

## History of the transsphenoidal endoscopic surgical approach to pituitary adenomas

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Interest in pituitary endocrinology is said to have begun in earnest in 1886, when Pierre Marie documented two patients with acromegaly.<sup>1</sup> In his paper, Marie described coarsening of the hands, feet, and facial features in addition to hypertrophy of the pituitary gland. Thus began a new era of neuroendocrinology.

Interest in pituitary endocrinology continued to grow in the late 19th century, with contributions from Oppenheim in 1889 demonstrating sella turcica enlargement via X-ray.<sup>2</sup> At this time, the first surgical resections of the pituitary gland were also being attempted, paving the way for the future of pituitary surgery, the endoscopic transsphenoidal approach.

The history leading up to endoscopic transsphenoidal pituitary surgery can be traced as far back as the Egyptians, who are said to have used long hooks to reach the contents of the cranial vault through the nose.<sup>3</sup> This paper attempts to summarize some of the main historical events leading up to current endoscopic pituitary surgery in two ways: first, by looking at the history of transsphenoidal surgery and second, by discussing the history of the endoscope.

### *Part I*

#### **Early Neurosurgery**

Sir Victor Horsley attempted the first pituitary tumor resection in 1889 using intracranial decompression. Unfortunately, this proved to be unsuccessful. Following Horsley, attempts at pituitary tumor resection were also made by Caton and Paul in 1903 and Kiliani in 1904. The first reported successful transsphenoidal resection of a pituitary tumor was by Hermann Schloffer in 1907 using a transfacial approach. However, it was not until 1910 that a purely endonasal transseptal transsphenoidal approach was used, this time by Oskar Hirsh. Also around this time Albert Halstead was developing a sublabial, subgingival approach to the sella. This had the added benefit of lessening cosmetic defect and preserving the ethmoid air cell, resulting in lowered rates of post-op meningitis.<sup>4,5</sup>

#### **Harvery Cushing and the End of Transsphenoidal Surgery in the United States**

Several other approaches to the sella were also developed during this time, including Ottokar Chiari's transthemoidal approach and Preysing's transpalatal approach.<sup>5</sup> In 1909, Harvery Cushing performed his first transsphenoidal surgery on a patient diagnosed with acromegaly. Cushing initially approached the sphenoid sinus through the frontal bone, but soon changed to the sublabial subgingival approach in 1912. Cushing eventually abandoned the transsphenoidal approach, returning to the transcranial method for unknown reasons. Because of Cushing's influence in the neurosurgical community, the transsphenoidal approach was virtually abandoned in the United States.<sup>4,5</sup>

#### **The Return**

The resurrection of transsphenoidal surgery in North America was in large part due to Canadian surgeon Jules Hardy. Hardy had learned the transsphenoidal technique from Garard Guiot, who had been exposed to the surgery by an apprentice of Cushing's, Norman Dott.<sup>5,6</sup> Hardy is also credited with introducing the operating microscope during the procedure, which he did in 1967 while working with Guiot.<sup>7,8</sup> Hardy's contribution to the transsphenoidal resection of pituitary tumors cannot be underestimated; current methods of the transsphenoidal surgery are essentially modifications of that used by Hardy.<sup>9</sup>

### *Part II*

#### **The Endoscope**

From the beginning, one of the major drawbacks of transsphenoidal surgery has been inadequate visualization of anatomical structures. Cushing's solution to this restricted visual field was the use of a headlight. Other pioneers found different solutions: Dott used a lit speculum retractor, and Hardy, an operating microscope. For the past 30 years, the endoscope has been used for the treatment of paranasal sinus disease and more recently for transsphenoidal pituitary tumor resection.<sup>10</sup>

## In the Beginning

Phillip Bozzini, a German physicist, is credited with the invention of the first endoscope 200 years ago. Visualization using the first scopes was quite limited and their use was painful for the patient.<sup>11</sup> Max Nitze further improved upon early designs, as did Thomas Edison with his invention of the incandescent light bulb in 1879.<sup>11</sup>

With continuing improvements of the device, applications for the endoscope in medicine were soon discovered.<sup>11</sup> In 1901, Hirschmann used a cystoscope to inspect the maxillary sinus, thus becoming one of the pioneers of paranasal endoscopic surgery.<sup>12</sup> The endoscope's introduction into neurosurgery was within the ventricular system. Walter Dandy, who is often considered the main pioneer in neuroendoscopy, first attempted ventricular endoscopic neurosurgery in 1922.<sup>13</sup>

