Pituitary Tumors: Unusual Situations

Michigan Chapter of AACE 2018 Annual Meeting

September 22, 2018

Mark E. Molitch, M.D.
Northwestern University Feinberg School of Medicine
Chicago, Illinois USA
Disclosures

• Financial
  – Products used in the treatment of patients with Pituitary Diseases
    • Research support from Chiasma, Novartis
    • Consulting with Ipsen, Pfizer, Novartis, Novo Nordisk, Genentech, Chiasma
Hyperprolactinemia: Dopamine Agonist Therapy

- Dopamine agonists are the preferred modality for initial treatment of patients with prolactinomas
- Normalize prolactin levels and achieve remission of associated symptoms in 80-90% with cabergoline and 70-80% with bromocriptine
- Reduce or stabilize tumor size – in over 80% with cabergoline and over 60% with bromocriptine
  - Preserves and sometimes restores anterior pituitary function
- Prevent disease recurrence or progression
- But Dopamine Agonist use not always straightforward
Case 1. 17 Year Old with Primary Amenorrhea

- No headaches, visual complaints, galactorrhea or other symptoms
- Prolactin 35.1 ng/mL
- Normal Visual fields
- FT4 1.08 (0.8-2.3), LH 0.25, FSH 1.5, IGF-1 164 (176-452), Cortisol 16.3
Two-Site Assays – “Hook Effect” from High Levels of Prolactin

Two-site standard conditions

“Hook” effect

Signal

PRL Concentration

Signal

PRL Concentration
Case 1. 17 Year Old with Primary Amenorrhea

- No headaches, visual complaints, galactorrhea or other symptoms
- Prolactin 48,600 ng/mL (on dilution)
- Normal Visual fields
- FT4 1.08 (0.8-2.3), LH 0.25, FSH 1.5, IGF-1 164 (176-452), Cortisol 16.3
Case 1. 17 Year Old with Primary Amenorrhea

What is the best choice for initial therapy of a patient with a Giant Prolactinoma?

1. Transsphenoidal surgery
2. Craniotomy
3. Combination transsphenoidal surgery & craniotomy
4. Cabergoline
5. Irradiation
Giant and Malignant Prolactinomas
Definitions

• Macroadenoma
• Invasive Macroadenoma
• Giant Prolactinoma (> 4 cm)
• Malignant Prolactinoma (Carcinoma)
  – Requires metastatic disease
    • Intracranial
    • Spinal
    • Extra CNS
Surgery for “Giant” Prolactinomas

• Giant pituitary adenomas defined as tumors > 4 cm in diameter
  − Usually have cavernous sinus extension and often wrapped around the internal carotid arteries
• Operative cures – none
• Operative complications high
  − Pia et al: 77 pts: 8 deaths, 4 visual loss, 8 oculomotor palsy, 15 DI, 14 mental deterioration, 5 CSF fistulas
  − Guidetta et al: 21 case: 2 deaths, 4 DI, 1 hemiparesis, 1 “hypothalamic failure”
Response of Giant Prolactinoma to Cabergoline

Date: 10/11/06
Prolactin: 48,600
Cabergoline: --

Date: 5/14/07
Prolactin: 229
Cabergoline: 4.5 mg/wk

Date: 10/27/09
Prolactin: 8.6
Cabergoline: 6 mg/wk

Date: 12/21/11
Prolactin: 9.2
Cabergoline: 6 mg/wk

Date: 12/11/12
Prolactin: 8.9
Cabergoline: 4 mg/wk

Date: 12/10/14
Prolactin: 10.3
Cabergoline: 2 mg/wk

Date: 12/16/15
Prolactin: 22.0
Cabergoline: 1 mg/wk

Date: 12/28/16
Prolactin: 17.0
Cabergoline: 1 mg/wk
Change in Giant Prolactinoma Volume with Cabergoline Treatment

Corsello et al., Clin Endocrinol 2003;58:662
Temozolomide

- Temozolomide is an alkylating agent that depletes MGMT (0-6-methylguanine-DNA methyltransferase), a DNA repair enzyme which methylates DNA and exerts an antineoplastic effect.
- Alkylating drugs not cell-cycle specific & can inhibit all stages of tumor-cell growth; therefore, patients with slow-growing tumors, might be well suited to this drug type.
- Absorbed rapidly after oral administration.
- Readily crosses the blood-brain barrier.
- Used for gliomas and cerebral metastases of melanoma.
- Adverse effects: nausea, vomiting, fatigue, edema, myelosuppression, Diffuse organizing pneumonitis (1 case).
  - PCP also reported and prophylaxis recommended.

