

POPULATION-BASED

Limitations of using population-based databases to assess trends in spinal stereotactic radiosurgery

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There exist no population-based examinations of stereotactic radiosurgery (SRS) of the spine. To address this, spinal SRS was analyzed using the New Jersey State Ambulatory Surgery and Services Database (SASD) and Nationwide Inpatient Sample (NIS) over 10-year periods. The SASD is a state-specific ambulatory surgery and outpatient database, while the NIS database comprises approximately 20% of all nonfederal hospital inpatient admissions and discharges in the United States. Only patients receiving SRS for at least one spinal lesion were included (ICD-9-CM=92.3x; diagnosis codes=63620,63621). 4,194,207 patients were contained in the New Jersey SASD from 2003-2012, of whom fewer than 0.0003% received SRS of any sort, with none receiving SRS of the spine. Of the 78,686,628 patients contained in the NIS, only 16 (0.00002%) received radiosurgery, none of whom received SRS of the spine. In conclusion, a decade-long analysis of the NIS and SASD from the most densely populated state in the United States revealed that no patients received spinal SRS with virtually none receiving SRS of any sort. Given the improbability of these findings, it is much more likely that neither the NIS nor SASD can accurately capture patients receiving SRS. Accurate characterization of the incidence and usage of spinal SRS will require databases less reliant on ICD-9 coding than the SASD or NIS.

Keywords: spinal stereotactic radiosurgery, State Ambulatory Surgery and Services Database, New Jersey, Nationwide Inpatient Sample

1. INTRODUCTION

Stereotactic radiosurgery (SRS) of the spine is a relatively new treatment modality, with the first clinical application in the peer-reviewed literature occurring in 1995 [1]. Since then, spinal SRS has gradually increased both in popularity and availability, and has been used for spinal pathology ranging from metastases to arteriovenous malformations [2-3]. Performed predominantly as an out-

patient procedure, spinal SRS has emerged as an attractive alternative to microsurgical resection in appropriately selected patients [3-4]. However, to date there has been no population-based examination of spinal SRS utilization nor on the role of patient demographics on the receipt of spinal SRS. This study was performed to address this issue, examining one of the most densely populated states (New Jersey) in the United States as well as a nationwide inpatient database over a ten-year period.

2. METHODS

2.1. Data Source

The data sources for this study were the State Ambulatory Surgery and Services Database (SASD; overview available at <https://www.hcup-us.ahrq.gov/sasdooverview.jsp>) for the state of New Jersey encompassing the years 2003 through 2012 and the Nationwide Inpatient Sample (2001-2004, 2006-2008, 2010-2012) which were obtained from Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality (Rockville, MD) [5]. The SASD includes encounter-level data for ambulatory surgery and other outpatient services from hospital-owned facilities, with the specific types of ambulatory surgery and outpatient services varying by state and data year. The SASD from each state includes encounter-level outpatient data that are translated into a uniform format to facilitate multi-state comparisons and analyses, and contains a core set of uniform clinical and nonclinical information on all patients, regardless of payer, including those covered by Medicare, Medicaid, private insurance, and the uninsured. Some SASD states include additional patient demographic information such as race. The NIS represents approximately 20% of all inpatient admissions to nonfederal hospitals in the United States (US). The NIS is comprised of discharges from a stratified random sample of nonfederal hospitals in up to 45 states, approximating a 20% representative subsample of all US nonfederal hospital discharges.

2.2. Inclusion and Exclusion Criteria

Using a combination of patient age and the International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis and treatment codes, a search of the SASD was undertaken. Patients with a diagnosis code of 63620 (a single spine lesion) and/or 63621 (each additional spinal lesion), and a primary procedure code of 92.3x (stereotactic radiosurgery) were included.

