-M) curves for the primary endpoint (any stroke or death within 30 days of enrollment or ischemic stroke in the territory beyond 30 days) using the log-rank test and the percentages of patients achieving target levels for primary and secondary risk factors during the study using Fisher exact test between patients at high-enrolling (≥ 12 patients) vs low-enrolling (< 12 patients) sites.

Results: In the stenting group, the K-M curves for the primary endpoint were similar at high-enrolling sites and low-enrolling sites ($p = 0.93$) with rates of 13.5% vs 14.7% at 30 days and 19.0% vs 20.6% at 2 years. In the medical group, the K-M curves differed between high-enrolling sites and low-enrolling sites ($p = 0.0005$) with rates of 1.8% vs 9.8% at 30 days and 7.3% vs 20.9% at 2 years. The percentages of patients who achieved targets for low-density lipoprotein cholesterol and systolic blood pressure at high- vs low-enrolling sites in both treatment groups combined were 64% vs 49% ($p = 0.003$) and 70% vs 59% ($p = 0.026$), respectively.

Conclusions: High-enrolling sites in SAMMPRIS achieved better control of primary risk factors and much lower rates of the primary endpoint than low-enrolling sites in the medical group, suggesting that experience with medical management is an important determinant of patient outcome. *Neurology*® 2015;85:2090-2097

GLOSSARY

AMM = aggressive medical management; **HDL-C** = high-density lipoprotein cholesterol; **K-M** = Kaplan-Meier; **LDL-C** = low-density lipoprotein cholesterol; **PTAS** = percutaneous transluminal angioplasty and stenting; **SAMMPRIS** = Stenting and Aggressive Medical Management for the Prevention of Recurrent Ischemic Stroke; **SBP** = systolic blood pressure.

It is an oft-quoted axiom that the favorable results of surgical and endovascular procedures depend on the skill, experience, and track record of the operator. The interventionist's previous performance and case volume, for instance, are known to impact outcomes of carotid stenting.^{1,2} Considerably less is understood about physician or center characteristics that potentially contribute to outcomes of patients treated medically. Mathematical modeling reveals treatment intensification rate, patient adherence, and visit frequency to be factors that have major effects on the rates of achieving successful risk factor control.³

In clinical trials, one might expect that study investigators and coordinators at higher volume sites may become more familiar with the study protocol and treatments, which could lead to improved outcomes in patients treated medically. In the Stenting and Aggressive Medical Management for the Prevention of Recurrent Ischemic Stroke (SAMMPRIS) trial,^{4,5} aggressive

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From Houston Methodist Hospital (D.C., R.P.K., C.D.M., L.B.K.), Weill Cornell Medical College, TX; Medical University of South Carolina (T.N.T., M.I.C.), Charleston; Emory University Rollins School of Public Health (M.J.L., A.N., B.F.L., J.M.), Atlanta, GA; Washington University School of Medicine (C.P.D.), St Louis, MO; State University of New York (D.F.), Stony Brook; and National Institute of Neurological Disorders and Stroke (S.J.), National Institute of Health, Bethesda, MD.

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medical management (AMM) alone was compared with AMM plus percutaneous transluminal angioplasty and stenting (PTAS) in patients with symptomatic intracranial stenosis, allowing us to compare outcomes of patients at high- vs low-enrolling sites in both treatment groups.

METHODS SAMMPRIS was a randomized clinical trial funded by the NIH conducted at 50 centers in the United States. Details of the study design, inclusion and exclusion criteria, AMM and PTAS protocols, and the main results have been published previously.^{6,7} In brief, the AMM protocol, which was identical in both groups of the trial, incorporated treatment algorithms that primarily targeted low-density lipoprotein cholesterol (LDL-C) <70 mg/dL and systolic blood pressure (SBP) lower than 140 mm Hg (<130 mm Hg if diabetic). Secondary risk factor targets included hemoglobin A1c <7% in diabetic patients, non-high-density lipoprotein cholesterol (HDL-C) <100 mg/dL, smoking cessation, moderate exercise at least 3 times per week, and weight reduction. The protocol dictated dual antiplatelet therapy with aspirin 325 mg per day and clopidogrel 75 mg per day for 90 days followed by aspirin 325 mg per day alone. A lifestyle modification program (INTERVENT) was administered by a coach who contacted the patients by telephone every 2 weeks for the first 3 months after enrollment and then monthly. If the study neurologist was unable to lower the participant's LDL-C or SBP to target by following the treatment algorithms, further assistance was provided by the central risk factor management team.

