

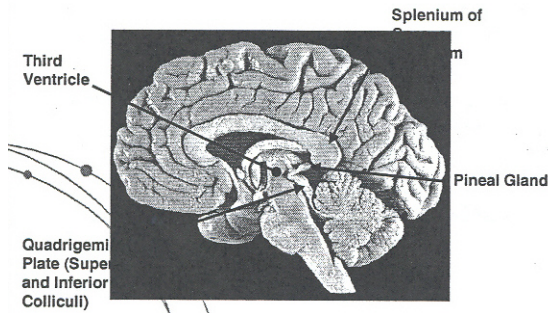
Complication Rates Associated with the Interhemispheric-Transcallosal Approach to Pineal Region Tumor

David R. Horgan

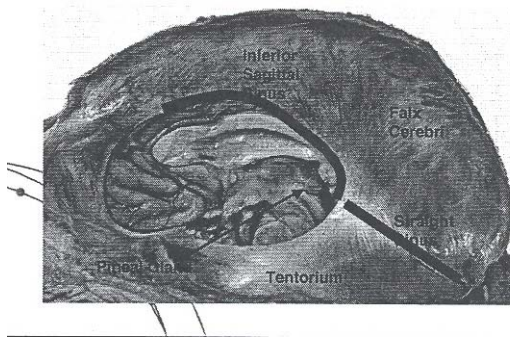
▪ A delicate business....

- The pineal gland, while not essential for life, lies at the geometric center of the cranium, and is surrounded by a number of extremely important structures:
 - Cerebellum
 - Third ventricle
 - Deep cerebral veins
 - Superior and inferior colliculi and tectum
 - Cerebral aqueduct
 - Thalamus

▪ Anatomy of the Pineal Region



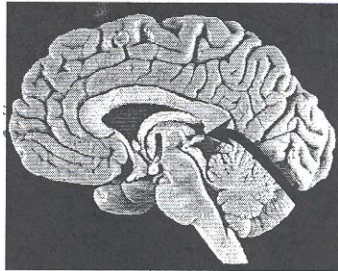
Dural Sinuses



• Common Surgical Approaches to the Pineal Region

- Infratentorial Supracerebellar Approach
 - Most commonly used
- Interhemispheric-Transcallosal Approach
 - Used for larger or supratentorial tumors

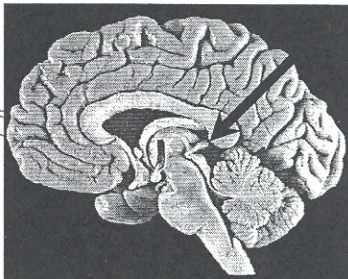
- **Infratentorial Supracerebellar Approach**



- Standard approach for pineal region surgery

- **Advantages**
 - Least invasive access to pineal region
 - Most pineal tumors are respectable by this approach with excellent results
- **Disadvantages**
 - Small operative field
 - Not appropriate for tumors with a large supratentorial or anterior extent

- **Interhemispheric-Transcallosal Approach**



- Indicated for tumors with a significant supratentorial or anterior component

- **Advantages**
 - Larger operative field
 - Good visualization of third ventricle and supratentorial structures
 - Useful for exposing tumors ventral to deep cerebral veins
- **Disadvantages**
 - May require division of bridging veins between parietal lobe and inferior sagittal sinus
 - Can cause venous infraction of cerebral hemispheres
 - Deep cerebral veins may obstruct operative field and may be injured during procedure
 - Cerebral falx obstructs view of opposite side of tumor
 - Requires retraction of occipital and/or parietal lobes
 - Potential for retraction injury
 - Requires division of posterior portion of corpus callosum

- **Study Significance**
 - The best outcome is found with the most complete resection
 - The surgeon would therefore like to be able to use either approach, based solely on the anatomy of the case
 - If complication rates are found to be similar, the most anatomically appropriate approach can be used with confidence

- **Previous Literature**
 - Bruce and Stein, 1995
 - 147 consecutive patients
 - 4% operative mortality, 3% permanent major morbidity
 - Complication rates for different operative approaches not compared
 - Potential complications, all approaches: altered mental status, impaired eye movements, ataxia, postoperative hemorrhage
 - Complications possible with interhemispheric-transcallosal approach: seizures, hemianopsia, hemiparesis
 - Hermmann, et al, 1992
 - 36 consecutive patients aged 4-67
 - 2% operative mortality, 8% permanent neurological morbidity
 - Only infratentorial-supracerebellar approach was used

- **Study Hypothesis**
 - The interhemispheric-transcollosal approach and the infratentorial supracerebellar approaches to pineal tumor resection have similarly low rates of morbidity and mortality

- **Methods**
 - **Study Design**
 - Retrospective observational, longitudinal analysis of 264 consecutive patients receiving surgery at this institution since 1968
 - All data will be obtained from patient charts and other hospital records
 - Definitions
 - Permanent Neurological Morbidity
 - Conceptual definition: Any harmful deterioration in neurological status to be attributable to the operative procedure
 - Operational definition: The patient's preoperative neurological exam will be compared to the discharge exam, and to 6-month follow-up exam, as noted in the patient record
 - Not present preoperatively
 - Present on postoperative exam and on six-month follow-up
 - Not attributable to some other process
 - Causes harm to the patient
 - Examples
 - Extraocular movement dysfunction
 - Altered mental status
 - Ataxia
 - Hemiparesis
 - Operative Mortality
 - Death attributable to the operation itself
 - E.g., hemorrhage into the tumor bed, herniation
 - Postoperative Mortality

