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Selläres Inzidentalom – Und was nun?

PD Dr. med. Sven Berkmann

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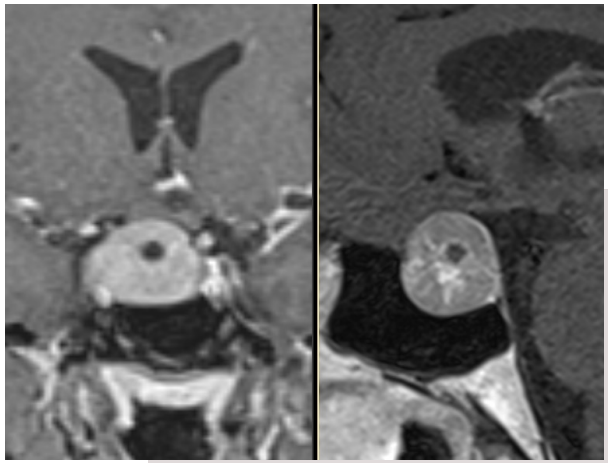

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The Prevalence of Pituitary Adenomas

A Systematic Review

Shereen Ezzat, M.D.[1]
Sylvia L. Asa, M.D., Ph.D.[2]
William T. Couldwell, M.D.[3]
Charles E. Barr, M.D., M.P.H.[4]
William E. Dodge, M.S., M.B.A.[4]
Mary Lee Vance, M.D.[5]
Ian E. McCutcheon, M.D.[6]

Overall estimated prevalence: 16.7%
On autopsy: 14.4%
On radiologic imaging: 22.5%

Cancer
Volume 101, Issue 3, pages 613–619, 1 August 2004

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Inzidentalom
???

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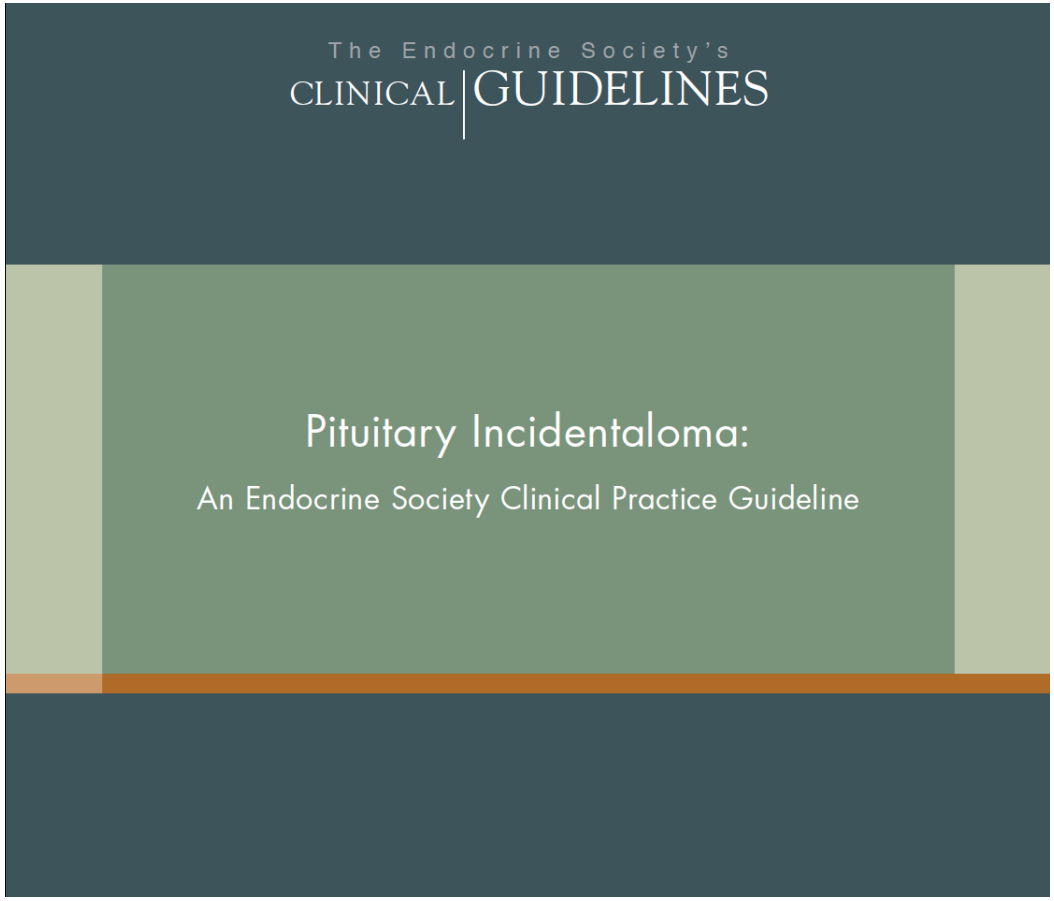

Journal of Clinical Endocrinology & Metabolism,
96(4):894–904, 2011

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Incidentaloma – Guideline Definition

"previously unsuspected pituitary lesion discovered on an imaging study performed for an unrelated reason. Appearance typical for a pituitary adenoma or a cystic lesion. <u>Imaging study is not done</u> for a symptom specifically related, as…

- visual loss,
- clinical manifestation of hypopituitarism,
- hormone excess"

"but for the evaluation of symptoms such as e.g.

- headache,
- head or neck neurological complaints,
- head trauma"

Journal of Clinical Endocrinology & Metabolism, 96(4):894–904, 2011

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Pituitary incidentalomas

George A. Scangas · Edward R. Laws Jr.

…although the majority of these tumors are clinically non-functioning macroadenomas, there is a wide spectrum of clinically silent or near silent variants, such as those that stain for Prolactin, GH or ACTH that may present as incidentalomas…

commentary - Edward Laws – HMS, Boston

Pituitary 2013 Sep 20.

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Presentation and surgical results of incidentally discovered nonfunctioning pituitary adenomas: evidence for a better outcome independently of other patients' characteristics

Marco Losa, Carmine A Donofrio, Raffaella Barzaghi and Pietro Mortini

Pituitary Unit of the Department of Neurosurgery, Istituto Scientifico San Raffaele, Università Vita-Salute, Via Olgettina 60, 20132 Milano, Italy

Cause	Asymptomatic incidentalomas ($n=117$)	Symptomatic incidentalomas ($n=95$)	All ($n=212$)
Headache	29 (24.8%)	13 (13.7%)	42 (19.8%)
Dizziness	17 (14.5%)	14 (14.7%)	31 (14.6%)
Stroke or transient ischemic attack	6 (5.1%)	13 (13.7%)	19 (9.0%)
Hearing impairment	9 (7.7%)	8 (8.4%)	17 (8.0%)
Head or cervical trauma	9 (7.7%)	8 (8.4%)	17 (8.0%)
Sinusitis	7 (6.0%)	5 (5.3%)	12 (5.7%)
Syncope	6 (5.1%)	5 (5.3%)	11 (5.2%)
Tumor staging	5 (4.3%)	5 (5.3%)	10 (4.7%)
Other causes	29 (24.8%)	24 (25.2%)	53 (25.0%)

Main reason to perform the neuroimaging study that led to the incidental discovery of a nonfunctioning pituitary adenoma in 212 patients

European Journal of Endocrinology (2013) **169** 735–742

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Clinical Guidelines

Operation empfohlen:

- Visus-/Gesichtsfeldabnahme
- Sonstige neurologische Kompressions-bedingte Symptome
- Hormonaktivität (ausser PRL)
- Hypophysentumorapoplex mit Kompressionssyndrom

relative OP-Indikationen:

- Kontakt zu Strukturen der Sehbahn
- deutliches Wachstum im follow-up
- Hypopituitarismus
- Schwangerschaftswunsch bei Tumor in der Nähe des OC
- NFA mit hohem Apoplexrisiko
- MarkoNFA bei Malcompliance
- Malignomverdacht

Journal of Clinical Endocrinology & Metabolism, 96(4):894–904, 2011

Review > Best Pract Res Clin Endocrinol Metab. 2019 Apr;33(2):101268.
doi: 10.1016/j.beem.2019.04.002. Epub 2019 Apr 13.

Management of pituitary incidentaloma

Cesar Luiz Boguszewski [1], Nina Rosa de Castro Musolino [2], Leandro Kasuki [3]

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Endocrine Society´s Clinical Guidelines - 2011

Journal of Clinical Endocrinology & Metabolism, 96(4):894–904, 2011

falls keine OP-Indikation: **follow-up**

MRI der Hypophyse

Makroadenome:

nach 6 Monaten; falls stabil, dann jährlich

Mikroadenome:

nach 12 Monaten

Endocrinologisches follow-up

Makroadenome:

nach 6 Monaten; falls unauffällig, dann jährlich

Mikroadenome:

falls initial unauffällig, kein Routine-follow-up

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Review > Best Pract Res Clin Endocrinol Metab. 2019 Apr;33(2):101268.
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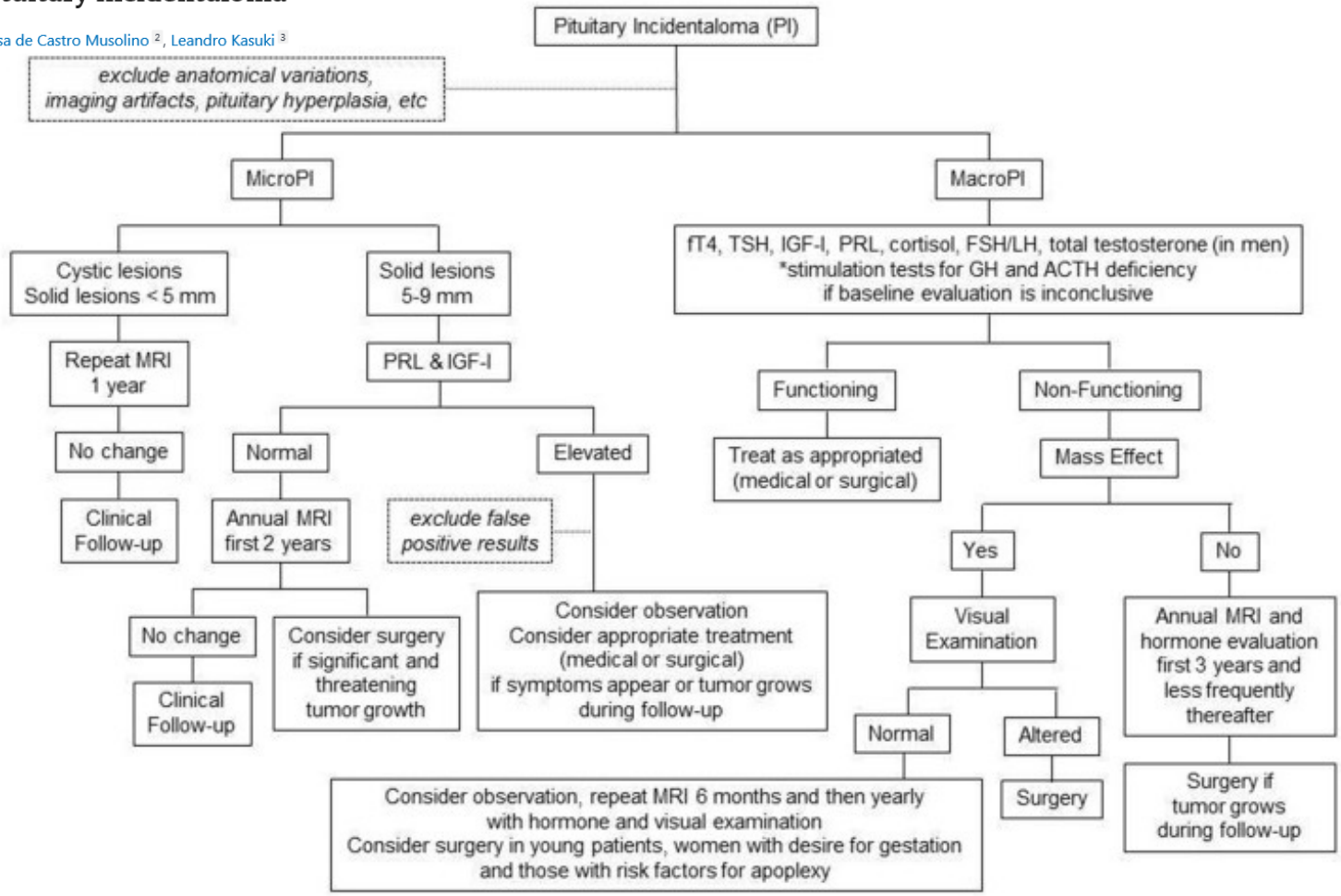

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Wächst ein Inzidentalom und kann es dann doch Symptome auslösen ???