Temozolomide for Refractory, Giant Prolactinoma

Neff et al., Pituitary 200710:81

Ada & TSS
Ext Beam XRT
Gamma Knife
High-dose Cabergoline
Octreotide
Estrogen Antagonism
Temozolomide
Temozolomide for Refractory, Giant Prolactinoma

Neff et al., Pituitary 2007:10:81
Summary
Giant Prolactinomas

• Cabergoline should be the initial choice for therapy
  – May need high doses (echocardiography)
  – Aromatase inhibitors helpful in rare cases
• Surgery for cabergoline-resistant cases
  – May require combined transsphenoidal and transcranial approaches
  – High complication rates with poor success
• Radiotherapy if continued progressive disease
• Temozolomide if continued progressive disease despite cabergoline, surgery and RT
Malignant Prolactinomas

• Overall frequency – only 53 reported cases (many unreported)
  – 1 – 2 / 1000 adenomas and 1/3 of all pituitary carcinomas

• Presentation
  – Loss of responsivity to dopamine agonist in a previously responsive tumor
  – Rapid regrowth after surgery
  – Repeated operations for tumor growth and increase in PRL levels
  – Development of metastases

• Pathology
  – Traditional features of malignancy – increased mitotic figures, nuclear pleomorphism, high cellularity, cytologic atypias, necrosis – uncommon
  – Cannot make diagnosis of malignancy purely on histopathology
  – Metastases may appear more aggressive than primary tumor on histopathology
  – Tend to have high Ki-67 labeling

Ragel BT & Couldwell WT. Neurosurg Focus 2004;16:1
Kaltsas GA et al. JCEM 2005;90:3089
Clinical Features in 53 Cases of Malignant Prolactinoma

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>((n=48^* + 5 = 53))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>35M:18F</td>
</tr>
<tr>
<td>Age (years)</td>
<td>43.5 (range 12 – 70)</td>
</tr>
<tr>
<td>Prevailing symptomatology</td>
<td>25% ↑ PRL, 75% Mass effects</td>
</tr>
<tr>
<td>Metastatic Sites</td>
<td>Intracranial 75%, Extracranial 33%</td>
</tr>
<tr>
<td>Mean Time Dx to Metastases</td>
<td>6.9 yrs (range 1 mo – 20 yrs)*</td>
</tr>
<tr>
<td>Mean Time Metastases to Death</td>
<td>1.9 yrs (range 1 wk – 8 yrs)*</td>
</tr>
<tr>
<td>Mean Time Dx to Death</td>
<td>8.0 yrs (range 2 mos – 25 yrs)*</td>
</tr>
<tr>
<td>Alive at publication (%)</td>
<td>36%</td>
</tr>
</tbody>
</table>

*Kars et al., Eur J Endocrinol 2006;155:523
Lim et al., Lancet Oncol 2006;7:518
Fadul et al., J Neurosurg 2006;105:621
Huang et al., J Neurooncol 2008;90:41
Hagen et al., Eur J Endocrinol 2009;161:631
Byrne et al., J Clin Neurosci 2009;16:1694
Malignant Prolactinomas
Multimodality Therapy

• Surgery – 46 cases
  – 38 also received radiotherapy

• Bromocriptine used in 35 cases
  – 22 escaped from prior control
  – 13 had been resistant

• Cabergoline used in 8 cases
  – 4 escaped from prior control
  – 4 had been resistant

