

## Historical vignette

### Harvey Cushing and Oskar Hirsch: early forefathers of modern transsphenoidal surgery

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✓ The transnasal transsphenoidal approach is the preferred route for removal of most lesions of the sella turcica. The concept of transnasal surgery traversing the sphenoid sinus to reach the sella has existed for nearly a century. A comprehensive historical overview of the evolution of transsphenoidal surgery has been reported previously. In the present vignette, the authors focus on transsphenoidal surgery in the early 1900s, particularly on the methods advocated by Harvey Cushing and Oskar Hirsch, two prominent pituitary surgeons who pioneered the transsphenoidal technique. Cushing championed the sublabial approach, whereas Hirsch was the master of the endonasal route. Coincidentally, both surgeons independently performed the submucous septal resection for the first time on June 4, 1910. Although Cushing's and Hirsch's approaches were predicated on the work of their predecessors, their transsphenoidal procedures became the two most popular techniques and, for future generations of pituitary surgeons, laid the foundation for modern transsphenoidal surgery. In this comparative analysis, the authors compare the operative nuances of the approaches of Cushing and Hirsch and describe the contributions of these pioneers to modern transsphenoidal surgery.

**KEY WORDS** • history of neurosurgery • transsphenoidal surgery • pituitary tumor • Harvey Cushing • Oskar Hirsch

If one is to approach the pituitary fossa through the sphenoidal sinuses, it is clear that the only promising, one could almost say justifiable, method is that of Hirsch and Cushing . . . Hirsch and Cushing's submucous septal approach is really one of the most ingenious in the whole range of surgery.

V. ZACHARY COPE, M.D., 1916

Since its inception in the early 1900s, the transsphenoidal approach has endured for nearly a century as the preferred operation or, as Cope asserted, "the only promising" method for removing tumors of the sellar region. The historical evolution of the transsphenoidal approach has been recently reviewed by Liu, et al.,<sup>29</sup> and Lanzino and Laws.<sup>27,28</sup> This discussion focuses on the contributions of Harvey Cushing<sup>6–10</sup> and Oskar Hirsch,<sup>15,16,18,20,21</sup> two pioneers in pituitary surgery in the early 1900s. Their developments in the transsphenoidal approach played a significant role in defining today's transsphenoidal technique. We describe the details of Cushing's sublabial approach and compare it with Hirsch's endonasal approach. These two methods eventually became the two most popular routes to the sellar region and are essentially those that remain in use by most pituitary surgeons today.

#### Historical Prelude

Although much of today's transsphenoidal technique is based on the foundations established by Cushing and Hirsch, other pioneers have made significant contributions to the preservation and refinement of transsphenoidal surgery. To appreciate the contributions of Cushing and Hirsch, it is important to provide a brief overview of their predecessors. Initial attempts at transcranial approaches to the pituitary gland in the late 1800s and early 1900s resulted in a mortality rate that was generally considered prohibitive.<sup>2,5</sup> Although Horsley<sup>22</sup> reported a mortality rate of 20% in his series of 10 patients, it was significantly better than those of his colleagues, which ranged from 50 to 80%.<sup>29</sup> As a consequence of the high mortality rate associated with transcranial approaches, surgeons sought safer, alternative extracranial routes to the sella.

#### Superior Nasal Approaches

Giordano<sup>1</sup> initially proposed a superior nasal route via a transglabellar–nasal approach based on the results of anatomical studies. Influenced by this work, Schloffer<sup>34,35</sup> per-

## Cushing and Hirsch's transsphenoidal approach

formed the first successful removal of a pituitary tumor in 1907 via a superior nasal transsphenoidal approach; this procedure involved a lateral rhinotomy incision and removal of the nasal turbinates, ethmoid sinuses, nasal septum, inner wall of the orbit, and left maxillary sinus. Despite the unsatisfactory cosmesis of this disfiguring operation, the procedure was received with enthusiasm because it offered an approach to the sella at the skull base.<sup>23,32</sup>

In his classic monograph on pituitary body disorders, Cushing<sup>9</sup> made the following comments regarding the superior nasal approaches adapted from Schloffer's approach: "All of the foregoing operations necessitate more or less *decortication du visage*, to use the descriptive French term; and not only are they needlessly mutilating, but they are apt to leave permanent nasal deformations." Interestingly, Cushing initially used a superior nasal approach (a modified Schloffer approach) in his early experience but converted this to a less invasive inferior nasal approach shortly thereafter.

### *Inferior Nasal Approaches*

Because of the poor cosmetic outcomes and risk of meningitis associated with the superior nasal approaches, other surgeons continued to seek alternative routes to the sella. In 1909, Kanavel<sup>24</sup> described an inferior nasal approach that involved making a curvilinear incision through the nasolabial junction and reflecting the external nose upward to remove the middle turbinates and nasal septum. Kanavel emphasized that there was less danger of meningitis because the ethmoid cells were not opened. In 1910, Hirsch,<sup>16</sup> a Viennese otolaryngologist, described his classic endonasal transsphenoidal approach, which was performed after administration of a local anesthetic (see *Oskar Hirsch: Endonasal Transsphenoidal Approach*). Hirsch reached the nasal septum directly by making an endonasal incision through the nares, thus avoiding a lateral rhinotomy.<sup>37</sup> The culmination of the inferior nasal modifications was found in the 1910 description of the sublabial gingival incision for the initial stage of sphenoid sinus exposure, which was written by Halstead.<sup>11</sup> The sublabial incision improved the operative field and left essentially no cosmetic defect.<sup>25,38</sup> This incision was eventually adopted by Cushing<sup>9</sup> in his later transsphenoidal operations.