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The 'Incidentaloma' of the Pituitary Gland

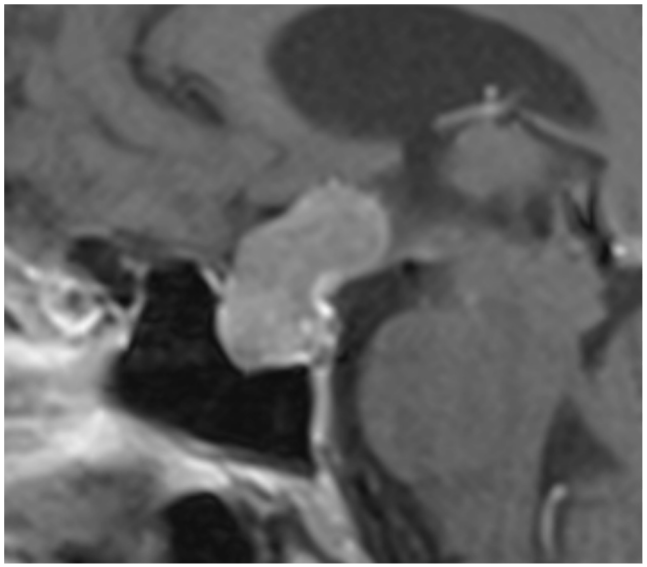
Is Neurosurgery Required?

Martin Reincke, MD; Bruno Allolio, MD; Wolfgang Saeger, MD; Jürgen Menzel, MD; Werner Winkelmann, MD

18 patients with accidental (CT/MR) discovered intrasellar tumour
average tumour diameter: **13** mm (5 - 25 mm)
bitemporal hemianopia: **2** patients
partial anterior lobe insuffiency: **5** patients
GH-oversecretion (without signs of acromegaly): **1** patient
neurosurgical procedure: **4** patients
1x chordoma; 3 x pituitary adenoma

<u>14 non-operated patients:</u>
no significant tumour growth during follow-up
(average: 22 months serial CT/MR-scans)

JAMA. May 23/30. **1990** – Vol 263. No.20



2010:

- 64-jährige Patientin
- MRI durch Psychiater indiziert
- OP abgelehnt
- Somatotrope Insuffizienz
- Visus/GF normal

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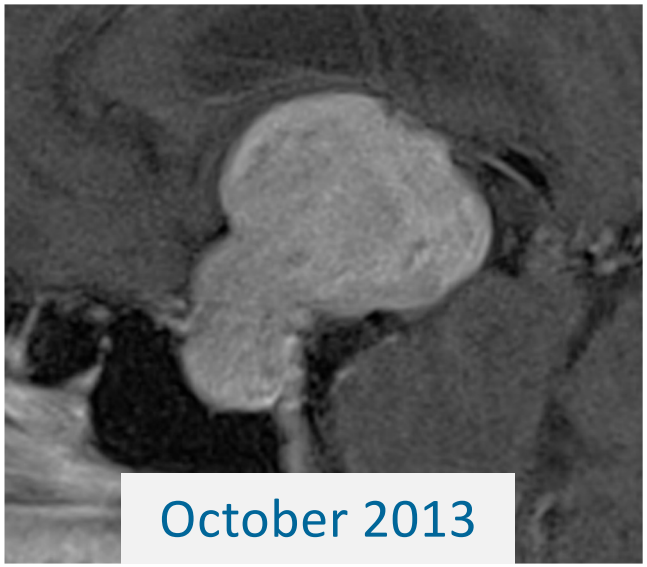

2013:

- Hydrocephalus occlusivus
- blind
- Panhypopituitarismus

=> nfm Kraniotomie

- *Ki-67: 2%, LH/FSH ++*

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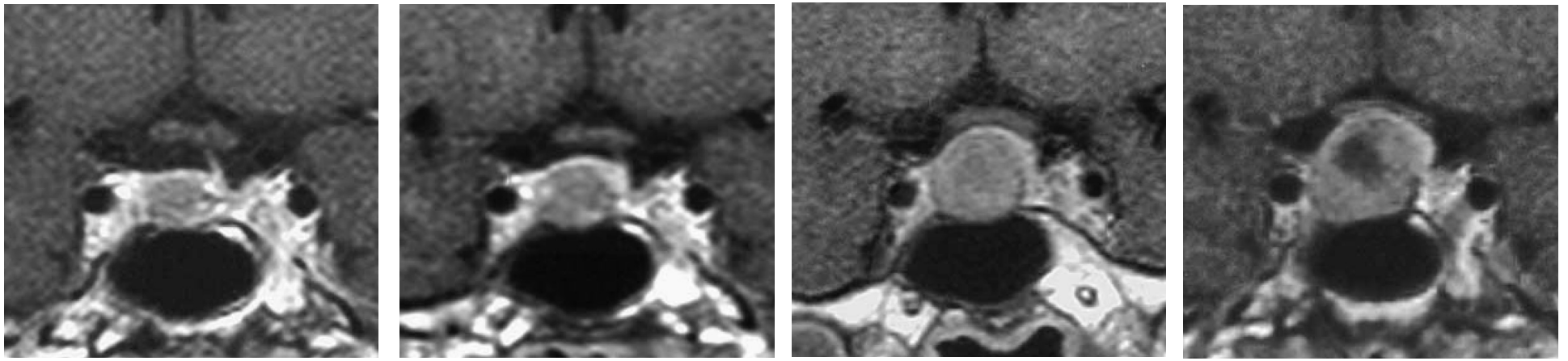
Growth modelling of non-functioning pituitary adenomas in patients referred for surgery

Juergen Honegger, Sanna Zimmermann, Tsambika Psaras, Manfred Petrick[1], Michel Mittelbronn[2], Ulrike Ernemann[3], Martin Reincke[4] and Klaus Dietz[5]



European Journal of Endocrinology (2008) **158** 287–294

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15 patients

4 female. 11 male

median follow-up period: **7.4 years**

range: 2.3 – 11.9

median age: **60 years**

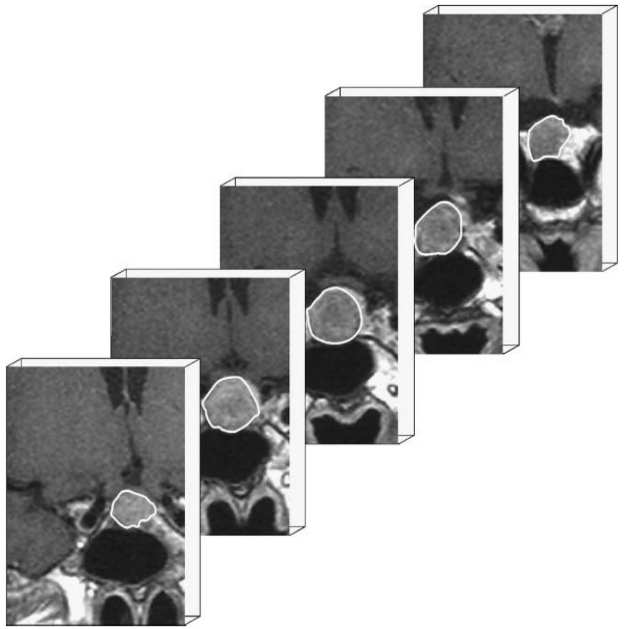
range: 32 – 77 years

median initial tumour volume: **1.6 cm3**

range: 0.7 – 5.3 cm3

median tumour volume at end of observation: **5.6 cm3**

range: 1.5 – 20.9 cm3



∑ in 93% a tumour growth occured

European Journal of Endocrinology (2008) **158** 287–294

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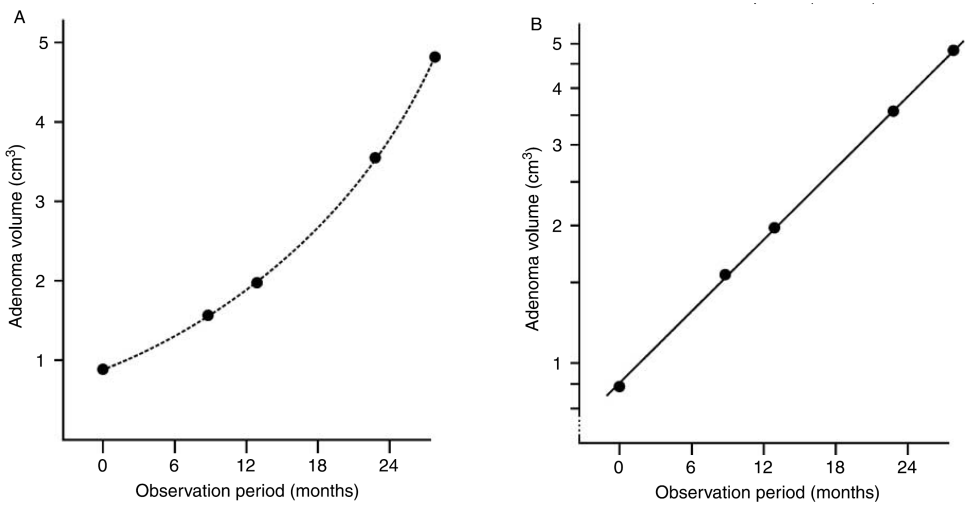
Longitudinal volumetric study of tumour regrowth in a 33-year-old patient following two prior operations. Regrowth is shown on both (A) a linear plot and (B) a semilogarithmic plot of tumour volume versus time. The adenoma shows a strictly **exponential growth** pattern.



Our volumetric study provides direct statistical evidence that non-functioning pituitary adenomas show an exponential growth pattern.

