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How Diagnosis-Related Group 559 Will Change the US Medicare Cost Reimbursement Ratio for Stroke Centers

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Background and Purpose—Thrombolysis for acute ischemic stroke saves societal costs, but hospitals that practice acute stroke care appear to shoulder the burden of the cost, which exceeds reimbursement. With creation of the diagnosis-related group (DRG) 559, the US Centers for Medicare and Medicaid Services pays hospitals approximately US \$6000 more per case when thrombolysis is administered. We sought to determine the total cost of, and reimbursement for, acute stroke treatment with thrombolysis at a single stroke center and the economic impact of DRG 559.

Methods—Between September 2001 and December 2004, we collected data on all patients with acute stroke who received thrombolysis. We identified all hospital costs and reimbursement per patient. Financial results were expressed as a cost-reimbursement ratio: average total cost to average total reimbursement per patient. We then reanalyzed data using the projected Medicare hospital reimbursement with DRG 559.

Results—Sixty-seven patients with stroke (mean age, 72 years) were treated (mean length of stay, 4.4 days; mean stroke severity, National Institutes of Health Stroke Scale score of 15; and symptomatic intracranial hemorrhage rate, 7%). The cost-reimbursement ratio was 1.41 (95% CI=0.98 to 2.28) before DRG 559 and estimated to be 0.82 (95% CI=0.66 to 0.97) after DRG 559.

Conclusions—Our hospital costs have traditionally exceeded Medicare reimbursement for the acute care of thrombolysed patients with ischemic stroke, but with DRG 559, a new economically favorable cost-reimbursement ratio for hospitals will be established. (*Stroke*. 2007;38:000-000.)

Key Words: ischemic ■ reimbursement ■ stroke ■ stroke treatment ■ thrombolysis

Thrombolysis for acute ischemic stroke is a cost-saving therapy from a societal perspective.¹⁻⁴ Both the clinical and the economic outcomes of thrombolytic treatment for stroke are favorable. On the front end, acute care costs for thrombolysis are greater, but savings are realized on the back end with a reduced need for rehabilitation and extended care. Treating patients with thrombolysis is more expensive because the patient with stroke must be monitored longer in the intensive care unit and there are other added costs such as for increased diagnostic imaging, increased laboratory and pharmacy costs, proper staffing (eg, an acute stroke team), and infrastructure. Unfortunately, hospitals and healthcare professionals who practice acute stroke care usually shoulder the burden of the cost, which has historically exceeded reimbursement. To remedy this discrepancy between cost and reimbursement, the US Centers for Medicare and Medicaid Services (CMS) announced that, as of October 1, 2005, it would begin paying hospitals approximately US \$6000 more per patient with stroke when thrombolytic treatment is administered.

CMS published its Final Rule for the Inpatient Prospective Payment System on August 12, 2005, including the new

diagnosis-related group (DRG) 559. In general, DRG 559 allows a hospital to be reimbursed an average of US \$11 578 for the care of a patient with acute ischemic stroke who is treated with thrombolysis. Before this action, DRG codes for stroke (DRG 14 and DRG 15) limited hospital reimbursement to US \$4000 to \$6000 regardless of the type of acute therapy.

We sought to determine the total hospital cost and reimbursement for thrombolytic treatment of patients with acute stroke at a single stroke center in a tertiary care academic medical institution and to estimate the economic impact of DRG 559.

Materials and Methods

Our hospital is a 208-bed facility located in north Phoenix in Maricopa County, Arizona. The facility is certified by the Joint Committee on Accreditation of Healthcare Organizations as a primary stroke center, and it is one of eight stroke centers in the Phoenix Metropolitan Matrix of Primary Stroke Centers.⁵ Our hospital also participates in the hospital-based quality improvement program “Get With the Guidelines” under the joint sponsorship of the American Heart Association and the American Stroke Association.⁶ Our hospital has a closed medical staff. Three salaried stroke neurologists share round-the-clock care 7 days per week (24/7). Each week, one of the three stroke neurologists is on call 24 hours per day

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for 7 consecutive days from Monday at 7:00 AM to Monday at 7:00 AM to respond directly to stroke alert calls at our institution. From 7:00 AM to 5:00 PM on weekdays, the on-call stroke neurologist is physically in the hospital. From 5:00 PM to 7:00 AM and on weekends, the on-call stroke neurologist can be off site but must be physically present at the stroke patient's bedside within 30 minutes of being paged.^{7,8}