Kars et al., Eur J Endocrinol 2006;155:523
Hagen et al., Eur J Endocrinol 2009;161:631
Lim et al., Lancet Oncol 2006;7:518
Fadul et al., J Neurosurg 2006;105:621
<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Partial or Complete Response</th>
<th>Stable Disease</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRL</td>
<td>12/27 (44%)</td>
<td>5/27 (19%)</td>
<td>10/27 (37%)</td>
</tr>
<tr>
<td>ACTH</td>
<td>12/34 (56%)</td>
<td>5/35 (15%)</td>
<td>10/34 (29%)</td>
</tr>
<tr>
<td>GH</td>
<td>3/8 (38%)</td>
<td>2/8 (25%)</td>
<td>3/8 (38%)</td>
</tr>
<tr>
<td>Nonfunctioning</td>
<td>6/27 (22%)</td>
<td>13/27 (48%)</td>
<td>8/27 (30%)</td>
</tr>
</tbody>
</table>
Case 2: 28 year old Woman with Macroprolactinoma

- Cabergoline initiated and gradually increased to 2 mg/wk
  - PRL decreased to 45 ng/mL in 1 month and 18 ng/ml at 3 mos
  - MRI at 3 mos showed 50% reduction in tumor size
  - Headaches and galactorrhea ceased and menses resumed
- During treatment, had nasal stuffiness
  - At 5 mos noticed watery rhinorrhea
Case 2: 28 year old Woman with Macroadenoma

What should be the next step in management?

1. Decrease dose of cabergoline
2. Switch to bromocriptine
3. Send nasal fluid for glucose and protein measurements
4. Send nasal fluid for β-transferrin measurement
CSF-Rhinorrhea

• Large, invasive skull-based prolactinomas can serve as a “cork” in base of skull
  – If tumor size reduced as result of dopamine agonist use, “cork” can shrink, allowing CSF leak around the tumor
• Symptom is primarily a watery discharge that can increase if person leans forward with head down
• Major concern is open passage for bacteria with risk of meningitis, although pneumocephaly can occur
CSF Rhinorrhea
Diagnose by Measuring $\beta_2$-Transferrin in Nasal Fluids

• B2-transferrin is an asialo transferrin isoform found only in CSF, ocular fluids and perilymph and not in nasal mucus

• In one series of 182 patients with rhinorrhea/otorrhea, 204 tests (some repeats) for $\beta_2$-transferrin done\(^1\)
  - Sensitivity 97%, specificity 99%, positive predictive value 97%, negative predictive value 99%
  - Glucose in CSF, CT scans, MRI scans all had less good results

\(^1\)Warnecke et al., Arch Otolaryngol Head Neck Surg. 2004;130:1178
CSF Rhinorrhea – Management Strategies

- Urgent (but not emergent) neurosurgical consultation, imaging
- Endonasal, endoscopic surgical repair to prevent meningitis generally recommended
- Use of prophylactic antibiotics pending surgery controversial
- Lumbar drainage usually not successful
- Reduction in dopamine agonist dose to allow tumor (cork) enlargement has been done but uncertain results

Lam et al., Neurosurg Focus 2012;32(6):E2
Case 3. 29 Year Old Man with Macroprolactinoma Responding to Cabergoline

- 29 year old man presented with decreased libido, erectile dysfunction and headaches
  - PRL - 2904 ng/mL
- Cabergoline initiated & gradually increased to 3.5 mg/wk
  - PRL normalized
  - Marked tumor size reduction
  - Normal libido and erections and headaches gone
- At recent clinic visit, wife asked if his dose of cabergoline could be reduced?
Case 3. 29 Year Old Man with Macroprolactinoma Responding to Cabergoline

Which of the following adverse effects of cabergoline is she likely concerned about?

1. Difficulty urinating
2. Hypersexuality
3. Sleep apnea
4. Restless legs
Impulse Control Disorders (ICD)

• Impulse Control Disorders (ICDs) can be defined as “a failure to resist an impulse, drive or temptation to perform an act that is harmful to the person or others.” They include, but are not limited to, problem gambling, hypersexuality, compulsive eating, compulsive shopping, and “punding”.
  – Punding is characterized by compulsive performance of and fascination with repetitive mechanical tasks, for example assembling and disassembling household objects or collecting or sorting various items.

• Mechanism of action behind ICDs seems to be an interaction between the dopamine agonists and the D3 receptors in the mesolimbic system, known to be responsible for the processes governing behavior, pleasure, and addiction

Noronha et al., Endocrine 2016;51:205
**Impulse Control Disorders (ICD)**

- Compulsive eating reported in 23% and compulsive shopping in 10% of patients on dopamine agonist therapy for restless legs syndrome.
- ICDs in general are seen in as many as 1 in 7 patients with Parkinson’s disease on dopamine agonist therapy.
- Impulse control disorders (hypersexuality, pathologic gambling, compulsive shopping) have been reported in patients taking dopamine agonists for hyperprolactinemia.
  - Clinicians should warn patients and their significant others or family members about this potential adverse effect.
  - Clinicians should ask about ICDs at subsequent visits.