European Journal of Endocrinology (2008) **158** 287–294

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Treatment and Follow-Up of Clinically Nonfunctioning Pituitary Macroadenomas

Author	No. of macroadenomas	Mean follow-up (months)	No. with increase in tumor volume (%)	No. with decrease in tumor volume (%)
Feldkamp *et al*. (19)	19	32	5 (26)	1 (5)
Donovan and Corenblum (17)	16	73	4 (25)	0 (0)
Reincke *et al*. (47)	7	22	2 (29)	0 (0)
Sanno *et al*. (20)	115[a]	51	23 (20)	11 (10)
Arita *et al*. (45)	37	62	19 (51)	0 (0)
Dekkers *et al*. (46)	28	85	14 (50)	8 (29)
Karavitaki *et al*. (21)	24	43	12 (50)	4 (17)
Nishizawa *et al*. (49)	28	67	2 (7)	0 (0)
Igarashi *et al*. (48)	23	61	6 (26)	10 (43)
Fainstein Day *et al*. (18)	7	20	1 (14)	0 (0)

J Clin Endocrinol Metab, October 2008, 93(10):3717–3726

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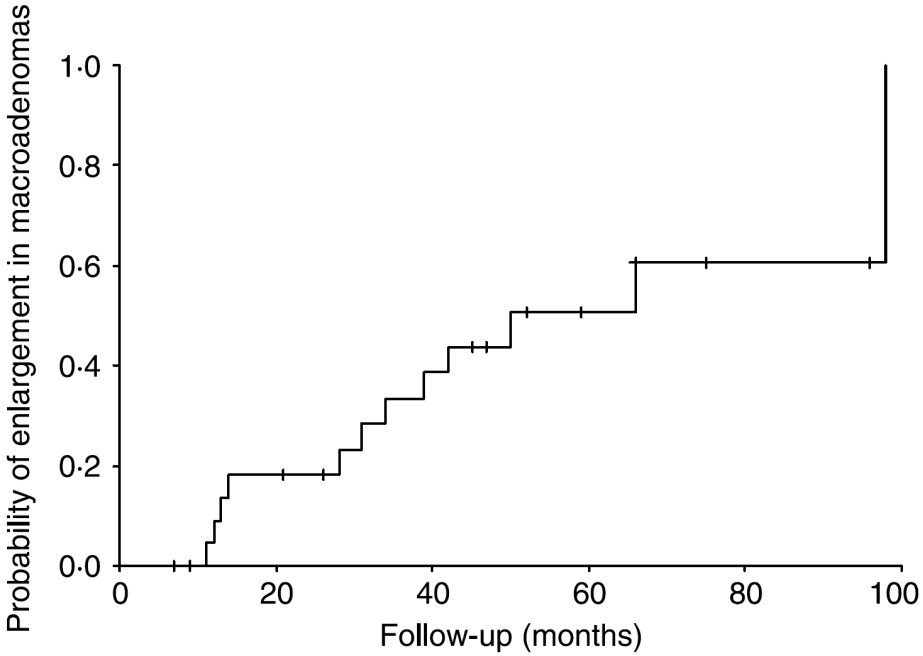
What is the natural history of nonoperated nonfunctioning pituitary adenomas?

N. Karavitaki*, K. Collison*, J. Halliday*, J. V. Byrne†, P. Price‡, S. Cudlip§ and J. A. H. Wass*



Probability of tumour enlargement in patients with macroadenoma during the follow-up period

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	Total tumours	Microadenomas	Macroadenomas
Mean follow-up, months (range)	42 (8–128)	41 (8–128)	43 (9–98)
Increase in size, *n* (%)	14/40 (35)	2/16 (12·5)	12/24 (50)
Mean time of detection, months (range)	34·3 (11–98)	21 (20–22)	36·5 (11–98)
Stable, *n* (%)	21/40 (52·5)	13/16 (81·3)	8/24 (33·3)
Decrease in size, *n* (%)	5/40 (12·5)	1/16 (6·3)	4/24 (16·7)
Mean time of detection, months (range)	24·6 (7–46)	19 (–)	26 (7–46)

Natural History of Nonfunctioning Pituitary Adenomas and Incidentalomas: A Systematic Review and Metaanalysis

	Incidence (100 PYs) and 95% CI
Increase in size (growth)	
Macroadenoma	12.53 (7.86–17.20)
Microadenoma	3.32 (2.13–4.50)
Solid	5.72 (2.28–9.16)
Cystic	0.05 (0.0–0.18)
Overall	5.75 (4.99–6.51)

J Clin Endocrinol Metab, April 2011, 96(4):905–912

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Natural History of Nonfunctioning Pituitary Adenomas and Incidentalomas: A Systematic Review and Metaanalysis

Risks caused by untreated NFA

risk of tumor growth per year (macroadenoma):

12.5 % per year

risk of new endocrine dysfunction per year (macroadenoma):

11.9 % per year

risk worsening of the visual field per year (*micro- & macroadenoma*):

0.65% per year

risk of pituitary apoplexy per year (*macroadenoma*):

1.1% per year

Clinical Endocrinology (2007) **67**, 938–943

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Natural History of Nonfunctioning Pituitary Adenomas and Incidentalomas: A Systematic Review and Metaanalysis

Median F/U
3.9 yrs
(range 1–15 yrs)

	Incidence (100 PYs) and 95% CI
Increase in size (growth)	
Macroadenoma	12.53 (7.86–17.20)
Microadenoma	3.32 (2.13–4.50)
Solid	5.72 (2.28–9.16)
Cystic	0.05 (0.0–0.18)
Overall	5.75 (4.99–6.51)
Apoplexy	
Macroadenoma	1.1 (0.0–2.5)
Microadenoma	0.4 (0.0–1.4)
Average growth <1 mm	0.5 (0.4–0.6)
Average growth 1–3.5 mm	0.2 (0.1–0.2)
Average growth >3.5 mm	14.3 (12.9–15.7)
Overall	0.2 (0.0–0.5)
New endocrine dysfunction	
Macroadenoma	11.9 (0.0–30.8)
Microadenoma	4.0 (0.0–31.5)
Overall	2.4 (0.0–6.4)
Worsening of visual field	
Average growth <1 mm	0.5 (0.4–0.6)
Average growth 1–3.5 mm	0.2 (0.1–0.2)
Average growth >3.5 mm	64.3 (60.1–68.5)
Overall	0.65 (0.47–0.82)

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Wenn ich mich operieren lasse, wie funktioniert das ???

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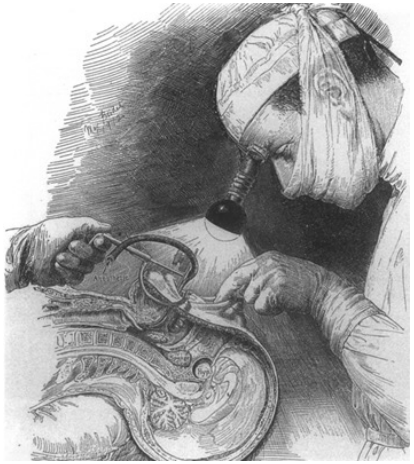
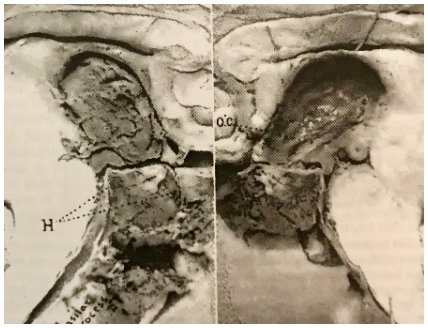
Die Herausforderungen der Hypophysenchirurgie

Lokalisation

Visualisation

Klinische Resultate





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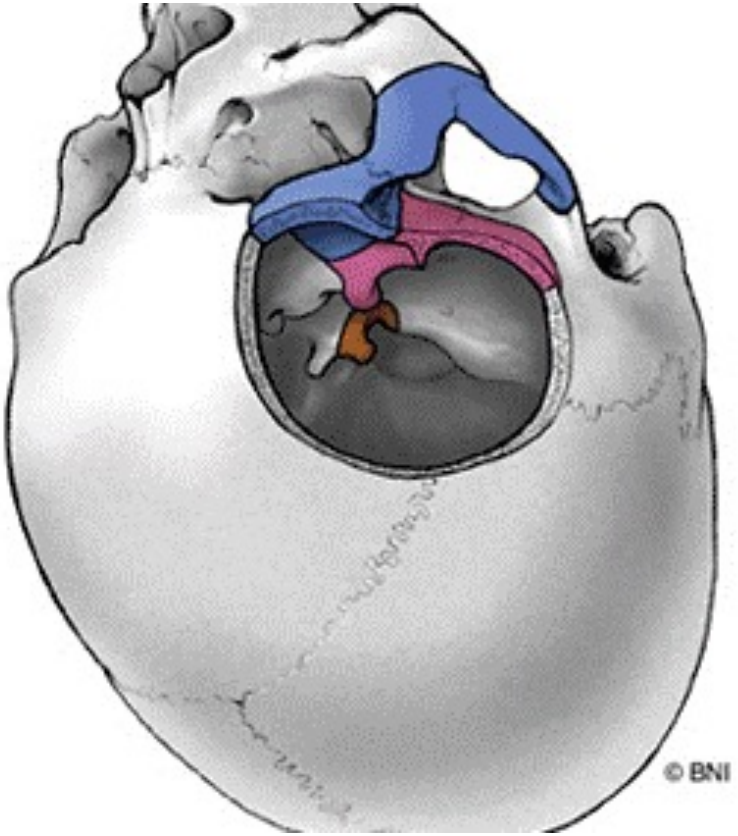
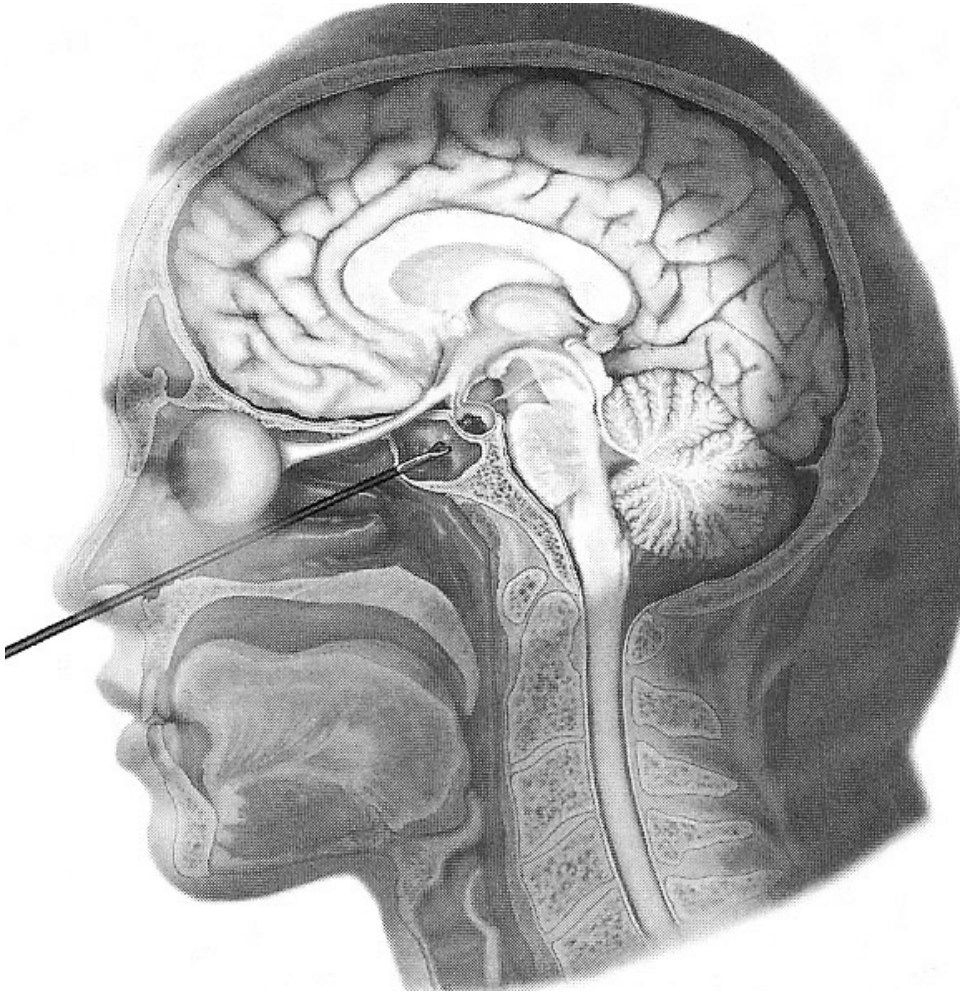
Lokalisation