### **Harvey Cushing: Sublabial Transsphenoidal Approach**

Cushing (Fig. 1) initially used transcranial approaches for resection of pituitary tumors, performing eight subtemporal decompression and five subfrontal operations. His initial results were quite discouraging, and, as a result, he sought an alternative and adopted the transsphenoidal approach.<sup>10</sup> It is interesting to note that Cushing's transsphenoidal operation underwent various modifications and evolutions as his experience increased.

#### *Cushing's First Transsphenoidal Operation: Modified Schloffer Approach*

Cushing performed his first transsphenoidal surgery on March 26, 1909, in Boston; he used a modification of Schloffer's superior nasal technique.<sup>8</sup> The patient, referred by Charles Mayo, was a 38-year-old man with acromegaly



FIG. 1. Photograph of Harvey Cushing, courtesy of the Cushing Tumor Registry at Yale University Department of Neurosurgery.

(Fig. 2) who presented with frontal headaches, photophobia, thickness of speech due a very long tongue, and enlarged jaw, hands, and feet. Ether-based anesthesia was induced. Because of the risk of airway obstruction due to the patient's enlarged tongue, a preoperative tracheostomy was performed. To prevent blood from entering the posterior nasopharynx, a sea sponge was placed in the posterior nares. The nasal mucosa was swabbed with 10% adrenaline solution.

An omega-shaped incision was made around the nose and over the frontal sinus region to allow a frontonasal flap to be reflected inferiorly. An osteoplastic flap of the frontal sinus' anterior wall was elevated. An ethmoidectomy was performed to create a 2-cm window toward the posterior part of the nasal fossa. With the aid of a headlight, the anterior wall of the sphenoid sinus was identified and removed. The thin, enlarged sellar floor was opened using a chisel. Cushing noted that the sellar dura mater was very tense. The dura was incised and approximately half of the tumor was removed piecemeal using a long-handled curette. Despite the fact that the tumor excision was incomplete, the patient experienced improvement of symptoms and lived another 21 years. Two small cigarette drains were placed in each nostril at the time of closure.

Cushing claimed that no significant blood loss had obscured the surgeon's view, possibly because of the adrenaline swabbing. With regard to the exposure provided by this approach, he commented, "It was surprising to find how small an opening had actually been made through the ethmoidal region and how accessible the sella turcica actually proved to be after the landmarks had once been well determined."<sup>8</sup>





FIG. 2. Photograph obtained 3 months postoperatively, showing Cushing's first patient to undergo a transsphenoidal operation. The patient presented with acromegaly. Note the omega-shaped facial incision that Cushing used in his modified Schloffer approach. From Cushing H: Partial hypophysectomy for acromegaly: with remarks in function of the hypophysis. *Ann Surg* 50:1002-1017, 1909.

#### *Cushing's Sublabial Submucosal Transseptal Approach*

Dissatisfied with superior nasal approaches, Cushing later modified his approach by adopting Kanavel's inferior nasal approach, incorporating Halstead's sublabial incision, and using Kocher's submucosal septal resection.<sup>9,10</sup> He performed his first sublabial submucosal transseptal transsphenoidal approach on June 4, 1910, which, coincidentally, was the same date that Hirsch first performed his submucosal transseptal transsphenoidal operation endonasally. Cushing's modification is remarkably similar to the approach performed by most contemporary neurosurgeons who use the sublabial approach today. Because the operation was a compilation of techniques adopted from various surgeons, Cushing humbly stated, "it therefore makes no claim for originality."<sup>10</sup>

In his early experience, Cushing used a Sewell mouth gag and tongue depressor apparatus that had a tube soldered to it so that ether vapor could be conducted directly to the glottis (Fig. 3).<sup>9,10</sup> Cushing reported no ether-related complications in 32 transsphenoidal operations. A preliminary tracheostomy was performed in some patients with acromegaly because of the risk of airway obstruction due to the enlarged tongue. Cushing also placed a sponge in the posterior nares to prevent leakage of blood into this region (as shown in the illustrations by Max Brodel, Fig. 3). He later reverted to using general intratracheal anesthesia and was therefore able to avoid plugging of the posterior nares.

In Cushing's modified approach, adrenaline-soaked cotton pledgets were inserted into each nostril to facilitate hemostasis. A 2-cm transverse sublabial incision was made, and then, by blunt dissection, the mucosa was elevated until the lower margin of the nasal septum was exposed (Fig. 4).