The population under study included only those patients who received thrombolysis for acute ischemic stroke. In this analysis, we defined the study population as any patient with acute ischemic stroke who received thrombolytic therapy. This included intravenous (IV), IV-intraarterial (IA), IA alone, IV plus use of a blood clot retrieval device, the Merci Retriever (Concentric Medical), and IA plus the use of the Merci. We excluded any patient who received only Merci or surgical thrombectomy without thrombolysis. Between September 2001 and December 2004, we collected data on all patients with acute stroke who received any IV, IA, or IV and IA thrombolysis at our stroke treatment center. Tracking these patients was made possible by our prospective registry of patients with acute stroke. This clinical registry was crosschecked by the International Classification of Diseases, Ninth Revision procedure code 99.10 (injection or infusion of thrombolytic agent) and by pharmacy records. All actual hospital costs (eg, patient care services, pharmacy, radiology, respiratory therapy, emergency department, surgery, cardiognostics, laboratory, and rehabilitation therapies) for each patient with stroke who received thrombolytic therapy were extracted during the patient's acute medical admission. As specified previously, we used costs rather than charges. Our institution uses a decision support system (sometimes referred to as a clinical management system) that incorporates a procedural costs system database. The system automatically collects the cost data based on all patient care procedures from admission to discharge. In the costing methodology that the system uses, product costs are based on department expenses (direct and indirect) and product volumes. Then the costs are allocated across the department products using factors that represent each product's relative resource intensity. All actual reimbursements to the institution for each thrombolytically treated stroke patient were also identified from the financial department records.

We also collected information about patient age, insurance payer, stroke severity, symptomatic intracranial hemorrhage complications, and length of hospital stay. A hospital does not typically release cost data outside the institution. After a review with our financial services personnel, we have carefully and intentionally avoided making any reference to absolute costs or absolute reimbursements for patient care at our institution. That type of information is confidential and proprietary for any healthcare institution. Instead, we have presented all the financial results in a relative form using the cost-reimbursement ratio (CRR). There is a precedent at our institution for using this format when presenting confidential financial data in an external forum or venue (eg, conference presentation, scientific abstract, or manuscript for publication).

The CRR is simply the ratio of the total cost per patient to the total reimbursement per patient. CRR results greater than 1 reflect that costs exceed reimbursement, whereas results less than 1 reflect that reimbursement exceeds costs. Then we reconducted the analysis by inflating all of the patients' costs to a 2005 reference year and by replacing the actual hospital reimbursements with the projected 2005 Medicare hospital reimbursement for DRG 559. We calculated the mean cost and reimbursement, their respective variances, SDs, and 95% CIs for our thrombolysis patient cohort before and after DRG 559. For each thrombolysed patient, we also calculated an individual CRR. This then allowed calculation of the mean CRR, variance, SD, and 95% CI for the patient cohort for each year of the study period before and after DRG 559. In a secondary analysis, we calculated the mean CRR and the range of CRRs for two subgroups: 1) patients treated only with IV thrombolysis and 2) patients treated with thrombolysis plus endovascular management (IV-IA, IA alone, IV plus use of a blood clot retrieval device, the Merci Retriever, and IA plus the use of the Merci). The Institutional Review Board approved this research protocol.

Results

During the 40-month study period, 67 patients at our stroke center received IV thrombolysis within 3 hours of symptom onset per the National Institute of Neurological Disorders and Stroke protocol for acute ischemic stroke, received IA thrombolysis or IV-IA thrombolysis within 6 hours, or received treatment with the Merci (in conjunction with or after thrombolysis) within 8 hours. Historically, at our stroke center, of all the patients with ischemic stroke who were treated with acute therapies, 77% received IV tissue plasminogen activator (tPA), 14% received IV-IA tPA, 4% received IA tPA alone, 3% received IV or IA tPA combined with treatment with the Merci, and 2% received treatment with the Merci alone or surgical thrombectomy alone. The thrombolysis treatment group in this study represented approximately 12% of all admitted patients with ischemic stroke. The mean age of these patients was 72 years. The mean stroke severity at presentation was a National Institutes of Health Stroke Scale score of 15. The symptomatic intracranial hemorrhage rate was 7%. Medicare was the primary insurance payer for 70% of these patients with stroke. Only 46% of the true thrombolysis registry cases were correctly coded with the nonoperating room International Classification of Diseases, Ninth Revision procedure code 99.10 (injection or infusion of thrombolytic agent).