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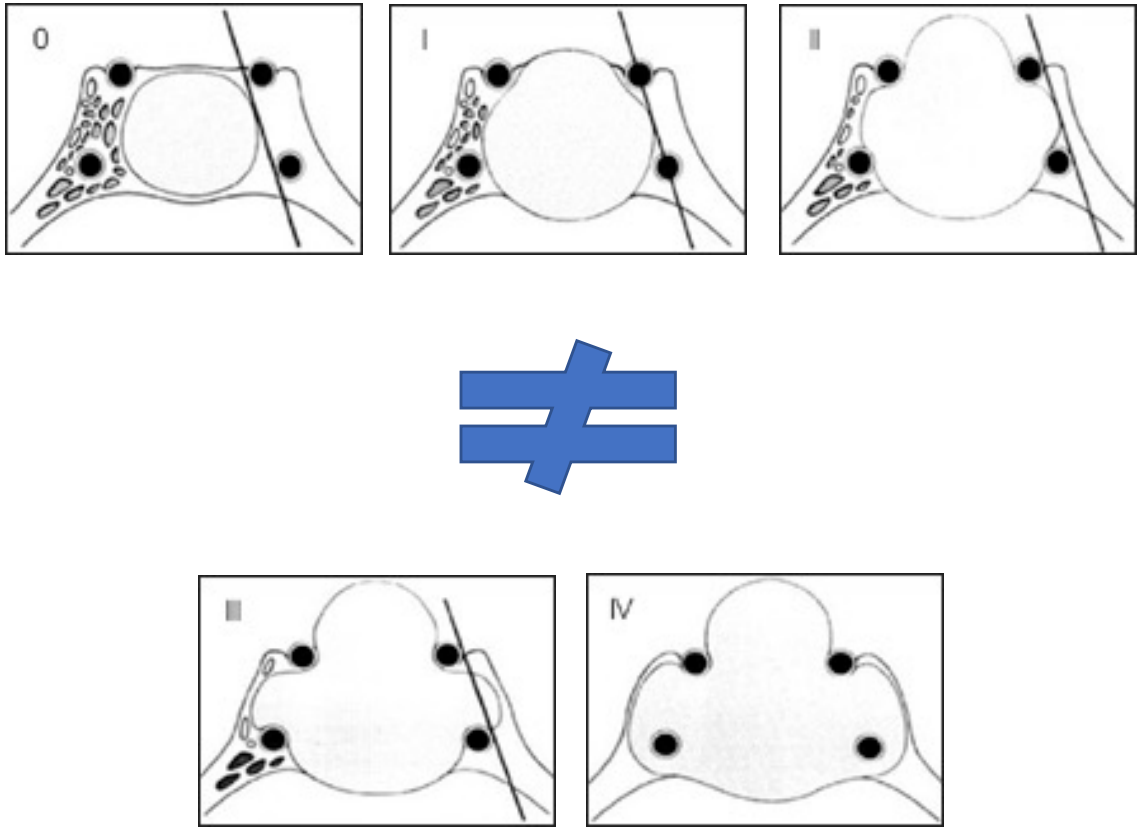
Neurosurgery. 1993 Oct;33(4):610-7; discussion 617-8.

Pituitary adenomas with invasion of the cavernous sinus space: a magnetic resonance imaging classification compared with surgical findings.

Knosp E[1], Steiner E, Kitz K, Matula C.



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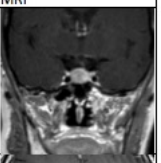
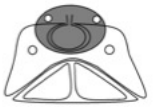
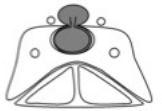
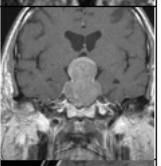
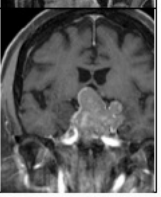
The Shape grading system: a classification for growth patterns of pituitary adenomas.

Berkmann S, Lattmann J, Schuetz P, Diepers M, Remonda L, Fandino J, Buchfelder M, Mueller B

Acta Neurochir (Wien), 163(11):3181-3189, 05 Jul 2021

The higher the Shape grade, the higher the likelihood for lower GTR rates, larger tumor remnants and need of further therapies.

Grading	Definition	Pattern	MRI
I spherical	- round appearance - max. diameters do not differ >25%		
IIA oval, non-invasive	- oval appearance - one max. diameter differs >25% from the others - no invasion into the CS (Knosp grades 0-2)		
IIB oval, invasive	- oval shape as IIA, but *with* invasion into the CS (Knosp grades 3-4)		
III dumbbell	- dumbbell-like shape - intra-/suprasellar growth mandatory - diameter at the level of the planum sphenoidale <75% of the max. diameters of the intra-/suprasellar parts		
IV mush-room	- mushroom-like shape - intra-/suprasellar growth mandatory - max. diameter of suprasellar part is >50% larger than that of the intrasellar part		
V octopus	- polylobulated, octopus-like shape - ≥2 tumor parts spread from a central part into the following regions: supra-/parasellar, clivus, sphenoidal sinus - the max. diameter of these parts is >50% of the diameter of the central part		

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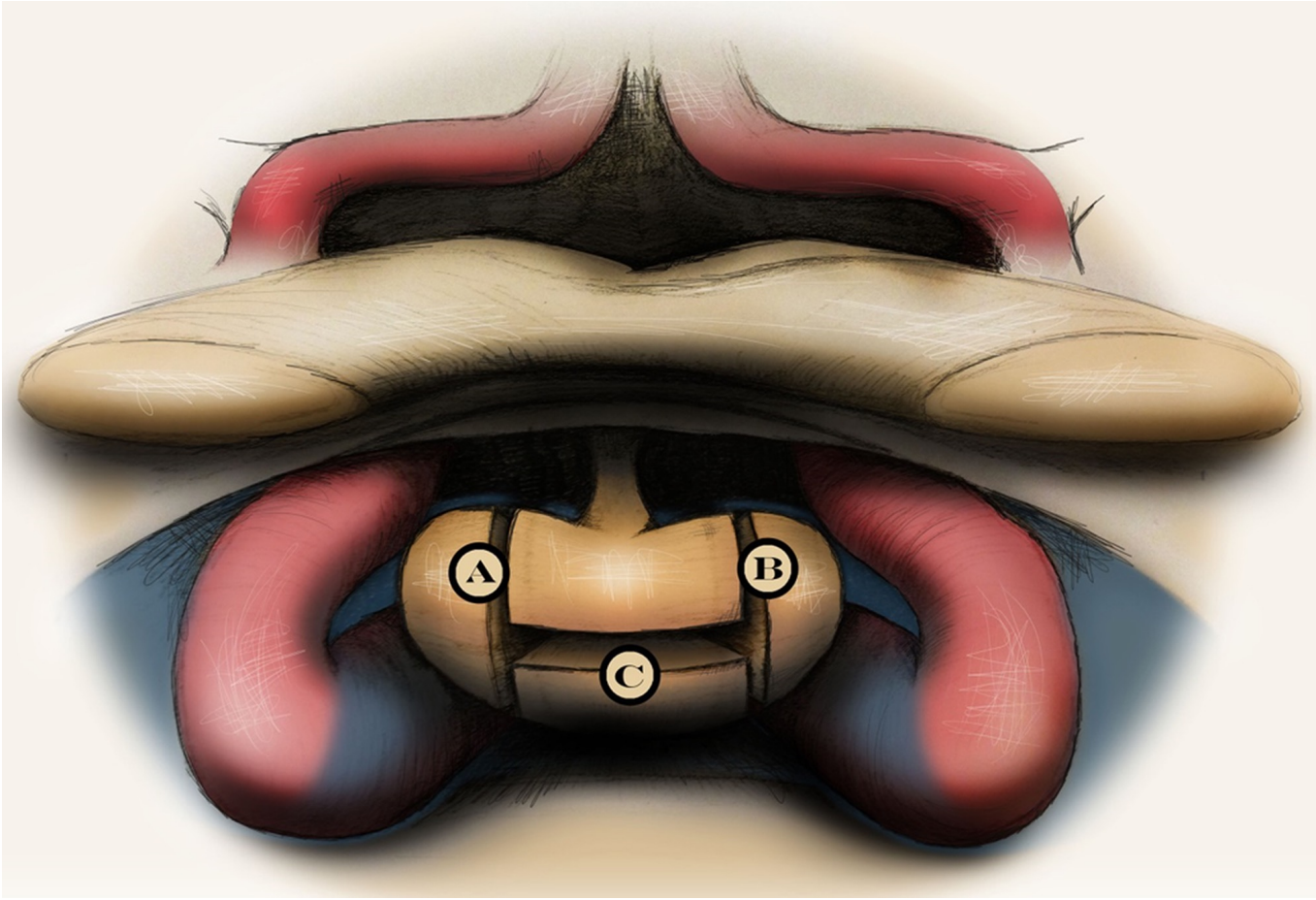
The ‘occult’ adenomas



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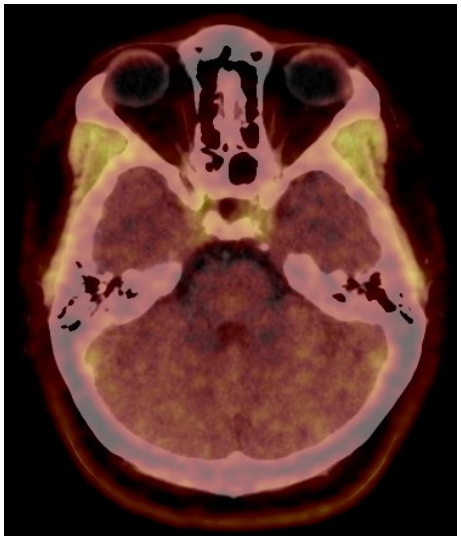
Selective resection of cushing microadenoma guided by preoperative hybrid 18-fluoroethyl-L-tyrosine and 11-C-methionine PET/MRI.

Berkmann S, Roethlisberger M, Mueller B, Christ-Crain M, Mariani L, Nitzsche E, Juengling F

Pituitary, 24(6):878-886, 21 Jun 2021

- N=15; visible on MRI in 67%; adenoma volume 0.02-0.78 cm^3 (mean 0.19).
- Intraoperative visualization of the tumors correlated with the point of maximum tracer accumulation on the FET-PET scans (neuronavigation) in all cases.



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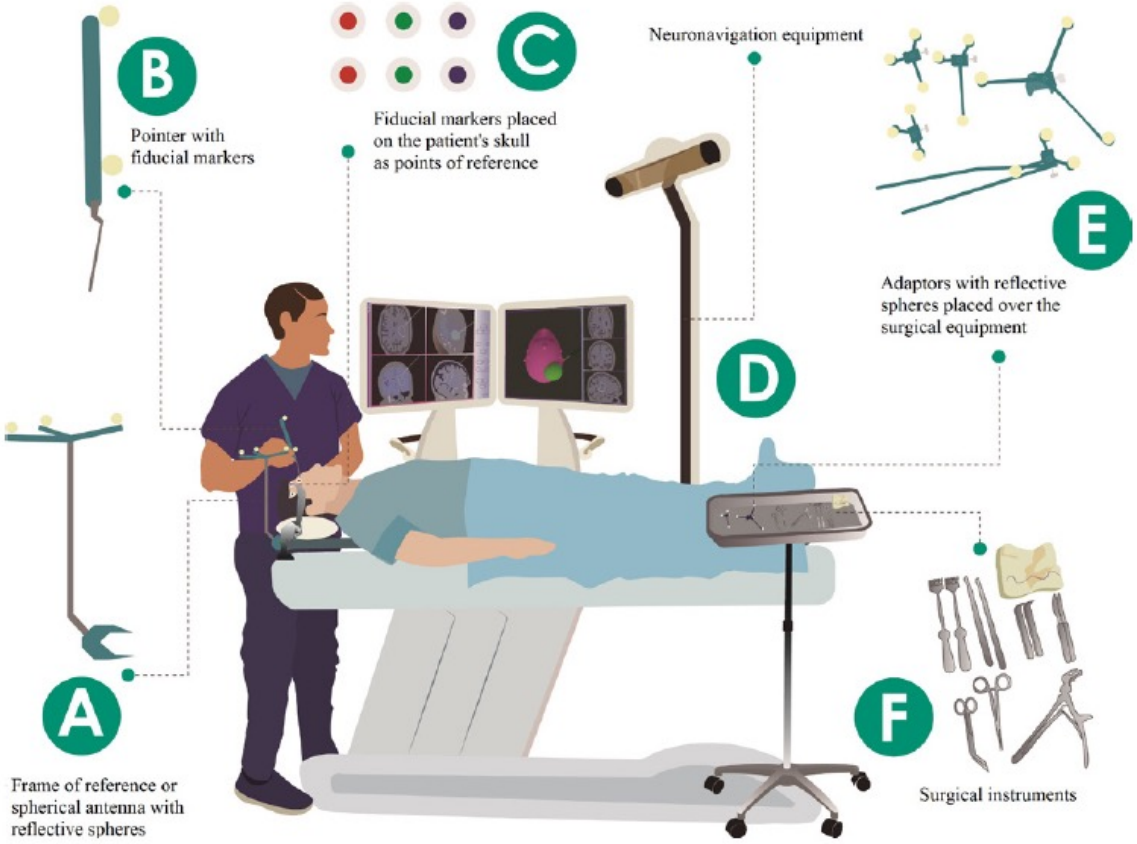
Neuronavigation