2.3. Characteristics of Patients, Providers and Hospitals

Race, patient age, sex, median household income for postal (ZIP) code of residence, primary payer (Medicare, Medicaid, private insurance, self pay, no charge, or other), were coded in the SASD data. Subset analysis focused on comparisons between that subset and the reference group; for race, the reference group was Cau-

casian race (i.e. African-American versus Caucasian), and for primary payer, the reference group was Medicare (i.e. private insurance/health maintenance organization (HMO) versus Medicare).

2.4. Statistical Analysis

The characteristics of patients, providers and hospitals were summarized by descriptive statistics. Results were to be expressed as mean (standard deviation, median, and range) for continuous variables and frequency (percentage) for categorical variables.

3. RESULTS

From 2003 through 2012, the SASD contained data on 4,194,207 outpatients in New Jersey. Of this population, fewer than ten SRS cases were performed on an outpatient basis, with none of these cases involving the spine. The incidence of SRS over this time span was less than 0.0003%. The extremely small number of patients in the SASD who received SRS prohibits more detailed depictions of these patients' demographics, consistent with the data use agreement employed by the database [6].

The NIS contained data on 78,686,628 inpatients over the ten-year period analyzed, of which only 16 SRS cases were performed, yielding an inpatient SRS incidence over this time span of 0.00002%. As in the case for the SASD, no cases of spinal SRS were found in the NIS.

4. DISCUSSION

Although there has yet to be a population-based examination of spinal SRS utilization, recent studies using a state-based outpatient database have examined the role of insurance status and race in receipt of cerebral angiography and in the rate of revisits following adult tonsillectomy [7-8], and have also examined the overall utilization of ambulatory surgical centers for ophthalmologic procedures [9]. Given the success of these investigations, we believed it would be feasible to utilize the same database to examine the utilization of spinal SRS.

Our findings indicate that over a ten-year period in one of the most densely populated states in the United States, none of the nearly 4.2 million outpatients in New Jersey received spinal SRS, and virtually no patients received SRS of any sort. Given the improb-

ability of these findings, it is much more likely that the SASD is unable to accurately capture patients receiving outpatient stereotactic radiosurgery. This may be for a number of reasons, but is most likely due to the reliance of the SASD on ICD-9 coding, as such reliance allows for potential uncertainty regarding the accuracy of case assignment for the database. Additionally, since there is no specific code for radiosurgery of the spine, it is possible that many institutions have used the code for intensity modulated radiation therapy (IMRT) as an alternative, which would have prevented those patients from being included in the present study and made it impossible to separate these patients from the multitude of other patients who receive IMRT for non-spinal pathology; this would also potentially be a problem for databases relying on the recently implemented ICD-10 coding system as well. It is also possible that given the relative novelty of spinal radiosurgery that: 1. adoption by physicians may have been slow, and 2. there may have been lack of insurance coverage. The incidence of SRS appears to have been inadequately recorded in the SASD despite the involvement of a large outpatient population over a ten-year period.

Similarly, our findings indicate that a national inpatient database is inadequate to accurately depict the incidence of SRS, despite the robustness of patients (more than 78.6 million) contained over the ten-year period analyzed in our study; this was somewhat expected, given the fact that the majority of SRS is performed on an outpatient, rather than an inpatient basis. The NIS shares a reliance on ICD-9 coding with the SASD, which may serve as a fundamental impediment to its ability to accurately capture the true incidence of SRS even among those patients who receive treatment as inpatients. Another nationwide database considered for this project was the US National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database; however, the inability of SEER to distinguish radiosurgery from radiotherapy rendered it unable to help address our primary objective [10].

5. CONCLUSION

This is the first study to examine usage trends and patient demographics in radiosurgery using the SASD and NIS. Based on our findings, it would be wise to presume that neither database should be used for assessing SRS. Accurate characterization of the incidence and usage of SRS will require databases more accurate and inclusive than the either the NIS or SASD, which would likely involve databases less reliant on ICD-9 coding.

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Authors' disclosure of potential conflicts of interest

The authors reported no conflict of interest.

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