Stenting was performed by neurointerventionists who were credentialed to participate in the trial based on review of 20 consecutive intracranial angioplasty and stenting cases, at least 3 of which must have used the Wingspan system. Details of the credentialing process, monitoring of stenting performance during the trial, and periprocedure outcomes according to previous operator experience have been published.⁸ Enrollment in the trial was stopped in April 2011 after 451 patients with recent stroke or TIA attributed to 70%–99% stenosis of a major intracranial artery had been randomized. The primary reason for stopping enrollment was the higher risk of stroke or death at 30 days after enrollment in the PTAS group.^{4,5} Treatment with AMM and follow-up of all enrolled patients were continued until April 2013 and the median duration of follow-up was 32.4 months.⁴

Standard protocol approvals, registrations, and patient consents. Human ethics committee approval was obtained at each SAMMPRIS clinical site. Written informed consent was obtained from all patients participating in the study before enrollment. SAMMPRIS ClinicalTrials.gov number is NCT00576693.

Statistical methods. The designation of a site as high- or low-enrolling was made by ranking the sites by number of patients and splitting the sites into 2 groups such that approximately half of all patients were from the higher-enrolling sites. Baseline characteristics of high- and low-enrolling sites were compared using an independent groups *t* test (for means), Fisher exact test (for percentages), or Wilcoxon rank-sum test (for medians). Patients missing data for a particular characteristic were excluded from the analysis of that characteristic.

To assess whether risk factor targets were achieved during follow-up for each patient, the measurements for a numerical risk factor were averaged across all time points (excluding the baseline

values) up to the time of a primary endpoint or the closeout visit. The in- or out-of-target determination was then based on whether the average met the target (table e-1 on the *Neurology*[®] Web site at Neurology.org). For smoking, the target was achieved if the patient did not smoke during follow-up. For the INTERVENT program, patients were considered compliant if $\geq 79\%$ of expected contacts (the median) between the patient and the coach were completed. For the assessment of compliance with the INTERVENT program, patients were excluded from the analysis if they withdrew consent early (i.e., before 3 expected INTERVENT calls had been made, which typically would have been made no later than 2 months after enrollment) or they reached a primary endpoint within 30 days of enrollment. The mean values of the risk factors, the in-target percentages, and the INTERVENT compliance rates were compared between the high- and low-enrolling sites for each of the treatment groups using the independent groups *t* test (for means) and Fisher exact test (for percentages).

The Kaplan-Meier (K-M) curves for the time to a primary endpoint (any stroke or death within 30 days after enrollment or within 30 days after a revascularization procedure performed during follow-up or ischemic stroke in the territory of the stenotic artery beyond 30 days after enrollment) were compared between patients enrolled at high- vs low-enrolling sites for each of the treatment groups using the log-rank test. Patients lost to follow-up or who withdrew consent were censored at the last contact date. To assess the impact of potential confounding factors on the primary endpoint at high- vs low-enrolling centers, we identified the baseline characteristics that were both different between the 2 groups of centers and also associated with the primary endpoint. A comparison of the primary endpoint between the groups of centers adjusted for these potential confounding factors was made using proportional hazards regression. *p* Values <0.05 were considered statistically significant. All analyses were done using SAS 9.3.

RESULTS Patients and baseline characteristics. Among the 451 patients in the study, 228 patients (51%) were from 12 sites enrolling 12–27 patients (designated high-enrolling sites) and the remaining 223 patients (49%) were from 38 sites enrolling 1–11 patients (designated low-enrolling sites). For the PTAS group, 11 patients were excluded from these analyses (4 patients declined the procedure after randomization and in 7 patients the procedure was aborted before the lesion was accessed). Of the remaining 213 PTAS patients (4 of whom underwent angioplasty only), 111 were from high-enrolling sites and 102 were from low-enrolling sites. For the AMM group, all 227 patients randomized to that group were included in the analyses presented here, with 114 from high-enrolling sites and 113 from low-enrolling sites.

