ORIGINAL ARTICLE

Relative Roles of Radiologists and Other Physicians in Percutaneous Endovascular Neurointerventions

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Abstract

Purpose: Cerebral catheter angiography and endovascular neurointerventions (ENIs) were developed and refined by early pioneers in neuroradiology. Recently, with developments in the safety and efficacy of ENIs, other physician specialists have expressed strong interest in performing these procedures. Our purpose was to compare volume and utilization of ENIs, among the various specialties, from 2000 to 2013.

Methods: Data from the Medicare Part B Physician/Supplier Procedure Summary Master Files for 2000 to 2013 were used to study ENI volume and utilization rates, by radiologists, neurosurgeons, neurologists, vascular surgeons, cardiologists, and other physicians.

Results: From 2000 to 2013, the volume of intracranial ENIs increased: overall, from 2,439 to 7,424; for radiologists, from 1,956 to 3,993; and for neurosurgeons, from 237 to 2,900. Although cardiologists did not perform many intracranial ENIs in these years, they performed most of the carotid artery stenting procedures (4,097, which is 51% of the total 8,201 performed in 2013).

Conclusions: Radiologists continue to maintain a strong presence in the field of neurointerventional radiology, particularly in percutaneous intracranial interventions, performing 51% of all intracranial procedures in 2013, down from 80% in 2000. However, neurosurgeons have made substantial inroads into ENI procedures, with their volume increasing from 10% to 33%, from 2000 to 2013. The overall volume of ENIs rose steadily from 2000 to 2013.

Key Words: Neurointervention, volume, radiologist, neurosurgeon, NIR, fellowship

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INTRODUCTION

Historically, cerebral catheter angiography and endovascular neurointerventions (ENIs) were developed, refined, and practiced by early pioneers in the field of neuroradiology. Before the advent of CT and MR, cerebral angiography was used to study vascular lesions of the central nervous system (CNS), and as a means of localizing CNS mass lesions by observing their displacing effect on adjacent vascular structures. To this day, conventional cerebral angiography offers the highest temporal and spatial resolution for the study of vascular pathology in the CNS, and is the gold standard for diagnosis of several types of vascular lesions.

In more recent years, rapid improvements in the field of CT and MR (particularly in the field of CT and MR angiography) soon relegated conventional angiography to a problem-solving diagnostic tool. Patients with cerebral aneurysms and other vascular pathology could be taken to the operating room for definitive treatment on the basis of high-quality CTA [1]. Aside from the nephrotoxicity and potential for contrast allergies related to intravenous iodinated contrast, CTA was much safer than conventional angiography; the reported 0.5% risk of stroke associated with conventional cerebral angiography was avoided by doing CTA [2]. In addition, CTA was faster to acquire, had wider availability, and was much less expensive.

Relatively recent advances in the field of device development in neuroangiography led to a resurgence of cerebral angiography, this time for the purpose of intervention. The development of the Guglielmi detachable

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coils meant that cerebral aneurysms could potentially be treated via an endovascular approach [3]. In addition, several stents, glues, and other embolization materials were developed for treatment of vascular CNS lesions.

These technical advances coincided with several trials that proved the feasibility, safety, and clinical efficacy of endovascular therapy for two major indications: ruptured cerebral aneurysms (the International Subarachnoid Aneurysm Trial [ISAT]) [4], and acute ischemic stroke (Prolyse in Acute Cerebral Thromboembolism [PROACT II]) [5]. In ISAT, 2,143 patients who had ruptured cerebral aneurysms were randomized to coiling, versus clipping, of the aneurysm. Morbidity and mortality were lower in the group treated with endovascular coiling (23.5% versus 30.9%; absolute risk reduction: 7.4%), which persisted in the five-year follow-up data. In PROACT II, 180 patients with acute middle cerebral artery occlusion presenting within six hours of symptom onset were randomized to intra-arterial thrombolysis, plus usual care or usual care alone. Increased rates of recanalization (66% versus 18%) and functional independence (40% versus 25%) were seen at 90 days in the group treated with intra-arterial thrombolytics.

On January 1, 2015, the results of the MR CLEAN study demonstrated the safety and efficacy of intra-arterial thrombolysis for acute ischemic strokes caused by proximal occlusions in the anterior circulation [6]. In the MR CLEAN study, 500 patients with proximal anterior circulation strokes were randomly assigned to intra-arterial therapy plus usual care or usual care alone. A 13.5% absolute difference was found in the rate of functional independence in favor of intra-arterial therapy, without any significant differences in mortality or symptomatic cerebral hemorrhage.

As the capability of conventional catheter cerebral angiography for interventional therapy became more widely accepted and available, specialists from fields other than radiology expressed interest in this new field and began training with prominent neuroradiologists. Partly in response to this influx of specialists from various backgrounds into the field of neuroangiography, the Society of Neurointerventional Surgery (SNIS) was formed to address and establish formal training standards for operators or neurointerventionalists [7]. Three formal pathways to becoming a neurointerventionalist are generally recognized by SNIS; the neuroradiology, neurosurgery, and neurology pathways [7]. Our purpose was to compare trends in volume of ENI performed among the various specialties, as well the overall volume trends from the years 2000 to 2013.

METHODS

Data from the CMS Physician/Supplier Procedure Summary Master Files for 2000 to 2013 were used for this study. This database covers the Medicare fee-for-service population but does not include Medicare Advantage patients. The Current Procedural Terminology, version 4 (CPT-4) codes for percutaneous neurointerventions (Table 1) were used to obtain the volume of procedures performed in the Medicare fee-for-service population. For this study, we analyzed allowed billing claims submitted for CPT-4 codes for interventional cerebral angiography of the intracranial and extracranial cerebral vessels (percutaneous embolization of tumors and vascular malformations, angioplasty for vasospasm, intracranial stenting, and extracranial carotid artery stenting). Using Medicare's provider specialty codes, we classified the physicians performing ENI into six groups: radiologists, neurosurgeons, neurologists, vascular surgeons, cardiologists, and other physicians.

We were not able to assess stroke-related procedures such as transcatheter intracranial thrombolysis or thrombectomy,

Table 1. Codes and descriptors for endovascular neurointerventions procedures

Code	Descriptor
61623	Endovascular temporary balloon arterial occlusion including selective catheterization
61624/26	Endovascular permanent occlusion/embolization, including tumor, vascular malformation
61630	Percutaneous balloon angioplasty, intracranial
61635	Transcatheter placement of intravascular stents, intracranial
61640/41/42	Balloon dilatation of intracranial vasospasm
61710	Treatment of aneurysm, arteriovenous malformations by intra-arterial embolization or balloon catheter
0075T/76T	Transcatheter vertebral artery stenting
0005T/6T	Extracranial carotid artery angioplasty and stenting
37215	Extracranial carotid artery stenting with distal embolic protection
37216	Extracranial carotid artery stenting without distal embolic protection