The mucous membranes were then dissected back from each side of the septum, allowing space for the lateral retractors to be placed (Figs. 4 and 5). Using a Ballenger swivel knife, the nasal septum, including most of the vomer, the lower edge of the perpendicular plate of the ethmoid, and a small strip of cartilage were removed. Next, a series of dilating plugs, up to a diameter of 1.8 cm, were introduced between the lateral retractors to flatten the lower turbinates (Fig. 5). Subsequently, a self-retaining bivalve speculum was inserted in place of the retractors (Fig. 6). Under direct visual observation and with the assistance of a headlight, special rongeurs were used to enter the sphenoid sinus. The lining of the mucous membrane of the sinus was then removed and the floor of the sella turcica was exposed and opened with a chisel. Cushing emphasized that "one needs all the room possible and that every step must be absolutely under the operator's direct vision" and furthermore that "[when] working at a depth in an operation of this kind the field must be absolutely dry, as identification of the structures at every bite of the rongeurs is essential."<sup>10</sup> He also believed that the chief danger in the transsphenoidal operation was misjudgment of the direction and trajectory of the approach.

#### *Surgery-Related Results*

Cushing continued to use this approach from 1910 to 1925 and surgically treated 231 cases of pituitary tumors in which the mortality rate was 5.6%.<sup>29</sup> In 1912, Cushing noted,

though the operation will unquestionably undergo further modifications at various hands—all of them tending toward greater simplicity and safety—doubtless in the majority of cases suitable for surgical treatment the preferred avenue of approach will continue to be an anterior transsphenoidal one.<sup>9</sup>

Nevertheless, Cushing's accelerated expertise with transcranial surgery reduced his mortality rate associated with subfrontal approaches to 4.5%. With the transcranial approach, Cushing believed he was better able to verify suprasellar tumors and achieve a more complete decompression of the optic apparatus, resulting in optimized recovery of vision and a lower recurrence rate. By 1929, Cushing completely abandoned the transsphenoidal approach in favor of the transcranial route.<sup>33</sup> Because of Cushing's dominant influence in American neurosurgery, the use of transsphenoidal surgery was suspended for the next 35 years until the efforts of Dott, Guiot, and Hardy.<sup>29</sup>

#### **Oskar Hirsch: Endonasal Transsphenoidal Approach**

Like Cushing, Oskar Hirsch (Fig. 7) believed that the superior nasal approaches advocated by Schloffer were unnecessarily disfiguring because of the unappealing facial incision and excessive resection of paranasal sinuses.<sup>16</sup> As an alternative, Hirsch developed an endonasal approach undertaken via a single nostril. His approach initially evolved out of anatomical studies in cadavers involving the paranasal sinuses; out of these experiences grew a yearly teaching seminar on the anatomy of the sphenoid sinus and the sellar region.<sup>14</sup> In 1909 at a meeting of the Gesellschaft der Aertze in Vienna, Hirsch demonstrated his endonasal approach to the sella for the removal of hypophysial tumors in a cadav-

## Cushing and Hirsch's transsphenoidal approach

er.<sup>15</sup> His method was based on Hajek's radical operation for removal of chronic empyema of the sphenoid sinus via the ethmoidal route.<sup>16</sup>

In his description, Hirsch suggested performing the operation in several stages after application of local cocaine-based anesthetic. In the first stage, the middle turbinate is removed. After a few days, the anterior and posterior ethmoidal cells are removed to expose the wall of the sphenoid sinus (Fig. 8). After an interval of several days, the anterior wall of the sphenoid is removed. At this juncture, the surgeon may continue opening the sellar floor and resecting the tumor or wait several days before completing this step. Hirsch claimed that using this less invasive method involving a local anesthetic, one could achieve as good a result as that yielded by the extensive operation described by Schloffer.<sup>16</sup> Skeptics did not enthusiastically embrace Hirsch's method initially because he did not have the opportunity to demonstrate it in a living patient until almost 1 year later. Even his mentor, Hajek, believed that this approach was too difficult and dangerous.<sup>28</sup>

### *Hirsch's First Transsphenoidal Operation: Staged Endonasal Approach*

Hirsch performed his first endonasal operation in a 35-year-old woman harboring a pituitary tumor; she had been referred from Hofrat von Wagner's clinic and presented with intractable headaches and progressive visual loss on March 10, 1910. The surgery was performed in a similar fashion as his previously described 5-week, five-stage cadaveric demonstration.<sup>16</sup> All stages were performed after the application of a local cocaine-based anesthetic. The middle turbinate was removed during the first stage. After several days, the ethmoid cells were removed. In the third stage, the anterior wall of the sphenoid sinus was excised, exposing the so-called hypophysial prominence, or sellar floor. In the fourth stage, the sellar floor was opened by carefully hammering a small chisel into the osseous floor.



FIG. 3. Cushing's adaptation of the transsphenoidal technique. This 1912 drawing by renowned medical illustrator Max Brodel shows the technique of the transsphenoidal approach to the hypophysis at that time. Note the modified Sewell mouth gag and tongue depressor apparatus that was used for the administration of ether anesthesia. A sponge is also seen in the posterior nasopharynx. Cushing later used intratracheal general anesthesia that obviated plugging of the posterior nares. From Cushing H: The Weir Mitchell Lecture. Surgical experiences with pituitary disorders. *JAMA* 63:1515-1525, 1914.