Among the baseline characteristics presented in tables e-2 and e-3, the only significant differences between high- and low-enrolling sites were as follows: for the PTAS group, the percent of patients with hypertension was higher at the high-enrolling sites (94% vs 84%, *p* = 0.045), and for the AMM group, the median number of days from the qualifying event to enrollment was 1 day less at the high-enrolling sites (7 vs 8 days, *p* = 0.035).

Occurrence of the primary outcome. In the PTAS group, the K-M curves for the primary endpoint were similar between the high- and low-enrolling sites ($p = 0.93$) (figure 1) with 30-day and 2-year rates of 13.5% and 19.0% at high-enrolling sites and 14.7% and 20.6% at low-enrolling sites (table 1). In contrast, the K-M curves for the AMM group showed a lower risk of the primary endpoint at high-enrolling sites compared with low-enrolling sites ($p = 0.0005$) (figure 2) with 30-day and 2-year rates of 1.8% and 7.3% at high-enrolling sites vs 9.8% and 20.9% at low-enrolling sites (table 1). Similar results were found with 3 categories of sites according to enrollment volume: high (≥ 20 patients), medium (10–19 patients), and low (1–9 patients), and also when the number of patients was analyzed as a continuous factor (table e-4 and figure e-1).

Success with AMM. We evaluated the relative success of AMM during follow-up between high- and low-enrolling sites. In the PTAS group, none of the risk factors differed between high- and low-enrolling sites during follow-up for either the percent in-target (table 2) or the mean values (table 3). In the medical group, high-enrolling sites attained LDL-C target in 68% of participants compared to 48% at low-enrolling sites ($p = 0.005$; table 2) and the mean LDL-C during follow-up was 9.5 mg/dL lower among patients at high-enrolling sites (65.3 vs 74.8 mg/dL, $p = 0.005$; table 3). The mean SBP during follow-up was lower at high-enrolling vs low-enrolling sites (131.4 vs 135.2 mm Hg, $p = 0.028$) despite the fact that the baseline mean SBP in the same patients was slightly higher at high-enrolling sites (148.1 vs

146.2 mm Hg). Additionally, mean non-HDL-C was also lower at high- vs low-enrolling sites during follow-up (87.4 vs 99.1 mg/dL, $p = 0.004$) (table 3).

Since the risk factor management protocol was identical for the PTAS and AMM groups and there were no significant differences between control of any risk factors between the PTAS and AMM groups,⁴ we also evaluated the relative success of AMM during follow-up between high- and low-enrolling sites in the total SAMMPRIS cohort. The percentages of patients at high- vs low-enrolling sites who reached LDL-C target were 64% vs 49% ($p = 0.003$), who reached SBP target were 70% vs 59% ($p = 0.026$), and who reached non-HDL-C target were 72% vs 63% ($p = 0.051$) (table e-5). The mean values during follow-up for SBP, LDL-C, and non-HDL-C were lower at the high-enrolling sites (table e-6). None of the other risk factors (hemoglobin A1c in diabetics, body mass index, smoking, physical activity) or compliance with the lifestyle modification program during follow-up differed between high- and low-enrolling sites in patients in both treatment groups combined or either of the treatment groups alone.

Assessment of potential confounding factors. In the PTAS group, the only potential confounding factor identified was age since it was associated with the primary outcome (older patients being at higher risk⁹) and there was a trend for a lower mean age at high-enrolling sites (59.7 ± 10.2 vs 62.5 ± 11.1 at low-enrolling sites, $p = 0.056$; table e-2). However, we found that the time to a primary endpoint did not differ between high- and low-enrolling sites (hazard ratio 0.96 [95% confidence interval 0.5–1.7], $p = 0.89$) when adjusting for age.

Figure 1 Occurrence of the primary endpoint in the stenting arm at high- vs low-enrolling sites

Table 1 Primary endpoint vs site enrollment

Site enrollment	No. patients	Patients with primary endpoint, n (%)	Probability of primary endpoint (95% CI)		Hazard ratio (95% CI) ^a	p Value ^b
			30 d	2 y		
PTAS (n = 213)						
High-enrolling	111	25 (22.5)	13.5 (8.4–21.4)	19.0 (12.8–27.7)	1.0 (0.6–1.8)	0.93
Low-enrolling	102	23 (22.6)	14.7 (9.1–23.2)	20.6 (13.9–29.8)		
AMM (n = 227)						
High-enrolling	114	8 (7.0)	1.8 (0.5–6.9)	7.3 (3.7–14.0)	3.7 (1.7–8.3)	0.0005
Low-enrolling	113	26 (23.0)	9.8 (5.5–17.0)	20.9 (14.4–29.7)		

Abbreviations: AMM = aggressive medical management; CI = confidence interval; PTAS = percutaneous transluminal angioplasty and stenting.