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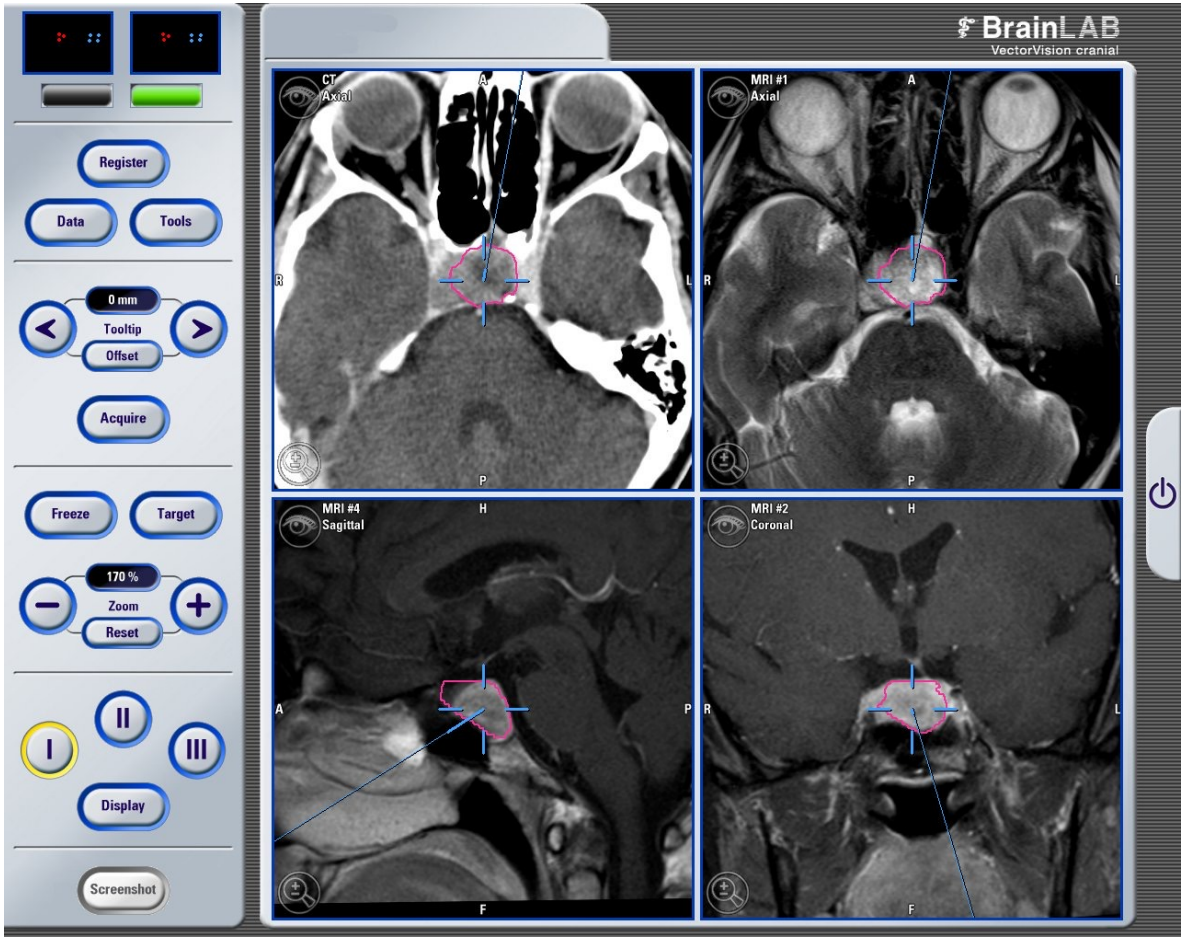

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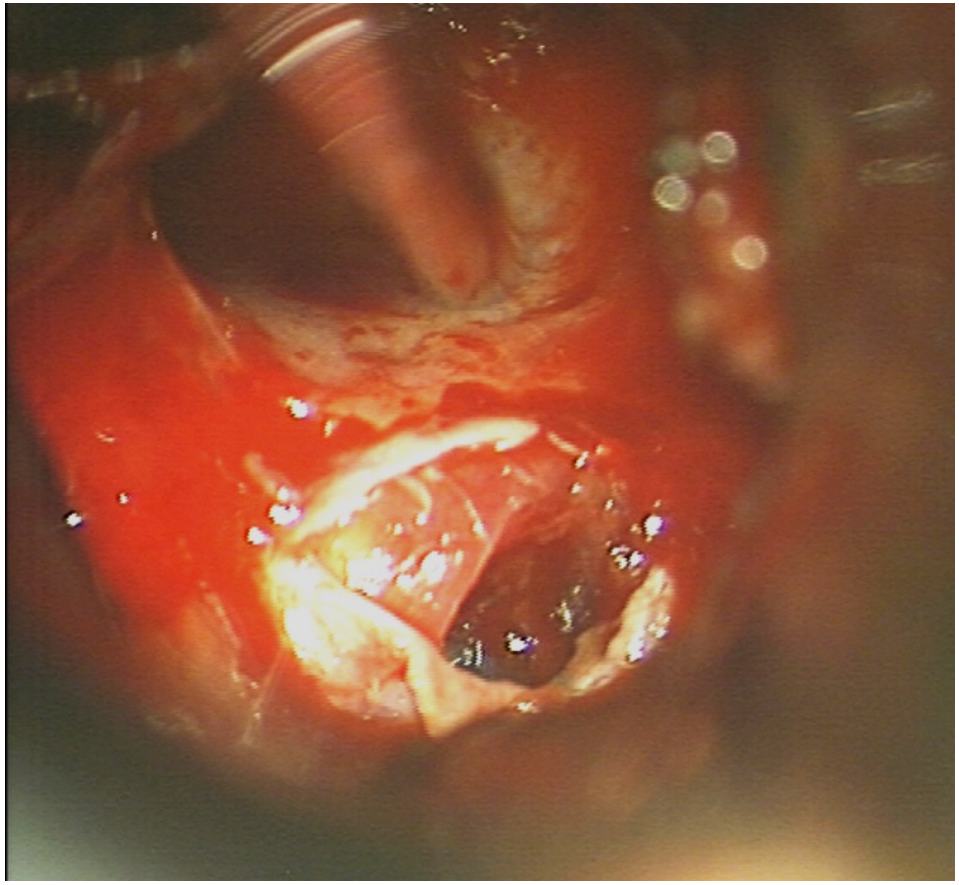
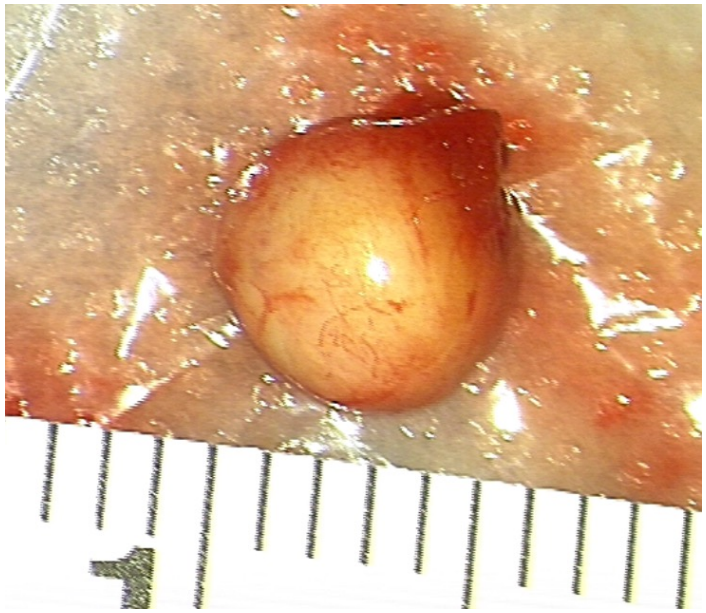
Visualization





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Und wenn ein Rest bleibt - kann das wieder wachsen ???

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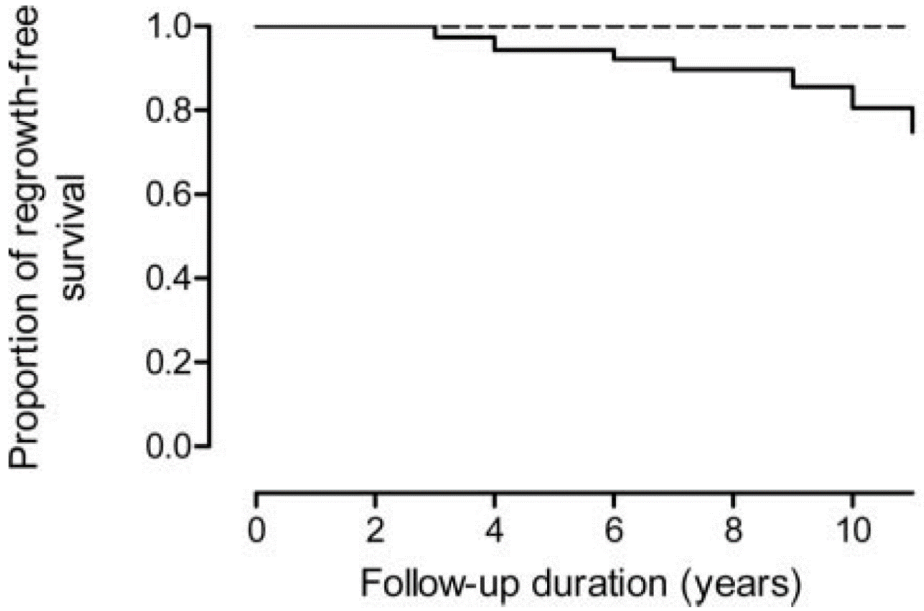
Treatment and Follow-Up of Clinically Nonfunctioning Pituitary Macroadenomas

J Clin Endocrinol Metab, October 2008, 93(10):3717–3726

--- Patients without residual tumor on MRI

—— Patients with residual tumor on MRI



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Acta Neurochir (2014) 156:2233–2243
DOI 10.1007/s00701-014-2210-x