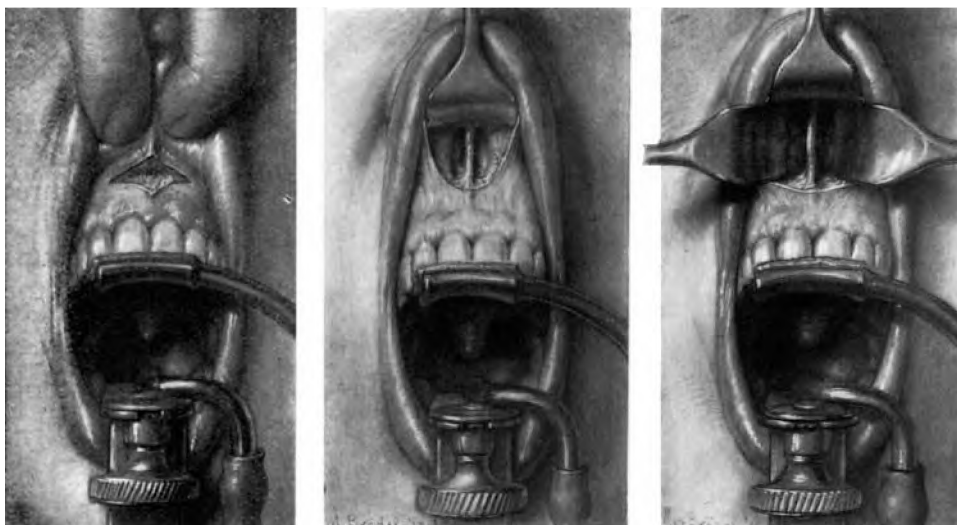


FIG. 4. Artist's drawing of Cushing's technique. *Left:* Sublabial transverse incision. A sublabial incision is made and the mucous membrane is elevated, exposing the lower edge of the cartilaginous septum. *Center:* The mucous membrane is elevated, exposing the lower edge of the cartilaginous septum. *Right:* The mucosa on each side of the septum are elevated and retracted laterally to create a submucosal tunnel in preparation for removal of the septum. From Cushing H: The Weir Mitchell Lecture. Surgical experiences with pituitary disorders. *JAMA* 63:1515-1525, 1914.



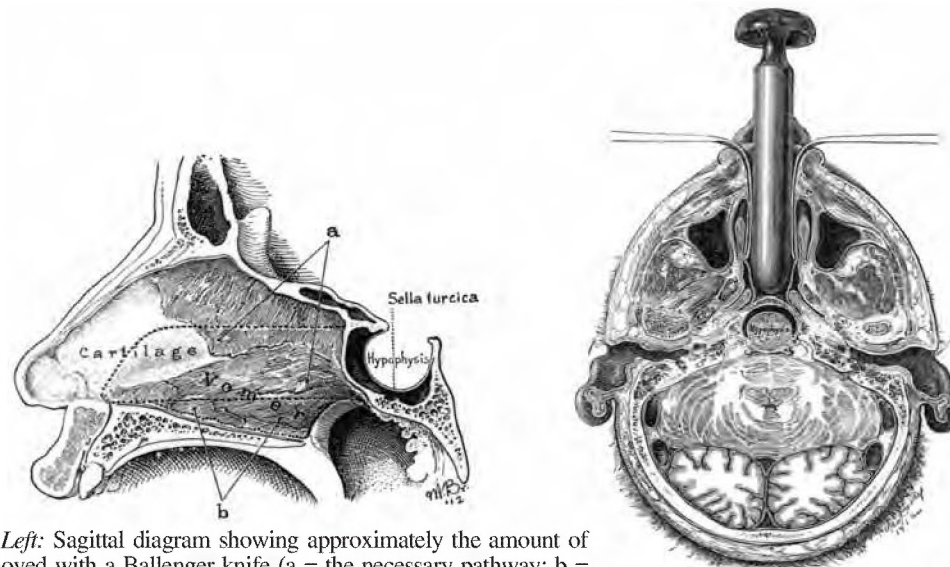


FIG. 5. *Left:* Sagittal diagram showing approximately the amount of septum removed with a Ballenger knife (a = the necessary pathway; b = portion of nasal septum to be removed in addition to ensure orientation by keeping close to the nasal floor). *Right:* Axial diagram demonstrating one of a series of dilating plugs introduced between the lateral retractors to flatten the lower turbinates. From Cushing H: The Weir Mitchell Lecture. Surgical experiences with pituitary disorders. **JAMA** 63: 1515–1525, 1914.

By inserting a right-angled elevator into the fractured floor, the sella was then opened widely until the “bluish dura became visible.” Hirsch decided to wait several days before resecting the tumor to see whether opening the sellar floor would relieve the patient’s visual symptoms. He stated, “this expectation was not realized and after several days it became necessary to lay bare the tumor itself.” In the fifth and final stage of the operation, the dura was opened using a knife along the sphenoidal septum and flapped laterally. The grayish tumor immediately herniated through the dural opening into the sphenoid sinus. At the time of closure, a small cotton ball was placed in the anterior nares of the surgically treated side of the nose. The patient’s headaches improved immediately after the operation and her vision improved gradually over several days to weeks.