High- vs low-enrolling sites by treatment.

^aHazard ratio (low-enrolling to high-enrolling sites) from a proportional hazards regression model with site enrollment as the only factor.

^bp Value for the log-rank test comparing the time to primary endpoint curves between high- and low-enrolling sites.

In the AMM group, the only potential confounding factor we identified was old infarcts in the territory of the qualifying artery. This factor was associated with the primary outcome¹⁰ and there was a trend for a lower percentage of patients at high-enrolling sites to have old infarcts in the territory (28% vs 39% at low-enrolling sites, $p = 0.09$; table e-3). Nevertheless, patients at low-enrolling sites remained at higher risk for the primary endpoint (hazard ratio 3.3 [95% confidence interval 1.5–7.4], $p = 0.0035$) when adjusting for old infarcts in the territory of the qualifying artery.

DISCUSSION High-enrolling sites had a lower risk of the primary endpoint in the medical group but not in the stenting group compared with low-enrolling sites

in SAMMPRIS. The difference was highly significant ($p = 0.0005$), indicating it was unlikely due to chance. Although the randomization of patients to treatment was stratified so that treatment assignment was balanced at each site, the assignment to high- vs low-enrolling sites was not random, so it is possible that some of the differences in primary endpoint rates may have been due to unknown confounding factors. However, known baseline characteristics and vascular risk factors, including those shown to be associated with a higher risk of a primary endpoint in SAMMPRIS,¹⁰ were well-balanced between high- and low-enrolling sites (tables e-2 and e-3).

A previous analysis showed that in the medical arm of SAMMPRIS there was a strong association between good control of the primary risk factors

Figure 2 Occurrence of the primary endpoint in the medical group at high- vs low-enrolling sites

Table 2 Risk factor targets during follow-up

Risk factor criteria for in target during follow-up	High-enrolling		Low-enrolling		p Value ^a
	No.	No. patients in target (%)	No.	No. patients in target (%)	
PTAS (n = 213)					
Mean systolic BP <140 mm Hg (<130 if diabetic)	95	71 (75)	87	56 (64)	0.15
Mean LDL-C <70 mg/dL	95	56 (59)	87	43 (49)	0.23
Mean non-HDL-C <100 mg/dL	95	69 (73)	87	55 (63)	0.20
Mean BMI ≤25 kg/m ^{2b}	95	20 (21)	86	16 (19)	0.71
No smoking during follow-up	96	68 (71)	87	67 (77)	0.40
Exercise: mean PACE score ≥4	96	40 (42)	87	41 (47)	0.55
Hemoglobin A1c <7.0% ^c	47	18 (38)	35	17 (49)	0.38
INTERVENT compliance	96	46 (48)	87	38 (44)	0.66
AMM (n = 227)					
Mean systolic BP <140 mm Hg (<130 if diabetic)	109	72 (66)	99	54 (55)	0.12
Mean LDL-C <70 mg/dL	110	75 (68)	98	47 (48)	0.005
Mean non-HDL-C <100 mg/dL	110	79 (72)	98	61 (62)	0.18
Mean BMI ≤25 kg/m ^{2b}	109	19 (17)	100	26 (26)	0.18
No smoking during follow-up	110	71 (65)	101	75 (74)	0.14
Exercise: mean PACE score ≥4	110	52 (47)	101	57 (56)	0.22
Hemoglobin A1c <7.0% ^c	48	22 (46)	48	24 (50)	0.84
INTERVENT compliance	111	56 (50)	99	54 (55)	0.58

Abbreviations: AMM = aggressive medical management; BMI = body mass index; BP = blood pressure; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; PACE = Patient-centered Assessment and Counseling for Exercise; PTAS = percutaneous transluminal angioplasty and stenting.

