Endocrine and Visual Outcomes after Pituitary Tumor Surgery

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Overview

1. Introduction
2. Visual Outcomes after Pituitary Surgery
3. Endocrine Outcomes after Pituitary Surgery

Disclosures

None
Focus of my neurosurgical research team at UCSF

- UCSF: 2007
  - California Center for Pituitary Disorders (CCPD) established
  - Integration of neurosurgical and neuroendocrine care
- Five years later
  - 1015 transsphenoidal surgeries
  - Benchmark for evaluation of morbidity and outcomes
- Surgical Research team at CCPD
  - Comprehensive database of cases
  - Pituitary surgery morbidity and symptomatic outcomes.

Case breakdown by pathology CCPD (5 years)

1. Vision loss – mass effect on the overlying optic chiasm
2. Hypopituitarism – mass effect on the surrounding pituitary gland
3. Headache – from mass effect on the dura

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3. Endocrine Outcomes after Pituitary Surgery
Visual symptoms caused by pituitary tumors based on patient anatomy

1. Chiasm over tuberculum (prefixed)
2. Chiasm over diaphragm
3. Chiasm over dorsum (postfixed)

% of patients
Tumor visual symptoms

- Contralateral hemianopsia: 10%
- Bitemporal hemianopsia: 80%
- Monocular deficit: 10%

Visual symptoms caused by pituitary tumors

- January 2003 - July 2012
  - 967 nonfunctional adenomas (benign tumors not producing pituitary hormones) resected at UCSF
- 492 (51%) presented with visual symptoms
- Median duration of vision loss prior to surgery was 6.5 months

Visual deficits observed in UCSF adenoma patient cohort (n=967)

<table>
<thead>
<tr>
<th>Deficit</th>
<th>Share of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitemporal hemianopsia</td>
<td>49%</td>
</tr>
<tr>
<td>Monocular</td>
<td>31%</td>
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<tr>
<td>Quadrantopia in one eye combined with quadrantopia or hemianopsia in the other eye</td>
<td>20%</td>
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Vision Improvement after Surgery for nonfunctional adenomas

Analysis of postoperative visual improvement after surgery for nonfunctional adenomas at UCSF:

- For adenoma patients with visual symptoms preoperatively,
  - 77% had some postoperative improvement in vision
  - 37% had postoperative return to baseline vision
- Multivariate analysis revealed increased age and increased duration of visual symptoms before surgery to be associated with decreased chance of visual improvement after surgery.

Source: Journal of Neurosurgery 116: 283, 2011
**Delay in Diagnosing Nonsecretory Adenomas Lowers Chance of Surgery Correcting Vision**

- Elderly patients tend to have a greater delay from onset of visual symptoms to adenoma diagnosis (>6 months vs 2 months in younger patients).
- Elderly patients often due to not seeking care or being diagnosed with other conditions (cataracts, retinopathy, glaucoma).
- Unfortunately elderly patients with prolonged duration of visual symptoms are unlikely to return to baseline vision after surgery.

**Race and age both increase duration of visual symptoms, reducing postop improvement**

**Apoplexy has less postop visual improvement and associated socioeconomic risk factors**

- Apoplexy is the extreme form of vision loss in adenoma patients
  - lowers chances of postoperative visual improvement
  - 81% in non-apoplexy cases
  - 53% in apoplexy cases at UCSF 2003-2012.
- Apoplexy patients were more likely to lack:
  - Insurance
  - Primary care
  - In retrospect had symptoms that could have led to the diagnosis of adenoma before apoplexy if they had access to care.
Standard hypothesis re: rates of deficits by axis

- Theories re: rates of deficits by axis are based on
  1. differential robustness of cells in the normal pituitary gland
  2. tendency of adenomas to form in the lateral gland

- Either line of reasoning leads to speculation that a growing adenoma causes endocrine deficits in the following sequence:
  1. growth hormone
  2. LH/FSH
  3. TSH
  4. ACTH

Variables associated with Preoperative Pituitary Deficits

- Patients with preoperative endocrine deficit(s) were
  - older (mean age=60 vs. 54 years; P=0.004)
  - More male (64% male vs. 36% female; P=0.0005),
  - Had larger NFAs (mean diameter=2.4 cm vs. 2.1 cm; P=0.02)

- Effect of size on specific axes: size correlated with male/female hypogonadism but not with low thyroid, GH/IGF-1, or cortisol.

Hypopituitarism

- Rates of preoperative central hormonal deficits at UCSF for 1015 cases, 305 nonfunctional adenomas. Every patient had some endocrine evaluation but some patients had incomplete evaluations:

PITUITARY ADENOMAS – SYMPTOMS VS. SIZE

Vision loss and hypopituitarism, but not headache, in adenoma patients become more common with increasing size
Improvement/Normalization of Endocrine Deficits after Nonfunctional Adenoma Surgery

- Difference between nonfunctional adenomas vs. other sellar tumors: delayed improvement unique to nonfunctional adenomas

New Endocrine Deficits after Surgery by axis

- No variables predicted development of new deficits
- Comparison to largest previous study (Webb et al.; JCEM 84: 3696, 1999): 56 NFAs – 25% new hypoadrenalism, 16% new reproductive, 14% new GH, 10% new TSH

Threshold for Surgical Correction of Pituitary Deficits

- **TSH:** No correction if < 0.03 mIU/mL (normal=0.45-4.12)
- **Testosterone:** No correction if < 2.0 ng/dL (normal =250-1100)
- **Cortisol:** No correction if < 1 µg/dL (normal=4-22)
- **IGF-1:** No correction if < 25 µg/dL (normal =34-246)

Multivariate Analysis – Factors Predicting Endocrine Improvement after surgery

- No variables predicted normalization in:
  - Male reproductive axis
  - Thyroid axis
- Factors Predicting Normalization in other axes:
  - Female Reproductive Axis
    - Younger Age
    - Cortisol
      - Smaller tumor
      - 1st Surgery
    - IGF-1
      - Younger age
      - Female gender
      - less low IGF-1

Source: Journal of Neurosurgery 2015, epub ahead of print
Preoperative and postoperative gland volume

- Measurements of normal pituitary gland volume reveal that most patients experience postoperative expansion of gland.

Conclusions

- Visual symptoms in nonfunctional adenoma patients become less likely to improve in older patients with symptoms for over 6 months. Unfortunately, older patients tend to have the greatest delay in diagnosis.
- Apoplexy patients have a higher incidence of lack of access to medical care.
- The rate of improvement of endocrine deficits after nonfunctional adenoma resection is highest for central hypothyroid and male hypogonadism.
- Patients who do not exhibit postoperative endocrine improvement have lower preoperative gland volume than those who go onto exhibit endocrine improvement.

Preoperative and postoperative gland volume

- Patients who do not exhibit postoperative endocrine improvement exhibit lower preoperative gland volume than those who go onto exhibit endocrine improvement (P<0.01).

Acknowledgements

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