Hirsch was pleased by the advantages of using a local cocaine-based anesthetic in this procedure. In his notes, he wrote that there was no significant pain or hemorrhage during any stage of the operation. He noted that the patient was “so slightly disturbed by the operation that she was able to walk with a nurse from the operating room to her ward” immediately after surgery.

#### *Hirsch’s Single-Stage Endonasal Submucosal Transseptal Approach*

Despite the success of his aforementioned approach, Hirsch was concerned with the long duration of the staged operations, especially in patients suffering from progressive visual loss, specifically optic atrophy.<sup>10</sup> He therefore modified his operation into a single stage and incorporated Kocher’s submucous resection of the nasal septum. He performed this operation successfully on June 4, 1910, in a woman suffering from headaches, visual field disturbances, secondary amenorrhea, and galactorrhea. The following description of Hirsch’s endonasal transseptal transsphenoid-

al approach (excluding resection of the middle turbinate) is essentially the endonasal method that is widely performed today (Figs. 9 and 10).<sup>4,30,31</sup>

The patient was seated with the head fixed and remained awake throughout the entire procedure. Illumination was provided by a reflective-mirrored light commonly used by otolaryngologists.<sup>12</sup> The instruments were frequently resterilized during the operation. Customarily the middle turbinates were removed some days before the main operation so that dilation of the submucous passage by special plugs (as used by Cushing) was unnecessary.<sup>3</sup>

The mucosal membranes of both sides of the septum were infiltrated with a 20% cocaine solution. An endonasal incision was made on one side of the septal mucosa along the anterior edge of the quadrangular cartilage. The mucosa was elevated in a submucoperichondrial fashion from the midline nasal septum. The cartilage was incised 0.5 cm from the mucosal incision, and submucoperichondrial elevation of the mucosa on the other side of the septum was performed. The mucosal membranes were now held apart by a nasal speculum, and a median nasal cavity was formed to expose the midline nasal septum. Hirsch emphasized that the mucosal membranes should be elevated off the face of the sphenoid to expose the sphenoid ostia. The cartilaginous septum was then removed with a sweep of the cartilage knife, and the bony septum (perpendicular plate of ethmoid and vomer) was removed using bone forceps. The posterior part of the vomer and rostrum of the sphenoid were resected using a chisel and bone forceps. The sellar floor was also opened in a similar fashion. In a cadaveric specimen, Hirsch had demonstrated that he could make a large opening in the floor of the sella turcica without injuring critical neighboring structures, such as the optic nerves and cavernous sinus.<sup>16</sup> He emphasized the importance of being constantly aware of probable anatomical variations to avoid damaging unidentified or hidden structures.<sup>12</sup>

## Cushing and Hirsch's transsphenoidal approach

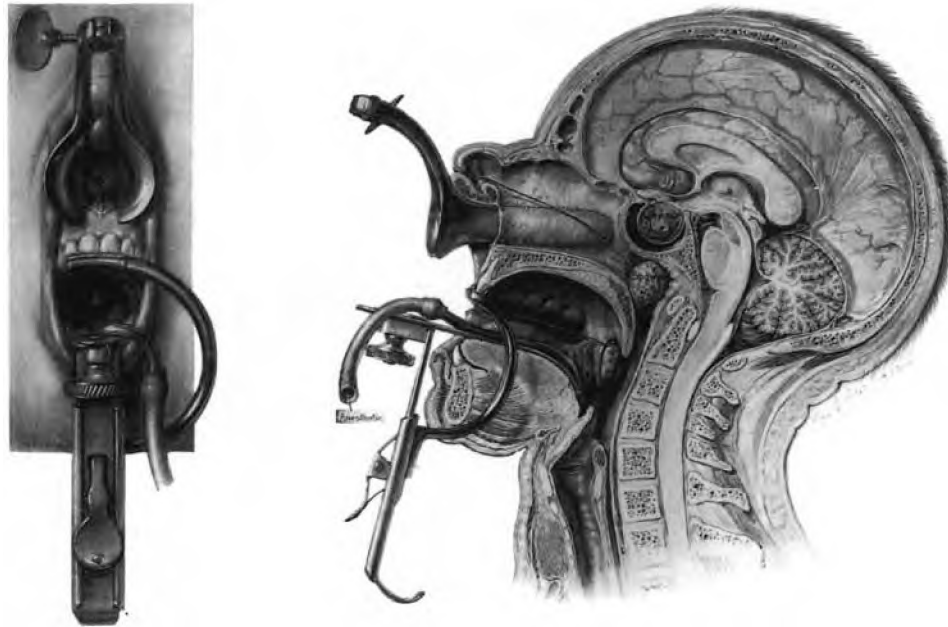


FIG. 6. Artist's illustrations. *Left:* View through the speculum of operative field after removal of the anterior wall of the sphenoid sinus and floor of the sella. *Right:* Sagittal view showing the substitution of the two lateral retractors for a self-retaining bivalve speculum through which further surgical instruments are introduced. Note the use of the intratracheal anesthesia apparatus used by Cushing. From: Cushing H: *The Weir Mitchell Lecture. Surgical experiences with pituitary disorders.* *JAMA* 63:1515–1525, 1914.