High- vs low-enrolling sites by treatment.

^ap Value for Fisher exact test comparing the percent of patients in target between the high-enrolling and low-enrolling sites.

^bIf initial BMI >27 kg/m², then in target if mean weight loss during follow-up was ≥10%.

^cDiabetic participants only.

(LDL-C and SBP) and lower risk of a primary endpoint.¹¹ Therefore, it is likely that the difference in the primary endpoint rates at high- vs low-enrolling sites in the medical group in the current study is at least partially explained by the higher percentage of patients achieving primary risk factor targets and the significantly lower mean LDL-C and SBP levels achieved during follow-up at high-enrolling sites. Although the 2-year primary endpoint rate was 65% lower at high-enrolling sites than at low-enrolling sites, the decline in mean SBP and LDL during follow-up at high-enrolling sites was only 3%–13%. However, the percentage of patients achieving target levels of LDL and SBP in the medical arm at high-enrolling sites were 42% higher (for LDL) and 20% higher (for SBP) than at low-enrolling sites, suggesting that there may be threshold levels for achieving control of these risk factors that is associated with a lower risk of stroke. This may be particularly true if target levels of both risk factors are achieved together. Nevertheless, the discrepancy

between the extent of the lower stroke risk vs the mean reduction in LDL and SBP levels at high-enrolling sites suggests that other factors may also have contributed to the lower stroke risk at high-enrolling sites.

In this regard, the difference in primary endpoint rates at high- vs low-enrolling sites in the medical group had already emerged by 30 days (absolute risk reduction of 8% at 30 days at high-enrolling sites) but continued to increase by 2 years (absolute risk reduction of 13.6% at 2 years at high-enrolling sites). It has been suggested that combining clopidogrel with aspirin for the first 90 days after enrollment in SAMMPRIS may have been partly responsible for the lower than expected stroke rate in the medical group of SAMMPRIS,^{4,5} which raises the possibility that a difference in compliance with combination antiplatelet therapy at high- vs low-enrolling sites may help explain the differences in early primary endpoint rates at these sites. Though pill counts of aspirin and clopidogrel were

Table 3 Mean values for risk factors during follow-up

	High-enrolling		Low-enrolling		
Risk factor	No.	Mean (SD)	No.	Mean (SD)	p Value ^a
PTAS (n = 213)					
Systolic BP, mm Hg	95	130.3 (9.9)	87	132.8 (11.2)	0.11
LDL-C, mg/dL	95	69.8 (24.0)	87	72.5 (22.0)	0.42
Non-HDL-C, mg/dL	95	92.7 (25.9)	87	94.4 (24.8)	0.65
HgbA1c, %	47	7.8 (1.9)	35	7.6 (1.8)	0.79
AMM (n = 227)					
Systolic BP, mm Hg	109	131.4 (11.2)	99	135.2 (13.2)	0.028
LDL-C, mg/dL	110	65.3 (17.1)	98	74.8 (28.3)	0.005
Non-HDL-C, mg/dL	110	87.4 (22.3)	98	99.1 (33.3)	0.004
HgbA1c, %	48	7.7 (1.6)	48	7.6 (1.7)	0.81

Abbreviations: AMM = aggressive medical management; BP = blood pressure; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; PTAS = percutaneous transluminal angioplasty and stenting. High- vs low-enrolling sites by treatment.

^ap Value for the independent group t test comparing the means of the high-enrolling and low-enrolling sites.

performed in SAMMPRIS, the reliability of these data is uncertain because many patients used their own or hospital-supplied clopidogrel or aspirin rather than study-provided drugs.

The SAMMPRIS AMM strategy was highly effective overall in achieving risk factor targets in study patients and likely led to the lower than expected rate of stroke in the medical group. It appears, however, that the degree of success varied significantly depending on site experience with the medical management protocol. Indeed, the low rates of the primary endpoint in the medical group of SAMMPRIS at the high-enrolling sites (7.3% at 2 years) suggest the possibility of an even greater reduction in the risk of stroke from AMM than the overall results of SAMMPRIS indicated. However, the rate of the primary endpoint at 2 years in the medical group at low-enrolling sites was 20.9%, similar to the 2-year rates in the stenting group at both high- and low-enrolling sites. If the reason for the higher rate of primary endpoints at low-enrolling sites in the medical group relates to poorer control of primary risk factors, as we suspect, this shows the critical importance of achieving LDL-C and SBP targets to derive the benefit of AMM.