- Death during the 30 days following the procedure
- Examples
 - Pneumonia
 - Pulmonary embolus
 - Shunt infection

- Statistical Analysis
 - Because the numbers in the complication groups are likely to be small, Fisher's exact test will be used
- Power analysis
 - It is estimated that approximately 25% of the patients (53) received their surgery via the interhemispheric-transcallosal approach
 - The remaining surgeries (211 patients) were performed via the infratentorial supracerebellar approach
 - The complication rate for the infratentorial supracerebellar approach is estimated at 5%
 - Given a power of .8 and an alpha of .05, this study can show a significant difference with the complication rate of 23% in the interhemispheric-transcallosal group
 - Problem: It is unlikely that the complication rate in the study will reach 23%
 - Therefore, it is possible that the study results may only be able to suggest a trend
 - The next step would be a multi-center study to increase statistical power

- Subject Selection
 - An attempt will be made to include all 264 pineal tumor patients, subject to the following exclusions
 - Prior neurological conditions
 - Death from non-operative causes prior to 6-month follow-up
 - Lack of complete patient records

- Summary
 - The study outlined above should aid surgeons and their patients in assessing the risks and benefits of pineal tumor resection

- Acknowledgements
 - Bartoll Brain Tumor Research Laboratory
 - Jeffrey N. Bruce, M.D.
 - Alfred Ogden, M.D.
 - Andrew Parsa, M.D.
 - Bahaa Hafez, M.D.
 - Carrie Muh, M.D.
 - Azadeh Fanin, M.D.
 - ICCR
 - Rajasekhar Ramakrishnan, PhD.
 - Beverly Diamond, PhD.

A. Study Purpose and Rationale

Surgery of the pineal region is difficult, due to this region's deep location within the brain and the vascular structures surrounding it. At this institution, pineal region tumors are resected via the infratentorial supracerebellar approach when possible, because this approach is felt to be safest. However, this approach cannot be used effectively when there is a significant supratentorial component to the tumor. In these cases, the transcallosal intrahemispheric approach must be employed. This latter approach is less-favored because it involves retraction of the cerebral hemispheres and deep cerebral veins, as well as resection of a portion of the posterior corpus callosum. Each of these steps has the potential for significant neurological complications for the patient. Despite these risks, the intrahemispheric approach is sometimes mandated by the anatomy of the tumor.

The purpose of this study is to determine whether there is an increased rate of complications associated with the use of the transcallosal intrahemispheric approach to pineal region tumors when compared with the infratentorial supracerebellar approach.

B. Study design and Statistical Analysis

A retrospective longitudinal analysis of 264 sequential patients receiving pineal region tumor resection at this institution since 1968. Data will be obtained from hospital medical records, and will include demographic data, preoperative and postoperative physical exam data, radiographic imaging, operative course, and hospital course. Each patient's preoperative neurological status will be compared with that of their neurological status one year postoperatively. The one-year delay is necessary because patients frequently have significant neurological deficits immediately following surgery which usually resolve completely within a few weeks or months postoperatively.

Patients' tumors were resected via either the infratentorial supracerebellar approach or the transcallosal intrahemispheric approach depending on the anatomical extent of the tumor. Approximately 25% of the resections were performed by the TCIH approach, or approximately 52 patients. It is anticipated that significant neurological complications occurred at a low rate in both the ISC and TCIH groups, perhaps 5-10%. Using this estimate of the number of patients in the two groups, and estimating an ISC complication rate of 5%, a TCIH complication rate of 23% or greater would be statistically significant at an alpha of .05 and a power of .80.

C. Study Procedure

No additional procedures will be required for this study.

D. Study Drugs

No drugs will be used in the study.

E. Medical Devices

No additional medical devices will be used in this study.

F. Study Questionnaires

The study does not use a questionnaire

G. Study Subjects

All 264 patients receiving pineal region surgery at this institution since 1968 will be considered in the review. Patients will be excluded if they had a neurological condition unrelated to their tumor, if they died of causes not attributable to the surgical procedure sooner than six months after surgery, or if their records do not include adequate information to determine their neurological status before and after the surgery.

H. Recruitment of Subjects

No recruitment will be required.

I. Confidentiality of Study Data

Patient records are kept in a locked office accessible only to staff of the Department of Neurological Surgery. Data extracted from the patient records will be coded so that the patient's identity will not be revealed, and this code will only be accessible to the investigators.

J. Potential Conflict of Interest

None are anticipated.

K. Location of the Study

Research will be carried out in the offices of the Department of Neurological Surgery.

L. Potential Risks

None.

M. Potential Benefits

None.

N. Alternative Therapies

Not applicable.

O. Compensation to Subjects

None.

P. Costs to Subjects

None.

Q. Minors as Research Subjects

There are no minors involved in this study.

R. Radiation or Radioactive Substances

None will be used in this study.