Bancos et al., Clin Endocrinol 2014;80:863
Noronha et al., Endocrine 2016;51:205
Case 4. Prolactinoma and Pregnancy

- 42 year old physician whom I had seen 20 years ago called with question:
  - Had a 2 cm macroprolactinoma that got much smaller, normalized prolactin, and had return of ovulatory menses on cabergolone
  - Had tried going off cabergolone a couple of times without maintaining normal PRL levels

- Now she is 20 weeks pregnant. Should she continue the cabergolone? She feels much better when taking compared to not taking cabergolone
Case 4. Prolactinoma and Pregnancy

Which of the following should be the next step in management?

1. Switch cabergoline to bromocriptine and continue throughout pregnancy
2. Continue the cabergoline throughout the pregnancy
3. Stop the cabergoline treatment now
4. Stop the cabergoline treatment now but restart if feeling badly
Prolactinomas and Pregnancy

• Prolactin levels and pituitary size increase during normal pregnancy from lactotroph hyperplasia

• Concerns in patients with prolactinomas
  – Dopamine agonist use
  – Increase in tumor size
## Safety of Dopamine Agonists in Pregnancy

<table>
<thead>
<tr>
<th></th>
<th>Bromocriptine</th>
<th>Cabergoline</th>
<th>Normals (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancies</td>
<td>6239</td>
<td>1016</td>
<td></td>
</tr>
<tr>
<td>Spontaneous Abortions</td>
<td>620 / 9.9</td>
<td>77 / 7.6</td>
<td>10-15</td>
</tr>
<tr>
<td>Terminations</td>
<td>75 / 1.2</td>
<td>66 / 6.5</td>
<td>20</td>
</tr>
<tr>
<td>Ectopic</td>
<td>31 / 0.5</td>
<td>3 / 0.3</td>
<td>1.0-1.5</td>
</tr>
<tr>
<td>Hydatidiform Moles</td>
<td>11 / 0.2</td>
<td>1 / 0.1</td>
<td>0.1-0.15</td>
</tr>
<tr>
<td>Deliveries (known duration)</td>
<td>4139</td>
<td>746</td>
<td></td>
</tr>
<tr>
<td>At Term (&gt;37 weeks)</td>
<td>3620 / 87.5</td>
<td>672 / 90.1</td>
<td>87.3</td>
</tr>
<tr>
<td>Preterm (&lt;37 weeks)</td>
<td>519 / 12.5</td>
<td>74 / 9.9</td>
<td>12.7</td>
</tr>
<tr>
<td>Deliveries (known outcome)</td>
<td>5120</td>
<td>670</td>
<td></td>
</tr>
<tr>
<td>Singleton births</td>
<td>5031 / 98.3</td>
<td>655 / 97.8</td>
<td>96.8</td>
</tr>
<tr>
<td>Multiple births</td>
<td>89 / 1.7</td>
<td>15 / 2.3</td>
<td>3.2</td>
</tr>
<tr>
<td>Babies (known details)</td>
<td>5213</td>
<td>863</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>5030 / 98.2</td>
<td>842 / 97.6</td>
<td>96.2</td>
</tr>
<tr>
<td>Major malformations</td>
<td>93 / 1.8</td>
<td>21 / 2.4</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Safety of Dopamine Agonists During Pregnancy

• Dopamine agonists are usually given for just the first few weeks of pregnancy until the first menstrual period has been missed
  – Most safety data based on limited drug exposure

• Only about 100 patients reported who took bromocriptine throughout gestation – only 2 minor abnormalities (1 undescended testes, 1 talipes deformity)

• < 20 cases reported of use of cabergoline throughout pregnancy – no problems
Enlargement of Prolactinoma During Pregnancy