The results of this study strongly suggest that the benefit of specialized stroke treatment extends beyond the ability to perform advanced surgical and endovascular procedures. Effectively implementing multimodal medical strategies for recurrent stroke prevention is a proven added value. For example, stroke order sets and standardized protocols at primary and comprehensive stroke center hospitals boost performance on quality metrics.¹² Performance feedback programs with ongoing education and training are shown to improve risk factor control. Much of the

risk factor management in SAMMPRIS was performed by study coordinators using medication titration algorithms with neurologist oversight, mirroring lipid management clinics that use physician extenders commonly seen in clinical practice. Though many neurologists are less experienced than internists and cardiologists at managing risk factors, SAMMPRIS neurologists and study coordinators at high-enrolling centers gained familiarity and proficiency in implementing the AMM protocol, leading to higher rates of LDL and SBP control.

This study has some important limitations. The study was conceived post hoc, the sites were assigned as high- or low-enrolling to ensure an equal number of patients at both types of sites, which meant that the 1 site enrolling 12 patients was considered high-enrolling whereas 5 sites that enrolled 11 patients were considered low-enrolling, and we cannot be certain that some of the differences in the primary endpoint rates at high- vs low-enrolling sites in the AMM group may have been due to unknown confounding factors.

Despite these limitations, the results of the study suggest that greater familiarity with the SAMMPRIS medical management led to better control of the primary risk factors (elevated LDL and SBP), which likely was an important contributor to the much lower primary endpoint rate in the medical group at high-enrolling sites. The focus of site selection in surgical and interventional trials has revolved around credentialing operators to establish a high degree of competence and experience but little attention has been given to choosing neurologists and internists who have been shown to be competent and experienced with medical management. The results of this study suggest that more attention should be paid to

the latter in choosing physicians and sites for future cerebrovascular and other clinical trials.

AUTHOR CONTRIBUTIONS

David Chiu: drafting/revising the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, study supervision. Richard P. Klucznik: study concept or design, accepts responsibility for conduct of research and final approval, acquisition of data. Tanya N. Turan: drafting/revising the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, study supervision. Michael J. Lynn: drafting/revising the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, statistical analysis, study supervision, obtaining funding. Charles D. McCane: drafting/revising the manuscript, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data. Lawrence B. Katz: drafting/revising the manuscript, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, study supervision. Azhar Nizam: analysis or interpretation of data, accepts responsibility for conduct of research and final approval, statistical analysis. Colin P. Derdeyn: drafting/revising the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, study supervision, obtaining funding. David Fiorella: study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, study supervision, obtaining funding. Bethany F. Lane: study concept or design, accepts responsibility for conduct of research and final approval, study supervision. Jean Montgomery: analysis or interpretation of data, accepts responsibility for conduct of research and final approval, study supervision. Scott Janis: study concept or design, accepts responsibility for conduct of research and final approval, study supervision. Marc I. Chimowitz: drafting/revising the manuscript, study concept or design, analysis or interpretation of data, accepts responsibility for conduct of research and final approval, acquisition of data, study supervision, obtaining funding.

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This Week's *Neurology*® Podcast

Basal ganglia T1-hyperintensity in LGI1-autoantibody faciobrachial dystonic seizures (see the December 2015 volume of *Neurology*® Neuroimmunology & Neuroinflammation)

This podcast begins and closes with Dr. Robert Gross, Editor-in-Chief, briefly discussing highlighted articles from the December 15, 2015, issue of *Neurology*. In the second segment, Dr. Jeff Waugh talks with Dr. Eoin Flanagan about his *Neurology: Neuroimmunology & Neuroinflammation* paper on basal ganglia T1-hyperintensity in LGI1-autoantibody faciobrachial dystonic seizures. Dr. Adam Numis reads the e-Pearl of the week on genetic testing in facioscapulohumeral dystrophy. In the next part of the podcast, Dr. Ted Burns focuses his interview with Dr. Steve Ringel on a *Neurology Today*® story about immunotherapy for autoimmune cerebellar ataxia.

Disclosures can be found at Neurology.org.

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