## Improvements in the Endoscope

In 1960, Hopkins invented the rod lens system, which had a nine-fold optical improvement over the Nitze system. In addition, it provided greater light transmission, wider view, better image quality, and a smaller diameter for the endoscope itself.<sup>14</sup> Simultaneously, in the late 1950's, Basil Hirschowitz developed the fiberscope, an endoscope with fiberoptics.<sup>15</sup> Several other advances in the modern endoscope were made during this time. One of the most significant was the development of the charge-coupled device camera by Bell Laboratories in the United States. These image sensors were approximately fifteen times more sensitive to light than the standard photographic film.<sup>16</sup>

## The Endoscope is Used in Neurosurgery

Prior to its introduction into neurosurgery, the endoscope's primary medical application was in Otolaryngology. The endoscope's initial application in neurosurgery was as an aid to the operating microscope, providing views traditionally out of the reach of the microscope. Previous to the endoscope, visualization of these areas was achieved with angled mirrors.<sup>17</sup> Early therapeutic neurosurgical uses of the endoscope included treatment of conditions inside the ventricular system, including obstructive hydrocephalus and intraventricular tumors or cysts.<sup>18</sup> Following this, the endoscope's use spread to the treatment of peripheral nerve disorders, which had already begun in orthopedic surgery. With the introduction of the thoroscope and laparoscope, initially used for diagnosis of tuberculosis, the application of the endoscope was further broadened to include thoracic and lumbar disk surgery. Naturally, this eventually led to the introduction of the myeloscope for direct spinal cord observation in 1931.<sup>19,20</sup>

Following Hirshmann's initial use of the endoscope in 1901, several otolaryngologists began realizing the utility of the endoscope in treating sinus disease.<sup>10</sup> In the early 1960's, Guiot pioneered endoscopic transsphenoidal surgery. He eventually discarded the method, citing poor visualization.<sup>21</sup> Several years later in the 1970's, Apuzzo with his colleagues Bushe and Halves resurrected this method, using it as an aid to the operating microscope.<sup>22</sup> The role of the endoscope in transsphenoidal surgery remained relatively constant for the next couple of decades until the early 1990's when the pure endoscopic transsphenoidal technique, without the use of the operating microscope, was introduced. In 1992, Jankowski and coworkers published their results from three cases of a pure endoscopic transsphenoidal approach to the sella, a collaboration between otolaryngologists and neurosurgeons.<sup>23</sup> Finally, in 1997 Jho and Carrau from the University of Pittsburgh published their findings on 50 patients with pituitary adenomas who were treated through a pure endoscopic approach. Jho, a neurosurgeon, and Carrau, an otolaryngologist, are considered the pioneers of the pure endoscopic endonasal approach for the treatment of pituitary adenomas.<sup>10,24</sup>

## Modern Endoscopic Neurosurgery

With an increasing number of technological advances, the field of endoscopic transsphenoidal surgery continues to move forward at a rapid pace. No longer simply used for pituitary pathology, endoscopic transsphenoidal surgery has expanded to treat lesions outside this area, a concept known as "extended approaches" to the skull base.<sup>26</sup> In Bologna, the ethmoid-pterygoid-sphenoid endoscopic approach to the treatment of cavernous sinus lesions was developed. Resection of suprasellar lesions is also possible with pure endoscopic surgery via a transplanum sphenoidal approach.<sup>27</sup>

Research and practice of endoscopic transsphenoidal neurosurgery continues internationally, with ongoing advances in the treatment of several skull base pathologies.

