Historical Perspective on Evolution in Management of Lateral Skull Base Tumors

Theodore R. McRackan, MD, Derald E. Brackmann, MD*

KEYWORDS

• Lateral skull base tumors • Lateral skull base lesions • Acoustic neuroma
• Schwannoma • Glomus jugulare • Jugular paraganglioma • Meningioma
• Stereotactic radiosurgery

KEY POINTS

- During the first 100 years of lateral skull base surgery, the mortality has decreased from 80% to the current rate of less than 0.5% through the efforts of Cushing, Dandy, House, and numerous others.
- The invention of modern imaging techniques (eg, MRI) has allowed a better understanding of the natural history of lateral skull base lesions.
- Modern deescalated radiosurgery doses of 12 to 13 Gy have maintained excellent tumor control rates (>90%) with decreased associated morbidity.
- Surgical resection has become less aggressive, favoring preserved facial nerve function rather than complete tumor resection.

INTRODUCTION

The history of lateral skull base tumor management is best understood through the history of acoustic neuroma (AN) surgery. Like most lateral skull base lesions, ANs were initially thought to be unresectable. Surgical resection of lateral skull base tumors had a tumultuous course before arriving at the extremely low mortalities seen with modern surgery. As understanding of these lesions continues to advance so does our treatment algorithm. This article describes the major turning points in the treatment of lateral skull base lesions and how treatment strategies continue to evolve.

EARLY HISTORY OF ACOUSTIC NEUROMA SURGERY

ANs were among the first lesions to be anatomically localized based on symptomatology alone. ANs therefore played a major role in neurosurgical history. The earliest

Disclosures: None.
House Ear Clinic, 2100 West 3rd Street, Los Angeles, CA 90057, USA
* Corresponding author. House Ear Clinic, 2100 West 3rd Street, Suite 111, Los Angeles, CA 90057.
E-mail address: dbrackmann@houseclinic.com

Otolaryngol Clin N Am 48 (2015) 397–405
http://dx.doi.org/10.1016/j.otc.2015.02.002 **oto.theclinics.com**
0030-6665/15/$ – see front matter

Abbreviations

AN Acoustic neuroma
GK Gamma Knife
WRS Word recognition scores

descriptions of cerebellopontine angle lesions causing deafness and facial numbness date back to the mid–nineteenth century.[1,2] However, it was not until the later part of that century that the first attempts at AN resection were made.

The first reported surgical attempt was by Charles McBurney in 1891, who opened a suboccipital plate with a mallet and chisel.[3] Because of excessive cerebellar swelling, no tumor could be removed and the patient died 12 days later. Soon thereafter (1894), an account from Charles Ballance described the first successful complete removal of an AN.[4] Exposure was performed through a suboccipital approach and tumor was removed using blunt finger dissection. During this earliest era of AN surgery, the surgical mortality approached 80%, with high operative morbidity affecting the few patients who survived.[5] It is clear that if posterior fossa surgery were to continue, significant advances would be needed.

More modern surgical techniques were ushered in during the Harvey Cushing era (early 1900s). His technique included using an extended bilateral suboccipital approach and a belief that only the core of the tumor could be safely resected.[6] He postulated that, by leaving the tumor capsule intact, cranial nerve function would be preserved and the brainstem vasculature would be left undisturbed. Cushing also advocated for the use of delicate and meticulous surgical technique, decreased cerebellar retraction, and the importance of relieving cerebrospinal fluid pressure to improve operative space. Along with the use of bone wax and electrocautery for hemostasis, this allowed him to decrease the surgical mortality to 20% in his lifetime.[6–8]

Although there was significant overlap with Cushing, the Walter Dandy era saw the increased use of diagnostic imaging to guide surgical technique. In 1918, Dandy invented ventriculography, which allowed neurosurgeons to identify the approximate location and size of brain tumors for the first time.[6,9] This ability was further advanced 1 year later by his development of pneumoencephalography.[6] In addition, Dandy, developed the more modern unilateral suboccipital approach using a smaller bone flap. He also created a schism between himself and Cushing by advocating and successfully performing total tumor excision.[10,11] Improving on Cushing's advances, Dandy was able to advance the modern surgical era.

The introduction of the operative microscope by William House[12] in 1961 changed neurosurgery forever. This microscope allowed improved viewing of the cranial nerves and blood vessels, permitting more complete tumor resection with decreased morbidity. It made facial nerve preservation with tumor resection possible for the first time. This improved vision paved the way for House to fully develop the translabyrinthine approach; unknown to House, this had been described by Panse[13] (1904) and Quix[14] (1911) decades earlier.[15] The microscope also allowed the development of the transcochlear approach as well as hearing preservation surgery in the form of the middle cranial fossa and the modern retrosigmoid approach.

Before William House's era, there was no cooperation between otologists and neurosurgeons in posterior fossa surgery. They were often vehemently opposed to their counterparts performing these surgeries. This lack of cooperation changed when William House invited William Hitselberger to join forces in treating posterior fossa lesions. The two spent countless hours together in the temporal bone laboratory cross-training