**Epidemiology and Complications of Acoustic Neuroma Excision in California**

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**Abstract**

**Objective:** To assess demographics, hospital charges, outcomes, and complications by temporal and hospital volume analysis in order to capture trends in the treatment of acoustic neuroma.

**Design:** Cross-sectional analysis.

**Setting/Methods:** The California Hospital Inpatient Discharge Database (CHIDD) from 1996 to 2010.

**Results:** Total of 7,002 cases were identified with 86.7% occurring at high volume centers. The average annual number of cases decreased from 479 in 1996-2000 to 428 in 2006-2010. Patients presenting for surgery were increasingly younger, from outside of the state, non-Caucasian, and likely to have comorbidities. Reported complications increased over time and were highest at high volume centers (24.9%). Total charges increased over time, with the median total charge in 2006-2010 being $92,284.50 compared to $29,448.00 in 1996-2000. Routine discharges were more likely at high and medium volume centers and less likely if patients had MedCal or were 65 or years older. Shorter lengths of stay were more likely at high volume and medium volume centers or if patients had private insurance and less likely if patients had MedCal. Mortality was less likely at lower volume centers. Lesser total charges were more likely at high and medium volume centers. Reported post-operative complications (including CNS) were more likely in 2001-2005 and 2006-2010 compared to 1996-2000.

**Conclusions:** Surgical volume and age are decreasing, suggesting a trend towards more conservative management. Patients are likely best served at high volume centers, where routine discharges, shorter length of stay, and lower total charges are significantly more likely and mortality significantly less likely.

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**Introduction**

- Advances in imaging, treatment modalities, understanding of tumor growth patterns, and public access to medical information in the setting of an ever-increasing focus on cost-effective care have undoubtedly altered the treatment landscape for patients with AN. 1-5
- Incidence of AN has been reported to be increasing.1,4
- AN surgical volume is decreasing likely due to increasing utilization of observation and radiosurgery.3-5
- MRI has led to increased detection of smaller tumors, requiring surgeons to consider options other than surgery.2,5
- Improved understanding of the relatively innocuous tumor growth of most AN tumors has led to increased conservative management.3,11,13
- The modern patient desire full disclosure of all treatments including those non-surgical in nature.

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**Demographics**

- Data for age, gender, state of residency, ethnicity, and comorbidities were examined. Cases had comorbidity if at least one predefined condition was present.

**Cost and Payer Data**

- Total charges and primary payer type were analyzed.

**Outcomes and Complications**

- Disposition, length of stay (LOS), and post-operative complications were examined. Cases had complications if at least one predefined condition or procedure was present.

**Hospital Volume Analysis**

- "High volume centers" (HVCs):100+ cases over the study period (11 hospitals); "Medium volume centers": 10-99 cases (28 hospitals); "Low volume centers" (LVCs): 1-9 cases (86 hospitals).

**Temporal Analysis**


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**Results**

- The number of cases performed/100,000 Californians decreased over the study period (R=−7.15, R2=0.52, P<0.003).
- Most patients over the study period were Caucasian (82.9%), female (50.9%), 35-64 years of age (73.5%), from within state (67.7%), had private insurance (78.6%), had no comorbidities (59.5%), and at a high vol. center (86.7%).

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**Discussion**

- Declining surgical volume is likely attributable to a paradigm shift towards more conservative management, improvements in imaging, better understanding of tumor growth patterns, and decreasing tumor sizes at initial presentation.11,13
- Patients presenting for surgery are younger, likely a product of smaller tumors being diagnosed, shifts in treatment philosophy, and tendency for older patients to favor conservative management.9
- Complications have increased, with rates at HVCs plateauing and at LVCs increasing. Due to dataset limitations, we could not examine case complexity to explain this however this may be due to the fact that tumors are increasingly larger and complex.2,15
- As shown by our analysis and other studies, HVCs are associated with the better outcomes and lower charges in AN resection and other surgeries.14,16,17,23-28,30
- Higher total charges at LVCs is likely secondary to HVCs seeing higher-risk patients (greater proportions of older patients, with comorbidities, and lower mortality risk scores) who have poorer outcomes as well as having more publicly insured patients which likely influences LVCs to operate at higher charge-to-cost ratios.16,18,19

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**Conclusions**

- The profiles of patients undergoing AN resection are changing.
- Decreasing surgical volume reflects a trend towards more conservative management and radiosurgery.
- Complication rates are increasing at LVCs and plateauing after rising at HVCs, perhaps a reflection of increasingly larger and complex tumors at surgery.
- Charges are dramatically increasing.
- Patients experience better outcomes and lower total charges at HVCs however they are also more likely to be lower-risk and privately insured who contribute to the benefits seen.

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**References**