### *Postoperative Irradiation Treatment*

Hirsch thought that neither the transcranial nor the transsphenoidal approach could allow for complete extirpation of the tumor.<sup>20</sup> In 1952, he stated,

This operation [transsphenoidal] provides only partial removal of the tumor, but no other method exists by which a tumor of craniocellar extension can be removed radically without endangering the patient's life. Since the craniocellar tumor causes visual disturbances, one can say that in a case with visual disturbances the tumor cannot be removed completely, either by the transsphenoidal or by the cranial method.<sup>21</sup>

His main goal was to decompress the optic apparatus via a subtotal resection.<sup>28</sup> In an attempt to prevent regrowth of the residual tumor, he therefore used local subsellar irradiation by delivering radium on a nasopharyngeal applicator that was secured to the superior teeth and left in situ for a short period of time (Fig. 11).<sup>19,21</sup> This technique was routinely used after tumor resection and eventually became an office procedure. It took almost 10 years, between 1911 and 1921, for Hirsch to determine the optimal dosage. Nonetheless, he believed that the radium treatment contributed to the lasting improvement demonstrated in 70% of his patients.<sup>12</sup> He stated, "only by this combination of surgery and postoperative radium treatment was it finally possible to achieve lasting results."<sup>20</sup>

### *Surgery-Related Results*

By 1937, which marked the end of the preantibiotic era, the mortality rate was 5.4% in the 277 patients with pituitary tumors that Hirsch had treated by performing surgery and postoperative radium application.<sup>20</sup> After the introduction of antibiotic agents, the mortality rate dropped to 1.5%.<sup>18</sup> By 1956, Hirsch had accrued a series of 413 pa-



FIG. 7. Photograph of Oskar Hirsch, a rhinologist from Vienna who championed the endonasal transsphenoidal approach. Reprinted from Hamlin H: Oskar Hirsch. *Surg Neurol* 16:391–393, 1981, with permission from Elsevier.



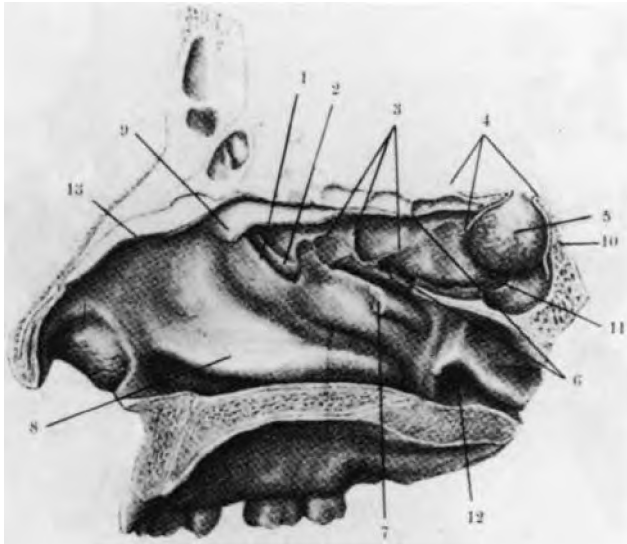


FIG. 8. Illustration of Hirsch's original method for removal of pituitary adenomas. The middle turbinate and the ethmoid sinuses are removed. The sphenoid sinus and the floor of the sella are opened and the sellar dura is incised. 1 = unciniate process; 2 = ethmoid bulla; 3 = remaining parts of the ethmoid sinuses; 4 = dura; 5 = pituitary adenoma; 6 = margin of the opened sphenoid sinus; 7 = posterior remaining part of the middle turbinate; 8 = inferior turbinate; 9 = remaining upper part of the middle turbinate; 10 = dorsum sellae; 11 = sphenoid sinus; 12 = ostium of the tuba; 13 = remaining part of the nasal septum. Reprinted from Hirsch O: Ueber Methoden der operativen Behandlung von Hypophysistumoren auf endonasalem Wege. *Arch Laryngol Rhinol* 24:129-177, 1911.

tients. Sixty-eight percent of the patients who participated in follow up for 5 to 19 years exhibited long-term improvement.<sup>20</sup>

In 1938, Hirsch emigrated to Boston after being expelled from Austria by the Nazis. Because Hirsch was not allowed to operate independently at Massachusetts General Hospital, he collaborated with Hannibal Hamlin,<sup>12</sup> a neurosurgeon in the Boston community. With Hamlin's assistance, Hirsch attempted to maintain the popularity of the transsphenoidal approach during a period in which transcranial approaches dominated the surgical management of pituitary tumors in the US.<sup>29</sup> Despite Hirsch's efforts, he remained, as Zervas described, an "obscure voice in the wilderness."<sup>38</sup>

#### Comparative Analysis of Cushing's and Hirsch's Techniques

Hirsch, a rhinologist, and Cushing, a neurosurgeon, shared the pioneering spirit of "pushing the envelope" of transsphenoidal surgery for pituitary tumors. Both were dissatisfied with their initial attempts and sought newer modifications to improve their surgical technique. Cushing converted his modified Schloffer approach to a more cosmetically appealing sublabial approach; Hirsch simplified his multistage operation to a single-stage procedure. Both surgeons initially traversed the ethmoid sinuses (Cushing via Schloffer's approach; Hirsch via Hajek's approach), but later each adopted Kocher's concept of submucosal septal resection. In Johnson's review of the development of transsphenoidal surgery, he commented:

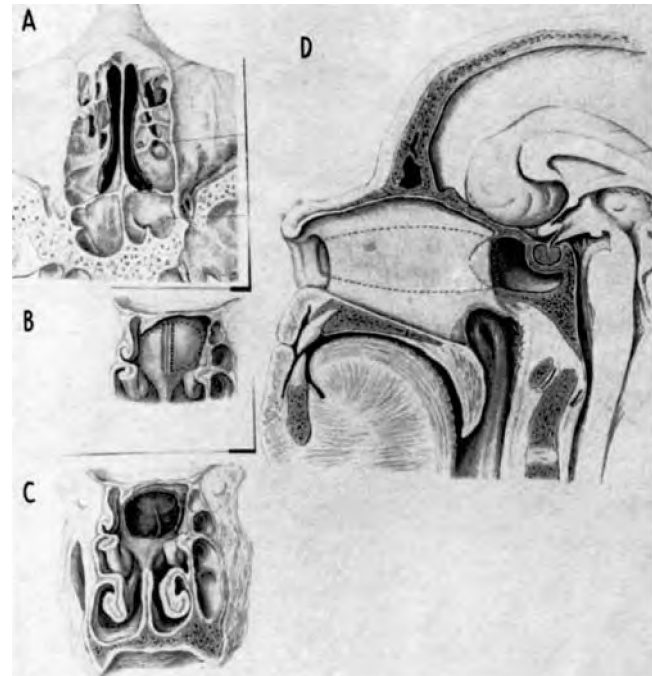


FIG. 9. Illustrations demonstrating Hirsch's endonasal submucosal transeptal approach. A: Axial view showing the relationship of the septum to the sphenoid sinuses. B: Anterior wall of the sphenoid sinus. C: Excision of the anterior wall of the sphenoid sinus. D: Dotted line outlines the part of the nasal septum that is excised. Reprinted from Hirsch O: Symptoms and treatment of pituitary tumors. *AMA Arch Otolaryngol* 55:268-306, 1952. Copyright 1952. American Medical Association. All rights reserved.

With the performance in June, 1910 of Cushing's oronasal submucosal operation and Hirsch's endonasal submucosal procedure, the surgical treatment of pituitary tumors was well established. The number of cases then rapidly increased.<sup>23</sup>

These two techniques have remained the standard for many years.

It is apparent in the literature that Cushing and Hirsch were critical of each other's approach. Cushing believed that Hirsch's single-nostril route was a "small avenue of approach" that provided limited exposure and "may give unnecessary hazard."<sup>39</sup> In his lukewarm endorsement he described the endonasal approach as providing "fair access to the sellar base" that "may be applicable to certain cases."<sup>39</sup> He also alluded to the fact that good surgical results when using this approach required "the hands of a skillful rhinologist." Cushing also stressed the importance of being able to convert to a craniotomy by commenting:

Still another reason why the rhinologist should hesitate to attack these cases unless he acts in cooperation with a neurological surgeon or is himself prepared to follow up his transsphenoidal operation by some intracranial measure, is the possible necessity, under these circumstances, of a subsequent craniotomy.<sup>9</sup>

In comparing his sublabial approach with Hirsch's endonasal approach, Cushing commented:

The external opening [of the sublabial approach] is twice as large as in the endonasal operation; the procedure is median from the outset, it is conducted, in favorable cases, without entering the mucus-lined nasal cavity, it can be carried out in

## Cushing and Hirsch's transsphenoidal approach

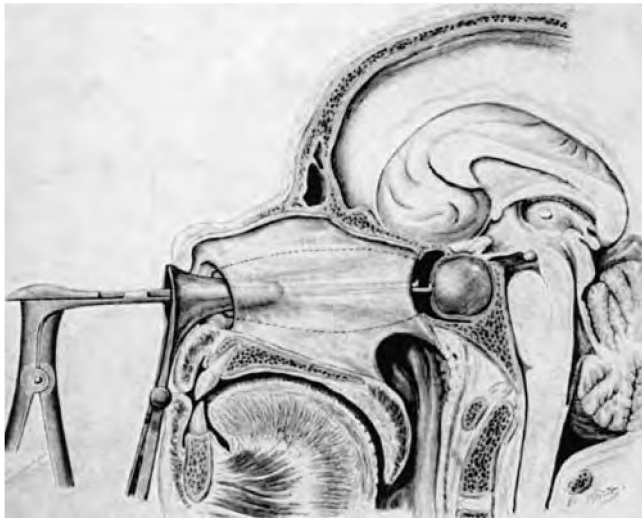


FIG. 10. Illustration of Hirsch's endonasal submucosal transseptal approach. Note the endonasal incision and submucosal placement of nasal speculum and instruments. Reprinted from Hirsch O: Symptoms and treatment of pituitary tumors. *AMA Arch Otolaryngol* 55:268–306. 1952. Copyright 1952. American Medical Association. All rights reserved.