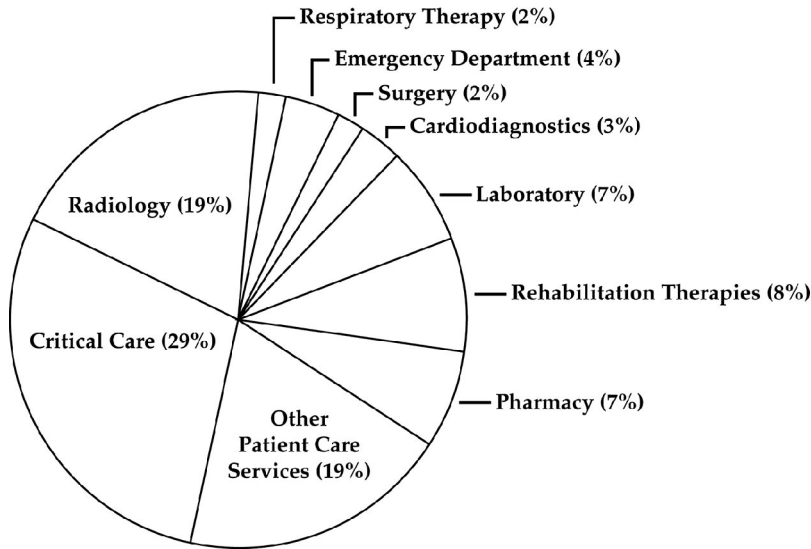
At our institution during the study timeframe (2001–2004), the costs for the acute inpatient stay of patients who received thrombolysis for ischemic stroke were distributed as follows: critical care services, 29%; medical–surgical acute care services, 19%; radiology, 19%; rehabilitation therapies, 8%; pharmacy, 7%; laboratory, 7%; emergency department, 4%; cardiognostics, 3%; surgery, 2%; and respiratory therapy, 2% (Figure). The CRRs before DRG 559 during the study period were 0.82 (2001), 1.39 (2002), 1.49 (2003), and 1.48 (2004) with a summary CRR of 1.41 (95% CI=0.98 to 2.28). The estimated CRRs after DRG 559 during the same study period were 0.91 (2001), 0.91 (2002), 0.85 (2003) and 0.69 (2004) with a summary CRR of 0.82 (95% CI=0.66 to 0.97) (Table).

In the secondary subgroup analysis, the range of CRRs (pre-DRG 559) for patients receiving IV thrombolysis alone was 0.44 to 3.02 with a mean CRR of 1.19. The range of CRRs (pre-DRG 559) for patients treated with thrombolysis plus endovascular management (IV-IA, IA alone, IV plus use of the Merci Retriever) was 0.97 to 3.93 with a mean CRR of 2.17.

Discussion

The costs at our primary stroke center between September 2001 and December 2004 exceeded Medicare reimbursement for the thrombolytic treatment of patients with acute ischemic stroke. The hospital CRR was 1.41 (95% CI=0.98 to 2.28). Expressed differently, this means that 29%, on average, of hospital costs went unreimbursed.

The hospital CRR trend for this patient population became progressively less favorable between 2001 and 2004 from a CRR of 0.82 to a CRR of 1.48. The hospital received progressively less reimbursement relative to costs over time.



Distribution of hospital costs by department for patients with stroke who received thrombolysis (2001-2004).

We presumed that the reimbursement rate was not keeping up with inflation.

The hospital CRR was 1.19 for the IV thrombolysis subgroup of the overall cohort and 2.17 for the IV plus endovascular management subgroup. Therefore, we concluded that 16% of the hospital costs for the IV thrombolysis subgroup and 54% of those for the IV plus endovascular management subgroup went unreimbursed.

We estimate that DRG 559 will have an overall favorable impact on the financial bottom line of our stroke center. The estimated new hospital CRR was 0.82 (95% CI=0.66 to 0.97). In other words, 122% of our hospital costs would appear to be reimbursable under DRG 559.

One challenging discovery is the fact that the procedure code 99.10 was recorded in only 46% of the instances when a thrombolytic agent was administered to a patient with stroke in our hospital. Other authors have previously concluded that International Classification of Diseases, Ninth Revision code 99.10 underestimates the use of recombinant when compared with pharmacy records.^{9,10} They demonstrated that in 2004, the International Classification of Diseases, Ninth Revision-based estimate was less than half the estimate based on pharmacy records. At our institution, we have reported a similar finding. The 99.10 code identifies only 46% of the true cases of thrombolysis for ischemic stroke.