Prepregnancy

8 Months Gestation, presented with increasing headaches
## Effect of Pregnancy on Prolactinomas

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Prior Therapy</th>
<th># Patients</th>
<th># Patients With Tumor Enlargement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microadenomas</td>
<td>None</td>
<td>764</td>
<td>18 (2.4%)</td>
</tr>
<tr>
<td>Macroadenomas</td>
<td>None</td>
<td>304</td>
<td>50 (16.4%)</td>
</tr>
<tr>
<td>Macroadenomas</td>
<td>Surgery/XRT</td>
<td>148</td>
<td>7 (4.7%)</td>
</tr>
</tbody>
</table>

Management of Prolactinomas During Pregnancy
(Microadenomas and Intrasellar Macroadenomas)

- Establish intermenstrual interval and stop dopamine agonist when menses missed
  - Stop dopamine agonist if pregnancy test positive
- Follow patient symptomatically every 3 mos
- If headaches or visual complaints, repeat MRI (non-contrast) and visual fields tests
- Reinstitute dopamine agonist if evidence of tumor enlargement
- Monitoring prolactin levels during pregnancy not indicated
Management of Prolactinomas During Pregnancy
(Macroadenomas with suprasellar extension)

• Consider pre-pregnancy transsphenoidal surgery to debulk if no shrinkage with dopamine agonist

• Stop dopamine agonist once pregnant and follow carefully
  – Visual fields each trimester or sooner if indicated
  – Re-institute dopamine agonist if tumor enlarges
  – Surgery, if no response to dopamine agonist

• Consider continuous dopamine agonist throughout pregnancy although not FDA approved
Women with Prolactinomas Who Become Pregnant: How Do Endocrinologists Around the World Actually Practice?

In what proportion of women with prolactinomas do you withdraw dopamine agonists once pregnancy has been confirmed?

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Endocrinologists</th>
<th>Microadenomas</th>
<th>Macroadenomas</th>
<th>Large Macroadenomas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada¹</td>
<td>34</td>
<td>94%</td>
<td>65%</td>
<td>18%</td>
</tr>
<tr>
<td>Brazil²</td>
<td>721</td>
<td>70%</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>Middle East &amp; North Africa³</td>
<td>468</td>
<td>65%</td>
<td>38%</td>
<td></td>
</tr>
</tbody>
</table>

²Vilar et al. Pituitary 2010;13:199
³Beshyah et al, Pituitary 2017;2092):231
Should this 42 year old physician with a prolactinoma that has gotten smaller on cabergolone and who is now 20 weeks pregnant stop her cabergolone?

- Stop it
  - It’s bad to take drugs during pregnancy – who know what might happen!
  - Negligible data demonstrating safety
- Don’t stop it
  - She is past the time of organogenesis so malformations very unlikely
  - Likely will prevent pregnancy-induced tumor growth
  - She feels better on cabergolone
Case 5: Silent Lactotroph Adenoma

- 35 year old man presented with erectile dysfunction and decreased libido
- Testosterone 153 ng/dL (280-1000) and PRL 58.2 ng/mL
  - PRL run at 1:100 dilution and still only minimally abnormal
- MRI showed large macroadenoma wrapped around left internal carotid artery
- Also found to have hemochromatosis (G845A [c282Y]) mutation (homozygous)

- Partial tumor resection via transsphenoidal surgery in 1999
- Tumor stained for PRL
Case 3: Silent Lactotroph Adenoma

What should be the next step in management of this patient with considerable residual tumor after surgery?

1. Repeat surgery
2. Conventional irradiation
3. Stereotactic irradiation (gamma knife, linear accelerator, proton beam)
4. Cabergoline
## Clinically Silent Pituitary Tumors

<table>
<thead>
<tr>
<th>Tumor Type (by staining)</th>
<th>Number (n=2012)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gonadotroph</td>
<td>865</td>
<td>43.0%</td>
</tr>
<tr>
<td>Null cell</td>
<td>678</td>
<td>33.7%</td>
</tr>
<tr>
<td>Corticotroph</td>
<td>111</td>
<td>5.5%</td>
</tr>
<tr>
<td>Lactotroph</td>
<td>34</td>
<td>1.6%</td>
</tr>
<tr>
<td>Somatotroph/Acidophil</td>
<td>21</td>
<td>1.0%</td>
</tr>
<tr>
<td>Thyrotroph</td>
<td>18</td>
<td>0.9%</td>
</tr>
<tr>
<td>Plurihormonal</td>
<td>36</td>
<td>1.8%</td>
</tr>
<tr>
<td>Unclassified</td>
<td>33</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Saeger et al., Eur J Endocrinol 2007;156:203
## Risk of Regrowth of Clinically Nonfunctioning Pituitary Adenomas According to Postoperative MRI Findings