one session, and it is somewhat less mutilating, inasmuch as the turbinates are merely flattened temporarily and not removed.<sup>9</sup>

Cushing thought that preserving the turbinates avoided the complication of postoperative ozena, which was “one of the disagreeable consequences of exenteration of [the lower turbinates],”<sup>10</sup> a practice that Hirsch commonly used a few days before the formal endonasal operation. In his defense, Hirsch contested:

But after carrying out submucous resection of the septum, the surgeon spreads the mucoperiosteal flaps apart with a nasal speculum to the width of both nasal and both sphenoidal cavities. The operation is carried out in a newly created, wide tunnel that has no communication with the nasal cavities except for the first linear incision, thus preventing or restricting possible infection.<sup>20</sup>

One of the major differences between Cushing's and Hirsch's operations was the choice of anesthesia. Cushing initially used ether anesthesia, but he found it difficult to use, particularly in patients with acromegaly in whom there was a higher risk of airway obstruction; he, therefore, began using intratracheal general anesthesia. Although Hirsch reported success with the use of local anesthetics, this technique received much criticism from the surgical community. Among these critics was Cushing, who stated:

Though Hirsch has shown that in his endonasal operations the sellar floor may be reached and removed in one or more stages under local anaesthesia, unquestionably most surgeons and most patients would prefer a general anaesthetic, provided it did not add an element of hazard to what in itself is regarded as a dangerous operation.<sup>9</sup>

In a review of surgical approaches to the pituitary fossa, Cope<sup>3</sup> discussed reasons why a local anesthetic would be unjustifiable in the majority of transsphenoidal operations:

There are grave drawbacks to the adoption of local anaesthesia for such a serious operation as removal of part of a pituitary tumor. In the first place, it is impossible to guarantee that the patient shall not feel pain during manipulation of the dura

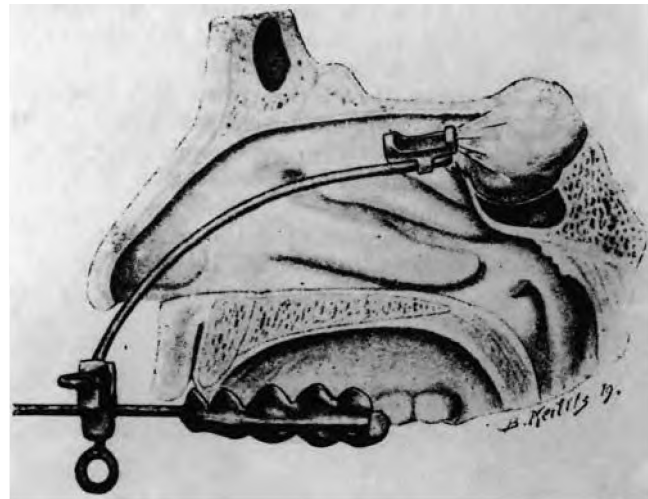


FIG. 11. Hirsch's method of delivering local postoperative radium for tumor control after a subtotal tumor resection. Reprinted from Hirsch O: Symptoms and treatment of pituitary tumors. *AMA Arch Otolaryngol* 55:268–306. 1952. Copyright 1952. American Medical Association. All rights reserved.

or contents of the sella turcica. Thus, in Case 8 of Hirsch's series, the operator “inserted a sharp spoon six or eight times, whereat the patient several times gave evidence of severe pain.”

In another account of one of Hirsch's cases performed after application of the local anesthetic, the discomfort of sudden pain caused the patient to touch the instruments with his hands and wipe the blood away. Although the operation was performed aseptically, the patient died 3 weeks later from suppurative basal meningitis. Another danger of using local anesthesia was the risk of injury caused by wayward surgical maneuvers induced by patient discomfort. The following was recorded in a report of a case performed by Stein<sup>36</sup> using Hirsch's technique:

Touching the dura caused great pain, and in an effort to orient myself as well as to mop the field for inspection. . . . I resorted to the use of a cotton-wrapped probe. While doing this shortly before finishing completely the decompression, the probe entered the brain on the left side, immediately causing a collapse of a patient, with every sign of haemorrhage into the brain, even to unconsciousness, paralysis, and retarded breathing.

Despite the differences in their techniques, Cushing and Hirsch each achieved excellent results and low rates of mortality. Cushing eventually abandoned the transsphenoidal approach in favor of the transcranial approach, whereas Hirsch continued using the technique into the antibiotic era. The modern transsphenoidal approaches that have been performed in the microsurgical era of Jules Hardy<sup>13</sup> and thereafter have been rooted in the fundamental techniques established by Cushing and Hirsch.

### Conclusions

In the early 1900s Harvey Cushing and Oskar Hirsch helped establish the transsphenoidal approach as a primary treatment in patients with pituitary adenomas. These surgeons had the two largest series reported in the literature and performed their operations with low associated mortality rates. Cushing advocated the sublabial approach, where-



as Hirsch promoted the endonasal approach. Both surgeons adapted the submucosal resection of the nasal septum to reach the sphenoid sinus. Nearly a century after the birth of transsphenoidal surgery, the fundamental techniques of Cushing's and Hirsch's approaches still resonate.

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