## REFERENCES

1. Stone JL, Meglio G, Laws ER Jr (2005) The development of pituitary surgery: The Chicago contributions. *J Am Coll Surg* 201:784-805.
2. Keene WW (1913) *Surgery, its principles and practice*. W.B. Saunders Company, New York and London, pp 269-316.
3. Heredotus Marincola JM, de Selincourt A (2003) *The histories*. Penguin Classics, New York, pp 127-129.
4. Cohen-Gadol AA, Liu JK, Laws ER Jr (2005) Cushing's first case of transsphenoidal surgery: The launch of the pituitary era. *J Neurosurg* 103(3):570-574.
5. Liu JK, Das K, Weiss MH, Laws ER Jr, Couldwell WT (2001) The history and evolution of transsphenoidal surgery. *J Neurosurg* 95(6):1083-3096.
6. Lanzino G, Laws ER Jr (2003) Key personalities in the development and popularization of the transsphenoidal approach to the pituitary: A historical overview. *Neurosurg Clin N Am* 14:1-10.
7. Hardy J (2007) Transsphenoidal hypophysectomy. *J Neurosurg* 107(2):458-

- 471.
8. Kanter AS, Dumont AS, Astragiri AR, Oskouian RJ, Jane JA Jr, Laws ER Jr (2005) The transphenoidal approach. *Neurosurg Focus* 18(4):E6 1-4.
  9. Grosvenor AE, Laws ER (2008) The evolution of extracranial approaches to the pituitary and anterior skull base. *Pituitary*.
  10. Prevedello DM, Doglietto F, Jane JA Jr, et al. (2007) History of endoscopic skull base surgery: Its evolution and current reality. *J Neurosurg* 107(1):206-213.
  11. Mouton WG, Bessell JR, Maddern GJ (1998) Looking back to the advent of modern endoscopy: 150th birthday of Maximilian Nitze. *World J Surg* 22:1256-1258.
  12. Draf W (1983) *Endoscopy of the Paranasal Sinuses: Technique, Typical Findings, Therapeutic Possibilities*. Berlin: Springer-Verlag.
  13. Abbot R (2004) History of neuroendoscopy. *Neurosurg Clin N Am* 15:1-7.
  14. Jennings CR (1998) Harold Hopkins. *Arch Otolaryngol Head Neck Surg* 124:1042.
  15. Draf W (1973) Clinical value of sinus endoscopy. *Z Laryngol Rhinol Otol* 52:890-896.
  16. Berci G, Forde KA (2000) History of endoscopy: What lessons have we learned from the past? *Surg Endosc* 14:5-15.
  17. Hardy J (1967) Surgery of the pituitary gland, using the trans-sphenoidal approach. Comparative study of 2 technical methods. *Union Med Can* 96:702-712.
  18. Li KW, Nelson C, Suk I, Jallo G (2005) Neuroendoscopy: Past, present, and future. *Neurosurg Focus* 19(6):E1.
  19. Hong JT, Lee SW, Han SH, Son BC, Sung JH, Park CK, et al. (2006) Anatomy of neurovascular structures around the carpal tunnel during dynamic wrist motion for endoscopic carpal tunnel release. *Neurosurgery* 58:ONS127-ONS133.
  20. Jaikumar S, Kim DH, Kam AC (2002) History of minimally invasive spine surgery. *Neurosurgery* 51 (5 Suppl):S1-S14.
  21. Liu JK, Das K, Weiss MH, Laws ER Jr, Couldwell WT (2001) The history and evolution of transsphenoidal surgery. *J Neurosurg* 9: 1083-1096.
  22. Apuzzo ML, Heifetz MD, Weiss MH, Kurse T (1977) Neurosurgical endoscopy using the side-viewing telescope. *J Neurosurg* 46:398-400.
  23. Jankowski RD, Auque J, Simon C, Marchal JC, Hepner H, Wayoff M (1992) Endoscopic pituitary tumor surgery. *Laryngoscope* 102:198-202.
  24. Litynski GS (1999) Endoscopic surgery: The history, the pioneers. *World J Surg* 23:745-753.
  25. Cappabianca P, Alfieri A, de Divitiis E (1998) Endoscopic endonasal transsphenoidal approach to the sella: Towards functional endoscopic pituitary surgery (FEPS). *Minim Invasive Neurosurg* 41: 66-73.
  26. Jho HD, Ha HG (2004) Endoscopic endonasal skull base surgery: Part 1-the midline anterior fossa skull base. *Minim Invasive Neurosurg* 47:1-8.
  27. Frank G, Pasquini E (2003) Approach to the cavernous sinus, in de Divitiis E, Cappabianca P (eds): *Endoscopic Endonasal Transsphenoidal Surgery*. Wein: Springer-Verlag, pp 159-175.

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