Transsphenoidal approach

History

As an alternative to the transcranial route the transsphenoidal approach was developed simultaneously in the first decade of the 20th century in the United States and in Europe, in particular in the Austrian monarchy. One reason that Vienna became the cradle for minimally invasive approach to pituitary tumours using an endonasal transsphenoidal approach was among others due to the basic and detailed anatomical studies of the paranasal sinuses performed in Vienna by the Austrian anatomist and Violin virtuoso Emil Zuckerkandl (1849–1910). His main work “On normal and pathological anatomy of the paranasal sinus and its pneumatic adnexes” in 1882 was the anatomical presupposition for the Viennese ENT surgeons to successfully develop minimally invasive endonasal approaches to pituitary tumours \(^1\).

Initially described by Hans Schloffer \(^2\) and Cushing \(^3\) and subsequently popularized by Guiot \(^4\) and Hardy and Wigser \(^5\), the transsphenoidal approach to the sella now represents the preferred approach for removing pituitary adenomas. Traditionally performed with a microscope and a sublabial incision, the implementation of the endoscope and endonasal access has rendered the transsphenoidal approach less invasive and provided improved visualization into and around the sella.

Guidelines

see Transsphenoidal approach guidelines.

Indications

The transsphenoidal approach is the gold standard for pituitary adenoma resection. However, despite advances in microsurgical and endoscopic techniques, some pituitary adenomas can be challenging to cure.

Traditionally performed with a microscope and a sublabial incision, the implementation of the endoscopic visualization and endonasal access has rendered the transsphenoidal approach less invasive and provided improved visualization into and around the sella.

see Endoscopic transsphenoidal approach

The standard endonasal approach has been expanded to provide access to other, parasellar lesions. With the addition of the endoscope, this expansion carries significant potential for the resection of skull base lesions.

see Extended endoscopic transsphenoidal approach

Although there is limited and low quality evidence available, the use of intraoperative ultrasound appears to be a safe and effective technological adjunct to transsphenoidal surgery for pituitary adenoma. Advances in ultrasound technology may allow for more widespread use of such devices \(^6\).
Suprasellar extension is regarded a drawback for complete removal of these tumors through this approach.

It is very important to evaluate the correlation between the preoperative radiologic craniocaudal extension on MRI of pituitary adenomas and the extent of tumor removal. A retrospective study. Tertiary care hospital. 560 patients underwent transsphenoidal removal of pituitary adenomas. The degree of removal of pituitary tumor in the follow-up imaging of the patients was correlated with the preoperative extension in mid-Coronal T1 W Gd. Tumors with suprasellar extension can be classified into: Type I tumors with extension confined to the sellar boundaries, resulted in complete removal in all cases (100%), type II tumors with suprasellar extension reaching the floor of the 3rd ventricle, resulted in complete removal in 70.2% of the cases, type III tumors with suprasellar extension above the 3rd ventricle, had only 13.5% of complete removal. Integration of radiologic findings into a scheme for the preoperative determination of possibility of total removal of the tumor through transsphenoidal approach, can give better correlation to the surgical outcome of pituitary tumors.

Transsphenoidal surgery can safely be performed in the setting of chronic rhinosinusitis (CRS) without increased risk of intracranial complications.

**Pre-op orders**

1. for transsphenoidal approach: Polysporin® ointment (PSO) applied in both nostrils the night before surgery
2. antibiotics: e.g. Unasyn® 1.5 gm (1 gm ampicillin + 0.5 gm sulbactam) IVPB at MN & 6 AM
3. steroids, either:
   a) hydrocortisone sodium succinate (Solu-Cortef®) 50mg IM at 11 PM & 6 AM. On call to OR: hang 1 L D5LR + 20 mEq KCl/l + 50 mg Solu-Cortef at 75 ml/hr
   
   OR

   b) hydrocortisone 100mg PO at MN&IV at 6AM
4. intra-op: continue 100 mg hydrocortisone IV q 8 hrs

**Complications**

see Transsphenoidal approach complications.

**Difficulties**

Difficulties achieving radical resection with this method are encountered in patients with pituitary adenomas (PA) invading the cavernous sinus (CS), due to the inability of the standard transsphenoidal approach to expose all tumors adequately.
Case series

2015

A retrospective review of adult patients who underwent transsphenoidal surgery for pituitary tumors at Barrow Neurological Institute (January 2011-March 2014) was performed to identify causes of unplanned readmission within 30 days of surgery. Patient demographics, tumor details, surgical complications, and endocrine function were documented.

Of 303 patients who had transsphenoidal surgery, 27 (8.9%) were readmitted within 30 days. Most of the 27 (15 [55.6%]) had delayed hyponatremia. Other causes were diabetes insipidus (4 [14.8%]), adrenal insufficiency (2 [7.4%]), and cerebrospinal fluid leak, epistaxis, cardiac arrhythmia, pneumonia, urinary tract infection, and hypoglycemia (1 each [3.7%]). Outpatient sodium screening was performed as needed. In cases of hyponatremia, the mean postoperative day of readmission was day 8 (range, 6-12 days) and the mean serum sodium was 119 mmol/L (range, 111-129 mmol/L). Numerous patient and surgical factors were examined, and no specific predictors of readmission were identified. They developed an outpatient care pathway for managing hyponatremia with the goal of improving readmission rates.