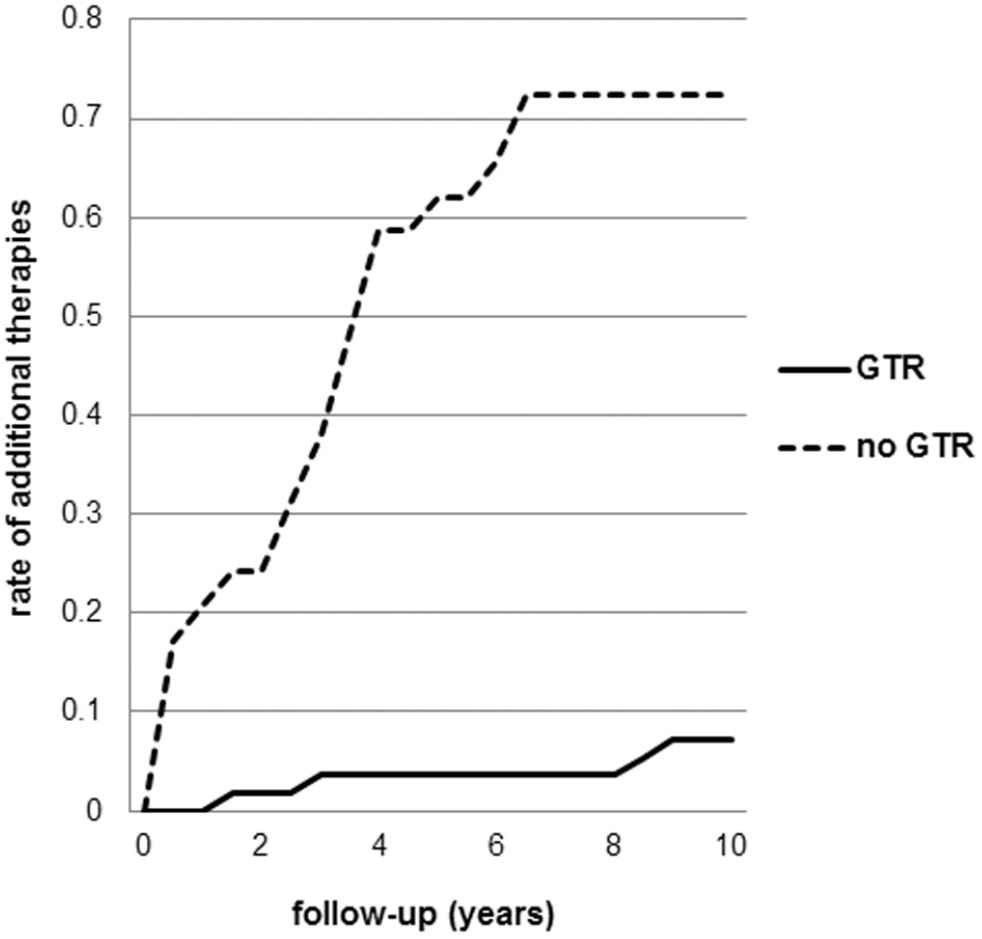
CLINICAL ARTICLE - BRAIN TUMORS

Follow-up and long-term outcome of nonfunctioning pituitary adenoma operated by transsphenoidal surgery with intraoperative high-field magnetic resonance imaging

Sven Berkmann · Sven Schlaffer · Christopher Nimsky · Rudolf Fahlbusch · Michael Buchfelder

N=85

Mean F/U: 5.6 ± 1.9 years



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Lowfield iMRI

Author	Ref.	Year	Diagnosis	n	iMRI setup	Field strength (T)	Remnant on 1st iMRI (n)	Additional resection (n)	GTR (n)	Increase of GTR rate by iMRI
Theodosopoulos *et al.*	115	2010	misc adenoma	27	Hitachi AIRIS II vertical-field	0.3	9 (33%)	4 (44%)	19 (70%)	p=0.0141 7%; p=NS 35%;
Vitaz *et al.*	118	2011	misc	100	General Electric Signa SP	0.5	41 (41%)	41 (41%)	76 (76%)	0.0077 20%;
Ramm-Pettersen	91	2011	misc adenoma	20	General Electric Signa SP	0.5	12 (60%)	11 (92%)	12 (60%)	p=NS 25%;
Berkmann *et al.*	19	2011	misc adenoma	32	Polestar N-20	0.15	15 (47%)	9 (60%)	25 (78%)	p=0.0321 23%;
Berkmann *et al.*	18	2012	NFA	60	Polestar N-20	0.15	23 (38%)	20 (87%)	51 (85%)	p=0.0034 21%;
Berkmann *et al.*	17	2012	misc	115	Polestar N-20	0.15	45 (39%)	36 (80%)	94 (82%)	p=0.0004 10%;
Bellut *et al.*	13	2012	misc adenoma	148	Polestar N-20	0.15	56 (38%)	44 (79%)	106 (72%)	p=NS 33%;
Tabakow *et al.*	113	2012	misc adenoma	18	Polestar N-20	0.15	9 (50%)	6 (67%)	15 (83%)	p=0.0375 15%;
Kim *et al.*	57	2013	misc adenoma	198	Polestar N-20	0.15	44 (22%)	37 (84%)	184 (93%)	p<0.0001 21%;
Hlavica *et al.*	51	2013	NFA	104	Polestar N-20	0.15	48 (46%)	44 (92%)	70 (67%)	p=0.0324

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Highfield iMRI

Author	Ref.	Year	Diagnosis	n	iMRI setup	Field strength (T)	Remnant on 1st iMRI (n)	Additional resection (n)	GTR (n)	Increase of GTR rate by iMRI
Pamir *et al.*	87	2011	NFA	42	Trio	3	22 (52%)	10 (45%)	24 (57%)	9%; p=NS
Meng *et al.*	77	2011	misc adenoma	30	Calgary Crane System, IMRIS	1.5	12 (40%)	10 (83%)	26 (87%)	27%; p=0.0195
Lang *et al.*	62	2011	misc	9	Siemens Magnetom Verio IMRIS	3	1 (11%)	1 (100%)	9 (100%)	11%; p=NS
Netuka *et al.*	81	2011	misc	86	Signa HDx General Electric	3	51 (59%)	31 (61%)	45 (52%)	11%; p=NS
Szerlip *et al.*	112	2011	misc adenoma	53	Siemens Magnetom Espree	1.5	34 (64%)	28 (82%)	33 (62%)	26%; p=0.0056
Tanei *et al.*	114	2013	misc adenoma	14	Siemens Magnetom Symphony	1.5	7 (50%)	5 (71%)	11 (79%)	29%; p=NS
Fomekong *et al.*	45	2014	misc adenoma	73	Philips Achieve	3	30 (41%)	8 (27%)	53 (73%)	14%; p=0.05
Berkmann *et al.*	21	2014	NFA	85	Siemens Magnetom Sonata Maestro	1.5	48 (56%)	40 (83%)	56 (66%)	22%; p=0.0027
Berkmann *et al.*	22	2014	NFA recurr	111	Siemens Magnetom Sonata Maestro	1.5	92 (83%)	62 (67%)	54 (49%)	32%; p<0.0001
Sylvester *et al.*	111	2014	misc adenoma	156	Siemens Magnetom Espree	1.5	112 (72%)	56 (50%)	59 (38%)	10%; p=0.0458
Paterno *et al.*	89	2014	misc adenoma	72	Siemens Magnetom Espree	1.5	42 (58%)	26 (56%)	53 (74%)	32%; p<0.0001
Coburger *et al.*	31	2014	misc adenoma	76	Siemens Magnetom Espree	1.5	NA	NA	40 (53%)	NA

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The use of iMRI leads to higher GTR rates

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When to use the iMRI?

Preop:

- large tumors
- invasive tumors
- awkward-shaped tumors (Shape 3-5)
- reoperations

Intraop:

- lack of intraop visualization of remnants
- remnants visible but not safely removable

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J Neurosurg. 2014 Nov;121(5):1166-75. doi: 10.3171/2014.6.JNS131994. Epub 2014 Aug 15.

Intraoperative high-field MRI for transsphenoidal reoperations of nonfunctioni adenoma.

Berkmann S[1], Schlaffer S, Nimsky C, Fahlbusch R, Buchfelder M.

Variable	Value (% or range)
GTR, all tumors	111
on 1st control iMRI	19 (17%)
additional resection possible	62 (67%)
on poMRI	54 (49%)
GTR rate % change caused by iMRI	32% ($p < 0.0001$)
iMRI results	
mean remnant vol on 1st control iMRI (cm^3)	1.6 ± 2.7 (0.1–12.9)
vol reduction on 1st control iMRI (%)	88% (22–100%)
mean remnant vol on last iMRI control (cm^3)	0.8 ± 1.7 (0.2–9.0)
mean vol reduced by iMRI-guidance (cm^3)	1.3 ± 2.0 (0.1–9.7; $p < 0.0001$)
% change of tumor remnant vol by iMRI (%)	50% (0–100)
poMRI results	
mean residual tumor volume (cm^3)	0.6 ± 1.3 (0–9.0)
mean difference of remnants vs iMRI (cm^3)	0.3 ± 0.3 (0.1–1.3)
GTR, noninvasive tumors	
on 1st iMRI control	16 (31%)
additional resection possible	25 (69%)
on poMRI	39 (75%)
GTR rate % change caused by iMRI	44% ($p < 0.0001$)
GTR, invasive tumors	
on 1st iMRI control	4 (7%)
additional resection possible	35 (64%)
on poMRI	15 (25%)
GTR rate % change caused by iMRI	18% ($p = 0.005$)

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iMRI? Microscope? Endoscope?

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Follow-up and long-term outcome of nonfunctioning pituitary adenoma operated by transsphenoidal surgery with intraoperative high-field magnetic resonance imaging

Sven Berkmann, Sven Schlaffer, Christopher Nimsky, Rudolf Fahlbusch, Michael Buchfelder

Acta Neurochirurgica
December 2014, Volume 156, Issue 12, pp 2233-2243

	microscopic (n=51)	endosc. assisted (n=34)	p
results iMRI			
1° iMRI GTR	25 (49%)	12 (35%)	0.15
remnant volume (cm^3)	1.0 ± 1.1	2.1 ± 4.0	0.30
additional resection possible	23 (88%)	16 (73%)	0.52

sensitivy GTR endoscope vs. high-field iMRI: 21% (95%CI 6-46%)
specificity GTR endoscope vs. high-field MRI: 78% (95% CI 40-97%)

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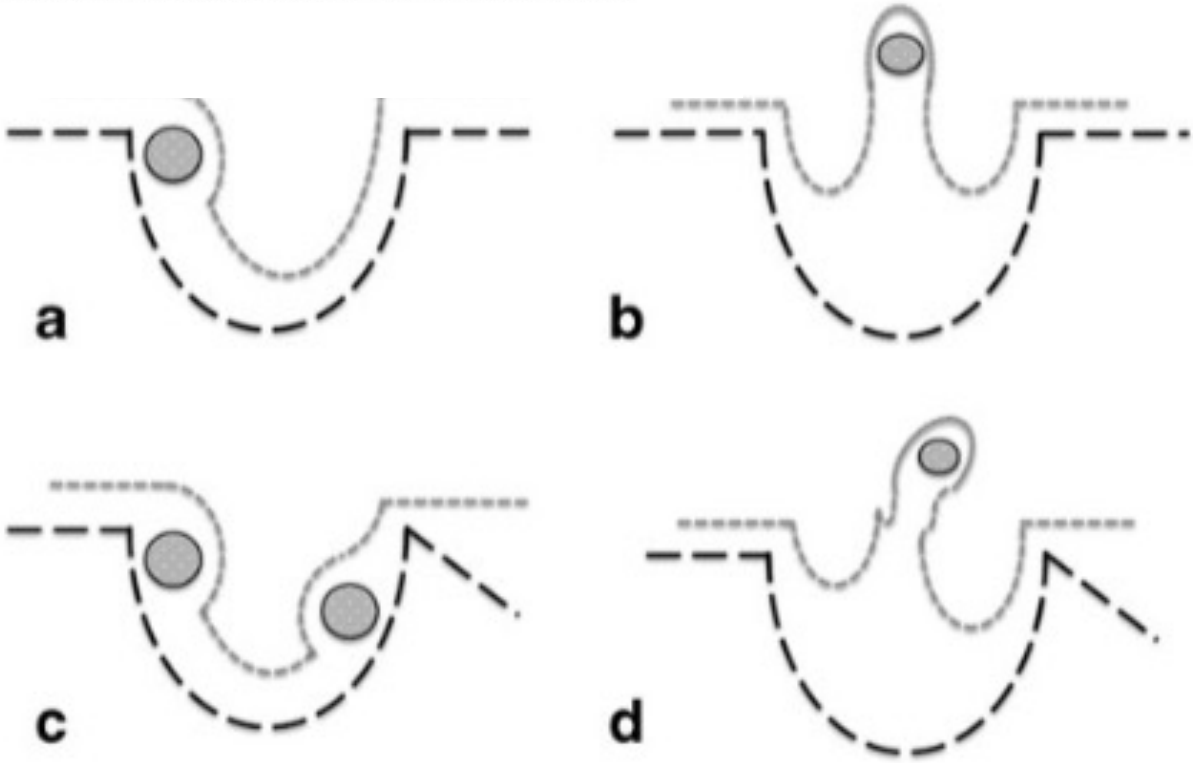
Acta Neurochir (2014) 156:463–474
DOI 10.1007/s00701-013-1978-4

