ORIGINAL ARTICLE

Changing Utilization Patterns of Cervical Spine Imaging in the Emergency Department: Perspectives From Two Decades of National Medicare Claims

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Abstract

Purpose: The aim of this study was to assess the changing use of emergency department (ED) cervical spine imaging in the Medicare population.

Methods: Using national aggregate Medicare claims data from 1994 through 2012, all cervical spine radiographic, CT, and MR examinations performed in the ED setting were identified. Shifts in modalities and providers and changes in utilization rates were studied.

Results: Between 1994 and 2004, ED cervical spine radiography volumes in the Medicare fee-for-service population increased from 203,645 to 306,442 (+50.5%) and then declined to 152,755 (−50.2%) by 2012. CT volumes increased every year, overall by +8,864% from 1994 through 2012 (from 6,360 to 570,121). MR grew by +1,381%, but volumes overall were small (from 944 to 13,979). With these changes, CT overtook radiography as the dominant ED cervical spine imaging modality in 2007. Per 1,000 Medicare beneficiaries, utilization rates of radiography, CT, and MR changed by −27%, +8,682%, and +1,351% from 1994 through 2012 (from 6.3 to 4.6, from 0.2 to 17.3, and from 0.0 to 0.4). For all years, compared with other specialists, radiologists remained by far the dominant providers of radiography, CT, and MR (+91.7%, +93.4%, and +96.0% in 1994 and +96.9%, +99.3%, and +99.0% in 2012) in the ED setting.

Conclusions: Between 1994 and 2012, the overall utilization rate of cervical spine imaging for Medicare beneficiaries in the ED setting more than tripled. With a small decline in radiography (−27%) but a dramatic increase in CT (+8,864%), CT is now by far the dominant modality for imaging the cervical spine in the ED. Radiologists remain overwhelmingly the dominant providers of these interpretive services.

Key Words: Cervical spine imaging, CT, emergency department, imaging utilization, MR, Medicare, radiography, radiology

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INTRODUCTION

More than one million patients with potential cervical spine injuries are treated each year in US emergency departments (EDs) [1,2]. Although cervical spine imaging is less frequently performed in the ED for indications other than trauma, concerns about increased throughput and medicolegal issues have intensified its utilization in recent years. Additionally, during this time, cross-sectional imaging technology has advanced greatly. Once the primary basis of evaluation, cervical spine radiography has at many centers been largely supplanted by CT, as evidence supports the latter's superiority in detecting clinically significant findings [3-7].

To help prevent inappropriate imaging and reduce practice variation, clinical prediction rules such as the National Emergency X-Radiography Utilization Study and Canadian C-spine rule have been established to assist emergency physicians [2,8-11]. These rules have demonstrated high sensitivity for predicting clinically significant cervical spine injuries evaluated by imaging [10]. But adherence to these guidelines has been greatly variable [12].

Despite anecdotes, opinions, and small series describing paradigm shifts in ED cervical spine imaging, supportive rigorous national trends data are lacking. For example, is CT replacing radiography or has it become an additive layer of

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diagnostic imaging? And as emergency medicine physicians increasingly incorporate imaging evaluation into their training curricula [13-16], has this translated into a shift in imaging interpretive work from radiologists to emergency physicians? Filling such knowledge gaps may prove important in optimizing future health care delivery systems and appropriately allocating costs and manpower in an era of bundle-paid care.

Using an aggregated 100% sample of all Medicare fee-for-service claims from 1994 through 2012, we aimed to analyze volume, modality, and specialty trends for cervical spine imaging in the ED setting and determine national modality-specific utilization rates.

METHODS

This HIPAA-compliant study of deidentified aggregated Medicare claims data from CMS designated public-use files was deemed review exempt by the Institutional Review Board of the ACR.

Our national Medicare claims-tracking methodology represented a modification of that used for other imaging services [17-19]. From CMS, we acquired its annual Medicare Physician/Supplier Procedure Summary (PSPS) Master Files from 1994 through 2012. PSPS Master Files aggregate Part B Medicare billing claims submitted by physicians and all other nonphysician providers nationally. Data fields include codes for procedure, provider specialty, and site of service and include total category numbers of procedures for which claims were submitted and paid. These data points are retrospectively compiled and aggregated by CMS in designated public-use files, which contain no individual patient or physician identifiers or diagnosis information.

PSPS Master Files include all claims for all beneficiaries in the traditional Medicare fee-for-service program, which currently represents approximately 71% of all Medicare supplementary medical insurance enrollees [20]. Although Medicare enrollment has increased over the past two decades, that growth has largely involved private Medicare managed care programs; thus, Part B enrollment has remained relatively stable (32.3 million and 33.0 million in 1994 and 2012, respectively) [20].

Using the unique ED site-of-service code 23, we were able to identify all claims attributable to EDs. Specific cervical spine imaging studies could then be identified using their specific Current Procedural Terminology codes (Table 1). Self-reported provider specialty codes were used to identify claims submitted by radiologists (diagnostic radiology, code 30; nuclear medicine, code 36; and interventional radiology, code 94) and emergency physicians (code 93). All other provider claims, as well as the very few for which specialty could not be determined, were aggregated in an "other" group. In addition to identifying total numbers of examinations, we calculated compound annual growth rates (CAGRs). Using separate annual CMS enrollment data files [20], we also calculated utilization rates per 1,000 Medicare fee-for-service beneficiaries each year.

Table 1. Current Procedural Terminology codes used to identify and modality-categorize cervical spine imaging examinations

Radiography	CT	MR
72020	72125	72141
72040	72126	72142
72050	72127	72156
72052		

Data analysis was performed using SAS version 9.1 (SAS Institute Inc, Cary, North Carolina) and Excel 2010 (Microsoft Corporation, Redmond, Washington).

RESULTS

Of the 210,949 ED cervical spine imaging examinations performed in the Medicare fee-for-service population during 1994, 193,581 (91.8%) were billed by self-identified radiologists, 7,493 (3.6%) by emergency physicians, and 9,875 (4.6%) by all other specialties combined (Table 2). In 2012, 736,855 (+249.3%) cervical spine imaging examinations were performed in the ED setting. Of these, 728,081 (98.8%) were billed by radiologists, 4,143 (0.6%) by emergency physicians, and 4,631 (0.6%) by all other specialties combined. This reflects a 276.1% increase in radiologist-interpreted examinations and a 49.5% decrease in interpretations by nonradiologists. Per 1,000 Medicare fee-for-service beneficiaries, the utilization rate for all ED cervical spine imaging increased 242% from 6.5 to 22.3.

Radiography

Between 1994 and 2004, total paid claims for ED cervical spine radiography increased by 50.5% from 203,645 to 306,442 and then declined by 50.2% to 152,755 in 2012, reflecting an overall 25.0% decline. This corresponds to a +3.8% CAGR from 1994 through 2004 and a −7.4% CAGR from 2004 through 2012, for an overall −1.5% CAGR from 1994 through 2012. Per 1,000 Medicare beneficiaries, the utilization rate decreased by 26.5% from 1994 to 2012 (from 6.3 to 4.6). These results are demonstrated in Figure 1. From 1994 to 2012, the percentage of billed radiologist-interpreted radiographic examinations increased from 91.7% to 96.9%; those by emergency physicians decreased from 3.7% to 2.1%.