This study establishes a quality benchmark for readmission rates after transsphenoidal surgery for pituitary lesions and identifies delayed hyponatremia as the primary cause. Implementation of an outpatient care pathway for managing hyponatremia may improve readmission rates.

Fifty-five patients ≥ 70 years of age (average age 72.5 years, range 70-84 years) underwent endoscopic surgery for treatment of PAs. The mean follow-up period was 50 months (range 12-144 months). The most common symptoms were visual impairment in 38 (69%) patients, headache in 16 (29%) patients, and complete ophthalmoplegia in 6 (10.9%). Elderly patients presented a higher incidence of ophthalmoplegia (p = 0.032) and a lower frequency of pituitary apoplexy before surgery (p < 0.05). Tumors with cavernous sinus invasion were treated surgically less frequently than in younger patients. Although patients with an American Society of Anesthesiologists score of 3 were more common in the elderly group (p < 0.05), no significant difference regarding surgical time, extent of resection, and hospitalization were observed. Elderly patients presented with more complications than patients < 60 years (32.7% vs 10%, p < 0.05). Complications observed in the elderly group included 5 CSF leaks (9%), 2 permanent diabetes insipidus cases (3.6%), 4 postoperative refractory hypertension cases (7.2%), 1 myocardial ischemia (1.8%), and 1 death (1.8%). Postoperative new anterior pituitary deficit was more common in the younger group (< 60 years old: 17.7%) than in the elderly (≥ 70 years old: 12.7%); however, there was no statistical difference.

2004

White et al. compared 50 patients undergoing sublabial transseptal transsphenoidal surgery from 1996 to 1999, as well as 50 patients undergoing endoscopic surgery from 2000 and 2002. There was no difference in the intra-operative blood loss and the incidence of diabetes insipidus between the two groups. However, they showed that endonasal complications were much lower in the endoscopic group compared to the sublabial group.

Operative Neurosurgery - https://operativeneurosurgery.com/
In a series of 146 consecutively treated patients who underwent an endoscopic endonasal transsphenoidal approach to the sellar region for resection of pituitary adenomas between January 1997 and July 2001. Complications were divided into groups (nasofacial, sphenoid sinus, sella turcica, supra or parasellar, and endocrine complications) according to the anatomical structures and the systems involved. Overall, a decreased incidence of complications has been observed, compared with large historical series of the traditional microsurgical transsphenoidal approach, likely because of the overview inside the anatomy facilitated by the endoscope, and the decreased surgical trauma.

Transsphenoidal surgery, either microscopic or endoscopic, is a safe procedure in experienced hands, but serious complications still occur and must be reduced as much as possible. Additional improvement can be expected with greater experience and new technical developments. A coordinated team effort with other dedicated colleagues from different specialties is advised.

Questionnaires regarding 14 specific complications of transsphenoidal surgery were mailed to 3172 neurosurgeons. The data reported were analyzed from the 958 respondents (82%) who reported performing the operation. The neurosurgeons surveyed were asked to estimate the number of transsphenoidal operations performed, to identify any complications observed, and to estimate the percentage of operations that had resulted in any of the 14 specific complications. The 958 respondents were placed into three experience groups, based on the number of transsphenoidal operations performed. The data were analyzed by using chi 2 tests and Spearman correlation coefficients. The secondary objectives were met through a detailed review of the literature, in light of our experience.

Of the respondents, 87.3% reported having performed < 200 operations and 9.7% reported 200 to 500 previous operations. The remaining 3% reported more than 500 previous operations. More extensive previous experience with transsphenoidal surgery was associated with a greater likelihood of having witnessed each specific complication. The mean operative mortality rate for all three groups was 0.9%. Anterior pituitary insufficiency (19.4%) and diabetes insipidus (17.8%) were complications with the highest incidence of occurrence. The overall incidence of cerebrospinal fluid fistulas was 3.9%. Other significant complications, such as carotid artery injuries, hypothalamic injuries, loss of vision, and meningitis, occurred with incidence rates between 1 and 2%. An inverse relationship was found between the experience group and the likelihood of complications, as indicated by significant negative Spearman correlation coefficients for all but 2 of the 14 complications listed in the survey (P < 0.05). Thus, increased experience with transsphenoidal surgery seems to be associated with a decreased percentage of operations resulting in complications. Some caution should be exercised in interpreting these data, because they are based on the respondents' estimates.

Transsphenoidal surgery seems to be a reasonably safe procedure, with a mortality rate of less than 1%. However, a significant number of complications do occur. The incidence of these complications seems to be higher, with statistical significance, in the hands of less experienced surgeons. The learning curve seems to be relatively shallow, because a statistically significantly decreased incidence of morbidity and death could be documented after 200 and even 500 transsphenoidal operations. Better understanding of the indications for transsphenoidal surgery and improved familiarity with the
regional anatomy should further lower the incidence of death and morbidity resulting from this procedure in the hands of all neurosurgeons 13).