REVIEW ARTICLE - BRAIN TUMORS

High-Field iMRI in transsphenoidal pituitary adenoma surgery with special respect to typical localization of residual tumor

Vincenzo Paterno′ · Rudolf Fahlbusch



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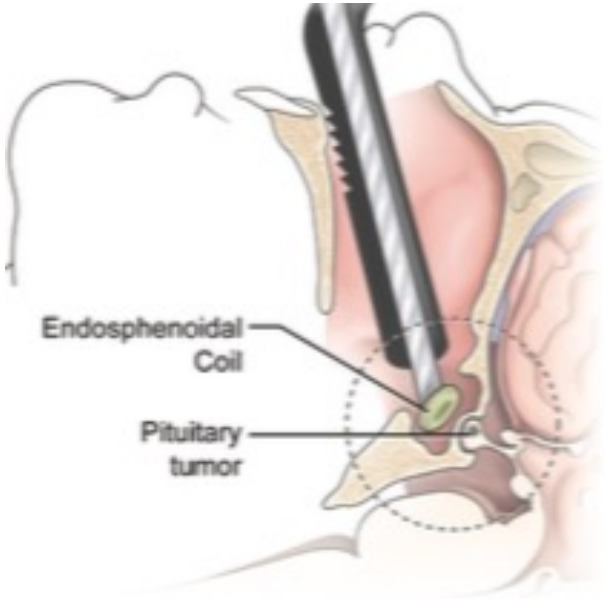
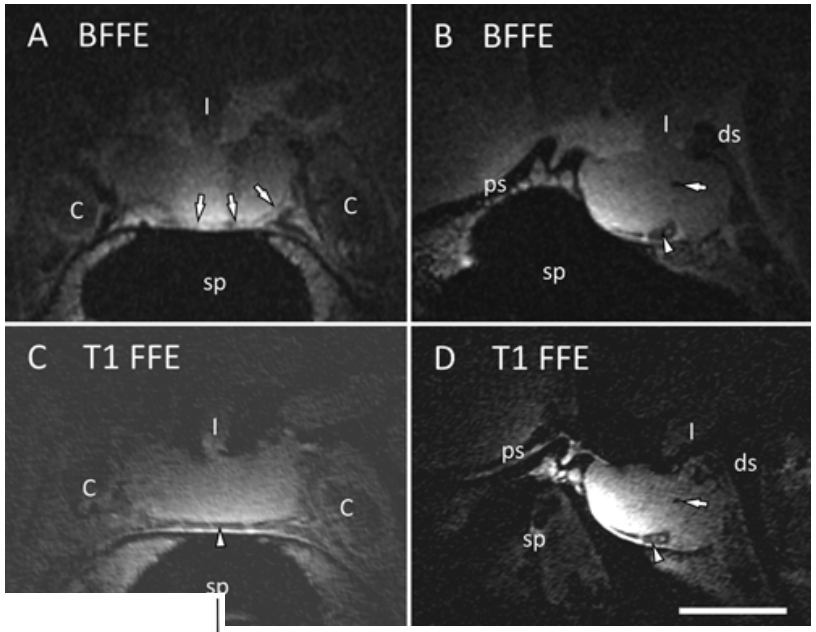
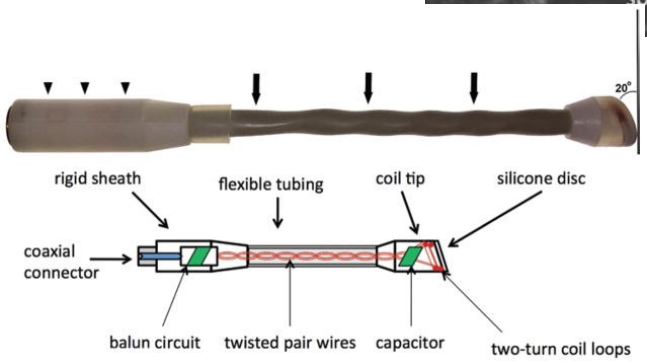
J Neurosurg. 2016 Dec; 125(6): 1451–1459.
PMID: 26991390
Published online 2016 Mar 18. doi: 10.3171/2015.11.JNS151465

Endosphenoidal coil for intraoperative magnetic resonance imaging of the pituitary gland during transsphenoidal surgery

Prashant Chittiboina, MD, MPH,[1] S. Lalith Talagala, PhD,[2] Hellmut Merkle, PhD,[3] Joelle E. Sarlls, PhD,[2] Blake K. Montgomery, BA,[1] Martin G. Piazza, MS,[1] Gretchen Scott, BSN, RN,[1] Abhik Ray-Chaudhury, MD,[1] Russell R. Lonser, MD,[1,5] Edward H. Oldfield, MD,[1,6] Alan P. Koretsky, PhD,[3] and John A. Butman, MD, PhD[4]







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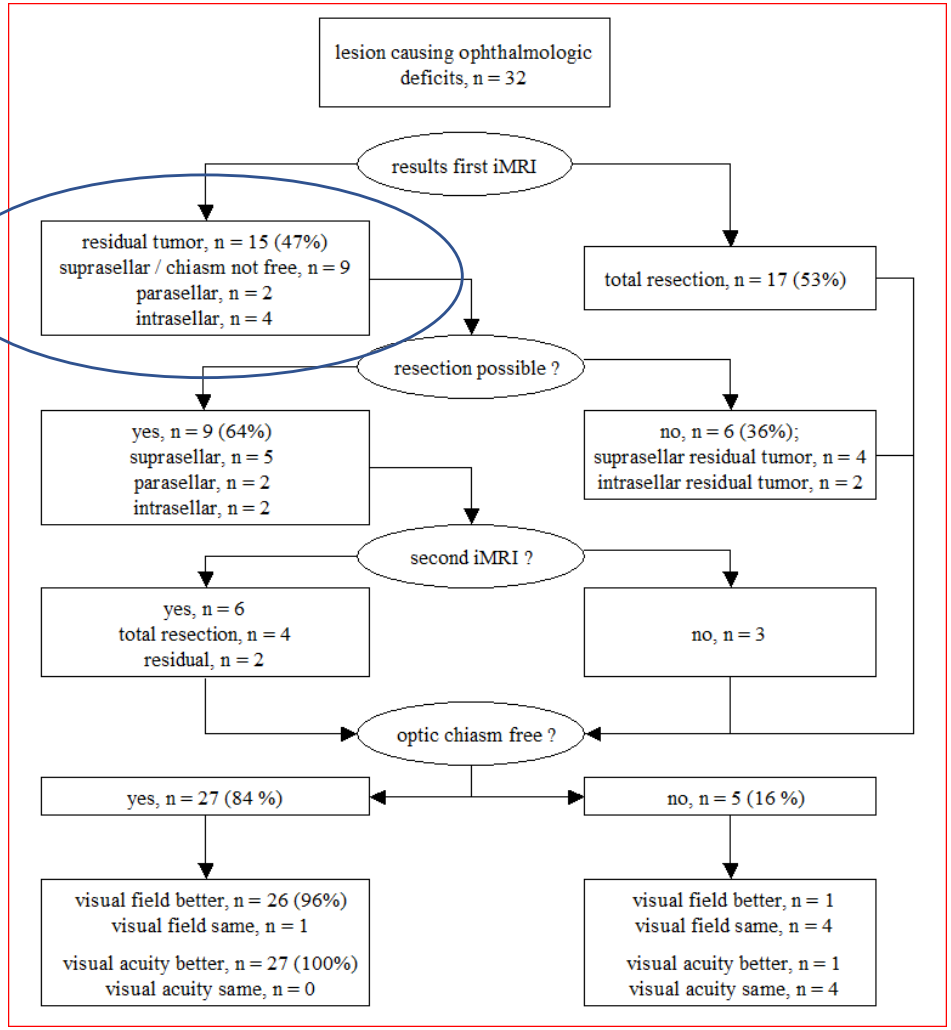
Intraoperative magnetic resonance imaging and early prognosis for vision after transsphenoidal surgery for sellar lesions

Clinical article

SVEN BERKMANN, M.D.,[1] JAVIER FANDINO, M.D.,[1] SASCHA ZOSSO, M.D.,[1] HANSPETER E. KILLER, M.D.,[2] LUCA REMONDA, M.D.,[3] AND HANS LANDOLT, M.D.[1]

Departments of [1]Neurosurgery and [2]Ophthalmology, and [3]Division of Neuroradiology, Department of Radiology, Kantonsspital Aarau, Switzerland



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10 YEARS' EXPERIENCE OF USING LOW-FIELD INTRAOPERATIVE MRI IN TRANSSPHENOIDAL SURGERY FOR PITUITARY ADENOMA: RESULTS OF THE SWISS PITUITARY REGISTRY (SWISSPIT)

Fabio Strange, MD[1]; Luca Remonda, MD[2]; Philipp Schütz, MD, MSc[3]; Javier Fandino, MD[1]; Sven Berkmann, MD[1]

[1] Department of Neurosurgery, Kantonsspital Aarau, Aarau, Switzerland
[2] Division of Neuroradiology, Department of Radiology, Kantonsspital Aarau, Aarau, Switzerland
[3] Division of Endocrinology, University Department of Medicine, Kantonsspital Aarau, Aarau, Switzerland

World Neurosurg. 2020 Apr;136:e284-e293.

N=231
Mean F/U: 62 months (9-178)

Table 4: OPHTHALMOLOGICAL STATE

	All	NFA	acromegaly	prolactinoma	Cushing's disease
preoperative ophthalmological deficiency					
visual field deficiency, n (%)	109 (47%)	91 (57%)	7 (25%)	9 (33%)	1 (10%)
visual acuity deficiency, n (%)	90 (39%)	79 (49%)	2 (7%)	7 (26%)	1 (10%)
oculomotor nerve palsy, n (%)	10 (4%)	9 (6%)	1 (4%)	1 (4%)	0 (0%)
trochlear nerve palsy, n (%)	2 (1%)	2 (1%)	0 (0%)	0 (0%)	0 (0%)
abducent nerve palsy, n (%)	6 (3%)	6 (4%)	0 (0%)	0 (0%)	0 (0%)
postoperative ophthalmological recovery					
recovery of visual field deficiencies, n (%)	94 (86%)	82 (90%)	4 (57%)	5 (56%)	1 (100%)
recovery of impaired visual acuity, n (%)	73 (81%)	66 (84%)	1 (50%)	4 (57%)	1 (100%)
recovery of oculomotor nerve function, n (%)	10 (100%)	9 (100%)	0 (0%)	1 (100%)	N/A
recovery of trochlear nerve function, n (%)	2 (100%)	2 (100%)	N/A	N/A	N/A
recovery of abducent nerve function, n (%)	5 (83%)	5 (83%)	N/A	N/A	N/A

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Results of Transsphenoidal Surgery in a Large Series of Patients with Pituitary Adenoma

Mortini P, Losa M, Barzaghi R, Boari N, Giovanelli M.