<table>
<thead>
<tr>
<th>Series</th>
<th>Tumor Visible (n)</th>
<th>Regrowth (%)</th>
<th>Tumor Visible (n)</th>
<th>Regrowth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molitch (review)¹</td>
<td>615</td>
<td>14.0%</td>
<td>476</td>
<td>50.1%</td>
</tr>
<tr>
<td>Lelotte et al²</td>
<td>48</td>
<td>6.2%</td>
<td>72</td>
<td>47.2%</td>
</tr>
<tr>
<td>Levy et al³</td>
<td>28</td>
<td>10.7%</td>
<td>67</td>
<td>38.8%</td>
</tr>
<tr>
<td>Ratnasingam et al⁴</td>
<td>42</td>
<td>4.8%</td>
<td>66</td>
<td>36.4%</td>
</tr>
</tbody>
</table>

²Lelotte et al., Eur J Endocrinol 2018;178:237  
³Levy et al., Clin Endocrinol 2018;89:354  
⁴Ratnasingam et al., Clin Endocrinol 2017;87:717
Clinically Nonfunctioning Adenomas
Therapy of Patients with Residual Tumor Postoperatively

• Observation
• Second Surgery
• Medical Therapy
  – Dopamine agonists
    • Bromocriptine
    • Cabergoline
  – Octreotide
• Radiotherapy
  – Conventional
  – Stereotactically (gamma knife, LINAC)
Results of Second Transsphenoidal Surgery for Pituitary Adenomas

Laws et al., J Neurosurg 1986;63:823
Regrowth of Pituitary Adenomas Following Surgery with and without Postoperative Conventional Radiotherapy when Tumor Status Known Postoperatively

• No visible tumor postoperatively
  - RT in 14, Regrowth in 1 (7%)
  - No RT in 615, Regrowth in 86 (14.0%)

• Visible tumor postoperatively
  - RT in 339, Regrowth in 38 (11.2%)
  - No RT in 487, Regrowth in 244 (50.1%)

Cumulative Percentage of Patients with Normal Pituitary Hormone Axes Following Pituitary Tumor Conventional Radiotherapy

![Graph showing cumulative percentage of patients with normal function for TSH, ACTH, LH/FSH, and GH over 10 years following radiotherapy.](image)

Littley et al., Quart J Med 1989;70:145
Number of Patients with New or Worsened Hormone Insufficiencies Requiring Hormone Replacement after Gamma Knife Radiotherapy in 92 Patients

<table>
<thead>
<tr>
<th>Hormones</th>
<th>Number of pts with New/Worse Insufficiencies Needing Treatment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LH/FSH</td>
<td>20 (21.7%)</td>
</tr>
<tr>
<td>TSH</td>
<td>22 (23.9%)</td>
</tr>
<tr>
<td>ACTH</td>
<td>8 (8.7%)</td>
</tr>
<tr>
<td>GH</td>
<td>12 (13%)</td>
</tr>
<tr>
<td>1 or more</td>
<td>37 (40%)</td>
</tr>
</tbody>
</table>

Feigl et al., J Neurosurg (Suppl 5) 2002;97:415-421
Tumor Progression-Free Survival in Patients with Postop CNFA Remnants:

**PREVENTIVE GROUP** – Cabergoline initiated upon residual tumor detection on postop MRI; **REMEDIAL GROUP** – Cabergoline initiated upon tumor growth detection during follow-up; **CONTROL GROUP** – untreated.

Case 5: Silent Lactotroph Adenoma

- Dopamine receptors have been found on some nonfunctioning tumors and some respond to dopamine agonists but none were characterized for PRL immunohistochemistry.
- No data on long-term follow-up of silent lactotroph adenomas and their treatment by any modality.
Case 5: Silent Lactotroph Adenoma

It was decided to try cabergoline 2mg/week and he has been on this now x 16 years

Official Neuroradiology report: No change in residual tumor size