If this underrecording of thrombolysis patients were to continue with DRG 559, the annual revenue loss to our hospital could amount to as much as US \$126 500. We therefore embarked on an urgent training and information session for neurologists, administrators, and hospital coders.

To provide ample cues for the coders, stroke neurologists now routinely dictate or margin code each patient's electronic chart with the phrases "administration of thrombolysis for acute stroke," "procedure code 99.10," and "DRG 559."

The former lack of Medicare reimbursement for stroke centers may have served as an impediment not only to the use of thrombolysis, but also to the growth of stroke centers throughout the United States. DRG 559 and the increased Medicare reimbursement may therefore prove to be catalysts for major change in the treatment approach to patients with acute stroke across the country. Since August 12, 2005, there has been an explosion in the number of hospital facilities applying for and attaining Joint Committee on Accreditation of Healthcare Organizations primary stroke center certification.¹¹

Unfortunately, Medicare reimbursement for stroke health-care professionals (eg, stroke neurologists) is still inadequate. Kleindorfer et al¹² concluded that physician reimbursement for the evaluation and treatment of acute stroke, when compared with that for other diagnoses commonly treated by neurologists, is relatively low in the United States and Canada. The revised CMS rules do not change this ongoing reimbursement gap for comparable care. The inadequate professional reimbursement may, in part, contribute to slow growth of the cerebrovascular neurology field. Despite the reimbursement adjustment that more accurately reflects hospital costs, the rate-limiting step for the development of additional acute stroke teams may be the willingness of neurologists to champion thrombolytic treatment for stroke. Fortunately, for institutions like ours, with full-time salaried

Comparison of the Hospital Cost Reimbursement Ratio for Thrombolytic Stroke Treatment Before and After DRG 559 During the Time Interval Between 2001 and 2004

Timeline	2001 CRR (N=5)	2002 CRR (N=18)	2003 CRR (N=23)	2004 CRR (N=21)	Summary CRR (95% CI) (N=67)
Before DRG 559	0.82	1.39	1.49	1.48	1.41 (0.98 to 2.28)
After DRG 559	0.91	0.91	0.85	0.69	0.82 (0.66 to 0.97)

cerebrovascular neurologists, the professional reimbursement losses are offset by the improved hospital reimbursement.

Given that we have demonstrated how a hospital may improve its CRR with DRG 559 reimbursement for this patient population, facilities that want to recruit or retain stroke neurologists should consider offering a stroke on-call stipend. There is already a precedent for on-call stipends for other emergency services (eg, critical members of hospital trauma teams). In Canada, on-call stipends for stroke neurologists are widespread, ranging from US \$150 to US \$850 per day for carrying and responding to a stroke pager. In the United States, this standard has not yet been uniformly adopted. Some reported stipends for neurologists in the United States range from US \$141 per day (25th percentile) to US \$539 per day (75th percentile).¹³ The estimated surplus hospital reimbursement provided by DRG 559 is a potential funding source for such an on-call stipend for stroke neurologists or neurology hospitalists.

Health policy decision-makers in the United States appear to have recognized the need to properly reimburse hospitals for their additional costs in caring for patients with acute stroke who require thrombolysis. Although DRG 559 serves us well now for patients with acute ischemic stroke, it is not broad enough to encompass other promising pharmacotherapies and endovascular surgical therapies for acute stroke in late stages of development. When new and improved therapies for acute ischemic and hemorrhagic stroke are approved by the US Food and Drug Administration, we suggest that the CMS evaluate the data and make additional DRG changes as appropriate. For example, in reference to the Merci device, there is a new DRG under consideration that is designed to accommodate endovascular mechanical embolus extraction in patients with acute ischemic stroke.¹⁴ The CMS is currently accepting public comments. From our subgroup analysis, it appears that the hospital care for patients with ischemic stroke who require any endovascular procedures in addition to thrombolysis was grossly underreimbursed from 2001 to 2004 (CRR, 2.17). Thus, an adjustment with a new DRG would appear to be justified. Additionally, we propose that the CMS begin to recognize acute treatment of patients with hemorrhagic stroke with hemostatic agents such as recombinant activated factor VII.¹⁵

The cost at our stroke center has traditionally exceeded the Medicare reimbursement for the care of patients with acute ischemic stroke treated with thrombolysis. We estimate that seeking reimbursement under DRG 559 will help establish a new economically favorable CRR for our stroke center.

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Disclosures

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