TABLE 3. Outcome of visual disturbances after removal of pituitary adenoma[a]

Series (ref. no.)	Patients with deficits/ patients operated	Normalized	Improved	Unchanged	Worsened
Salmi et al., 1982 (60)	40/56 (71%)	NR	28/40 (70%)	7/40 (17%)	5/40 (12%)
Ebersold et al., 1986 (15)	72/100 (72%)	NR	53/72 (74%)	15/72 (21%)	3/72 (4%)
Bevan et al., 1987 (4)	33/58 (57%)	9/33 (27%)	20/33 (61%)	4/33 (12%)	0/33 (0%)
Shone et al., 1991 (67)	24/35 (69%)	8/24 (33%)	11/24 (46%)	4/24 (17%)	1/24 (4%)
Marazuela et al., 1994 (43)	21/35 (60%)	5/21 (23%)	7/21 (33%)	9/21 (43%)	0/21 (0%)
Current series	289/1140 (25.4%)	117/289 (40.5%)	140/289 (51.2%)	21/289 (7.3%)	3/289 (1%)[b]

Neurosurgery 56 1222-1233; 2005

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Kann man mit der OP einen Hormonmangel behandeln ???

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Impact of primary surgery on pituitary function in patients with non-functioning pituitary adenomas – a study on 721 patients

P. Nomikos[1], **C. Ladar**[1], **R. Fahlbusch**[2], and **M. Buchfelder**[1]

	Postoperative endocrine deficits			
	Normalized	Improved	Unchanged	Worse
Transsphenoidal surgery N = 660	110 (19.6%)	169 (30.1%)	274 (48.9%)	8 (1.4%)
Transcranial surgery N = 61	0	6 (11.3%)	49 (73.7%)	8 (15%)

Acta Neurochir (Wien) (2004) 146: 27–35

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CLINICAL ARTICLE

Intraoperative MRI and endocrinological outcome of transsphenoidal surgery for non-functioning pituitary adenoma

Sven Berkmann · Javier Fandino · Beat Müller · Luca Remonda · Hans Landolt

Acta Neurochir (2012) 154:639–647

Table 3 Outcome of anterior pituitary function

	iMRI group, percentage of patients with new deficit (%)	Control group, percentage of patient with new deficit (%)	iMRI group, percentage of patients with functional recovery (%)	Control group, percentage of patients with functional recovery (%)
Corticotroph axis	15%	13%	26%	44%
Thyreotrope axis	18%	13%	40%	50%
Gonadotrope axis	17%	46%	44%	32%
Somatotroph axis	13%	20%	40%	14%

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Impact of primary surgery on pituitary function in patients with non-functioning pituitary adenomas – a study on 721 patients

P. Nomikos[1], **C. Ladar**[1], **R. Fahlbusch**[2], and **M. Buchfelder**[1]

Tumour size	Number of patients (n)	Preoperative hypopituitarism	Partial or complete recovery of pituitary function following surgery
>10 mm	22	16 (72.7%)	14 (87.5%)
10–20 mm	221	157 (71%)	114 (72.6%)
20–30 mm	334	298 (89.2%)	164 (55%)
30–40 mm	106	103 (97.1%)	25 (24.2%)
>40 mm	38	38 (100%)	4 (10.5%)

Preoperative hypopituitarism and recovery of pituitary function depend on tumor size

Acta Neurochir (Wien) (2004) 146: 27–35

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Pituitary Hormonal Loss and Recovery after Transsphenoidal Adenoma Removal

Fatemi N, Dusick JR, Mattozo C, McArthur DL, Cohan P, Boscardin J, Wang C, Swerdloff RS, Kelly DF

Predictors of Hormonal Recovery:

- younger age (47 versus 56 years, *P*=0.006)
- absence of a postoperative CSF leak (*P*=0.03)
- absence of hypertension (*P*=0.05)

Neurosurgery 63:709–719, 2008

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CLINICAL ARTICLE

Intraoperative MRI and endocrinological outcome of transsphenoidal surgery for non-functioning pituitary adenoma

Sven Berkmann · Javier Fandino · Beat Müller · Luca Remonda · Hans Landolt

Predictive factors on univariate analysis	*P*	Odds ratio	95% CI
More recovered axes in the iMRI group, than in the control group:			
Hardy's grade 1 and 2 tumours	0.04	5.11	0.95–27.56
Less axes lost in the iMRI group, than in the control group:			
male gender	0.05	2.17	0.93–5.06
age below 65 years	0.023	3.27	1.15–9.28
absence of arterial hypertension	0.003	3.78	1.54–9.28
history of tobacco smoking	0.037	6.00	1.21–29.74
pituitary stalk not extended on postoperative MRI	0.05	8.18	0.86–78.09
Less patients with loss of axes in the iMRI group, than in the control group:			
2 or 3 defunct axes pre-operatively	0.049	6.50	1.00–42.19
absence of arterial hypertension	0.003	7.50	1.88–29.92

Acta Neurochir (2012) 154:639–647

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Können bei der OP Komplikationen auftreten???

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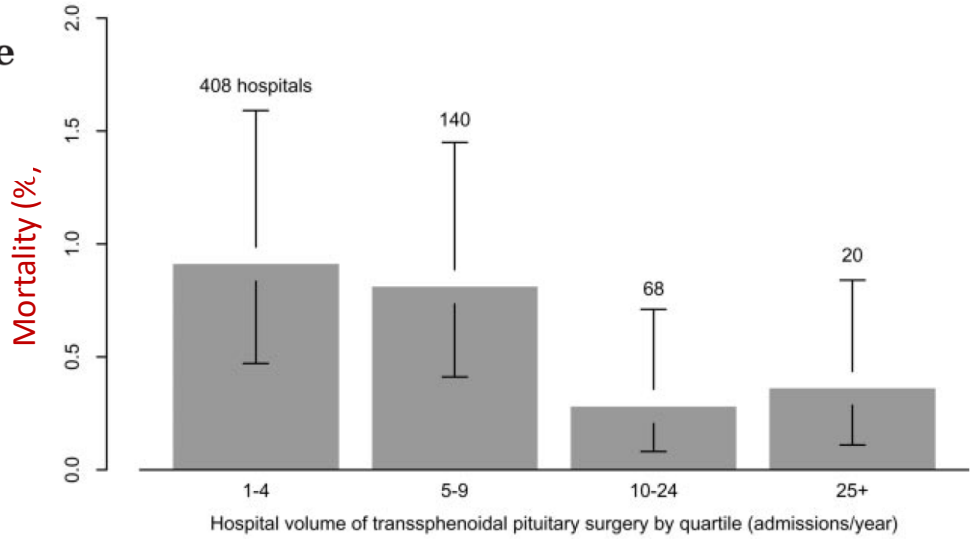
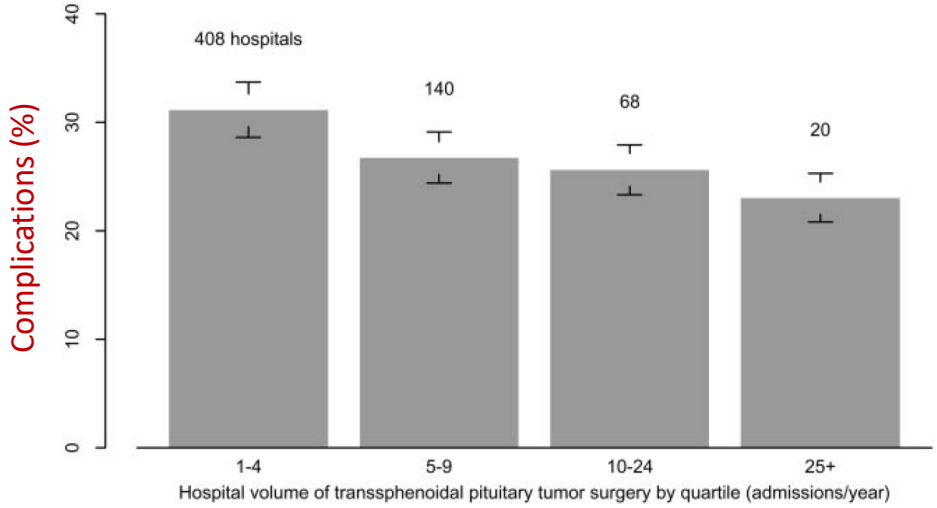
Transsphenoidal Surgery for Pituitary Tumors in the United States, 1996–2000: Mortality, Morbidity, and the Effects of Hospital and Surgeon Volume

FRED G. BARKER, II, ANNE KLIBANSKI, AND BROOKE SWEARINGEN

in-hospital mortality as a function of hospital volume of transsphenoidal pituitary tumor surgery, by quartile. **Mortality was lower with higher-volume hospitals** (*P* = 0.02)





postoperative complications as a function of hospital volume of transsphenoidal tumor surgery, by quartile. The relationship between **large caseload and lower complication rates** was significant (*P* = 0.03)

J Clin Endocrinol Metab, October 2003, 88(10):4709–4719

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Results of Transsphenoidal Surgery in a Large Series of Patients with Pituitary Adenoma

Mortini P, Losa M, Barzaghi R, Boari N, Giovanelli M.

Septumperforation	3 - 8%
Sinusitis	3 - 9%
Hypopituitarismus	7 - 20%
Diabetes insipidus	7 - 19%
Liquorfistel	1 - 4% (Endoskop höher!)
Visus/GF-Abnahme	0.5 - 2%
Meningitis	0.5 - 2%
Verletzung A. carotis int.	0.5 - 1%
Mortalität	0.2%

Neurosurgery 56 1222-1233; 2005

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Und nun...?

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What is the natural history of nonoperated nonfunctioning pituitary adenomas?

N. Karavitaki*, K. Collison*, J. Halliday*, J. V. Byrne†, P. Price‡, S. Cudlip§ and J. A. H. Wass*

…. In conclusion, within a mean follow-up period of 43 months, we found that non-operated presumed

macroNFAs have a ***significant growth potential****….*

the decision for surgical intervention should balance:

- presence of significant comorbidities
- anaesthetic/peri-operative risks at presentation
- probability of tumour enlargement (and its consequences)
- possible loss of the advantages associated with early operation

Clinical Endocrinology (2007) **67**, 938–943

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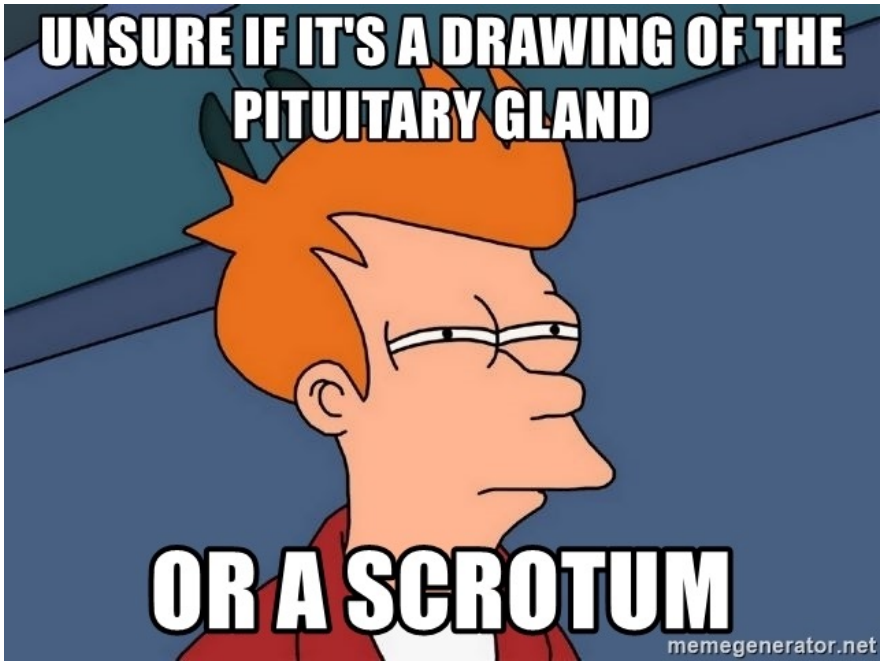
Fragen ?



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Danke

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