TABLES

Table 1: Surgical Approach (endonasal, sublabial, micro, endo, craniotomy, etc).

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Nielsen EH, Lindholm J, Laurberg P, Bjerre P, Christiansen JS, Hagen C, Juul S, Jorgensen J, Kruse A, Stochholm K (2007)[50]	Retrospective review of 192 Danish NFPA patients who had surgery from 1985 to1996 (160 transsphenoidal approach vs 32 craniotomy approach) evaluating causes of death and quality of life based on questionnaire response.	Therapeutic / III	Among 109 (81%) patients who responded to the questionnaires (SF36 and MD-10 depression surveys), there was no difference in cardiovascular/cerebrovascular or cancer mortality between the transsphenoidal vs craniotomy groups. Univariate and multivariate analysis showed that craniotomy patients scored significantly worse in SF-36 mental health and mental components and had significantly higher median MDI scores (11.5 vs 5.78) for depression. No differences among the surgical groups were detected with regard to number of surgeries, pituitary insufficiency, pituitary apoplexy incidence, and radiotherapy. The retrospective design of this study renders it Class III evidence.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Kremer P, Forsting M, Ranaei G, Wüster C, Hamer J, Sartor K, Kunze S (2002)[12]	Assessment of immediate (within 3 days) postoperative MRI in assessing extent of resection	Diagnostic / III	Diagnostic study evaluating immediate postoperative MRI for detecting residual adenoma. Fifty patients underwent immediate (within 3 days) postoperative MRI following transsphenoidal resection of NF pituitary macroadenomas. Detection of residual adenoma on the immediate postoperative MRI was felt to be markedly hindered by blood products and adipose packing. Twenty-five (50%) patients were suspected of having residual tumor based on immediate MRI; however, delayed MRI studies at 3 months and 1 year demonstrated residual tumor in only 15 (30%) patients. The lack of blinded evaluation renders this Class III evidence.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Fahlbusch R, Ganslandt O, Buchfelder M, Schott W, Nimsky C (2001)[9]	Assessment of extent of resection in 44pts with pituitary macroadenomas using intraoperative MRI	Therapeutic / III	Intraoperative 0.2T MRI was utilized in 44 patients undergoing transsphenoidal resection of pituitary macroadenomas. In 30% of patients, intraoperative MRI interpretation was felt to be limited by the presence of artifact. Among 33 patients with surgeon-estimated gross total resection, 9 (27%) had residual tumor detected by intraoperative MRI leading to further resection. Overall, intraoperative MRI increased the rate of complete surgical resection from 43% to 70% as confirmed by delayed MRI. False-positive results for intraoperative residual tumor were observed in 16% of patients. Although performed in a prospective manner, the lack of an appropriate control group renders this Class III evidence.
Yoon PH, Kim DI, Jeon P, Lee SI, Lee SK, Kim SH (2001)[13]	Assessment of immediate (within 7 days) postoperative MRI in assessing extent of resection	Diagnostic / III	Thirty-two patients underwent immediate (within 7 days) postoperative MRI following transsphenoidal resection of NFPA. Residual tumor was detected in eight patients based on nodular enhancement pattern and confirmed by delayed (6 months) MRI. The lack of an appropriate control group renders this Class III evidence.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Flitsch J, Spitzner S, Lüdecke DK (2000)[14]	Prospective study of emotional disturbances in forty-eight patients (11 with NFPA) who underwent transsphenoidal resection of pituitary adenomas	Therapeutic / III	Emotional disorders were assessed in 11 patients with NFPA before and after transsphenoidal resection. Fatigue, depression, and excitability were the most common emotional disorders reported on preoperative interview. Following resection, the majority of patients reported an increase in physical wellbeing at 6 months postoperatively. The lack of an appropriate control group renders this Class III evidence.
Lillehei KO, Kirschman DL, Kleinschmidt-DeMasters BK, Ridgway EC (1998)[15]	Prospective study evaluating rate of tumor recurrence following gross total resection of NFPA by the transsphenoidal approach	Therapeutic / III	Gross total resection of non-functioning pituitary macroadenomas was achieved in 38 of 45 patients (84%) via transsphenoidal surgery. Subsequent radiotherapy was not performed in 32 patients. Serial radiographic assessment revealed a 6% 5-year recurrence rate. Recurrence occurred in 2 patients, who were both successfully treated using radiation therapy (1 required repeat operation). The lack of an appropriate control group renders this Class III evidence.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Jho HD, Carrau RL (1997)[66]	Initial assessment of clinical outcomes following endoscopic endonasal transsphenoidal resection of 50 sellar lesions (19 NFPA)	Therapeutic / III	Early assessment of 50 patients who underwent endoscopic endonasal transsphenoidal surgery. Among 19 patients with NFPA, gross total resection was achieved in 16 patients (84%), with cavernous sinus residual noted in 3 patients. Postoperative visual improvement was observed in all 11 patients presenting with impairment. New hypopituitarism was observed in 3 of 10 patients (30%) with normal preoperative anterior pituitary function. The lack of an appropriate control group renders this Class III evidence.
Kremer P, Forsting M, Hamer J, Sartor K (1996)[11]	Prospective observational study assessing the ability of postoperative MRI to detect residual tumor following NFPA resection	Diagnostic / III	Diagnostic study evaluating the ability of MRI to detect residual tumor in 22 patients with NFPA following transsphenoidal resection. Residual tumor was detected in 11 patients (50%) at 3 months postoperatively (n = 4 suprasellar; n = 5 parasellar; n = 2 retrosellar). No progression of residual tumor was observed over a 2-year radiographic follow-up. The lack of blinded evaluation renders this a Class III diagnostic study.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Arita K, Uozumi T, Yano T, Kurisu K, Hirohata T, Eguchi K, Tominaga A, Pant B, Iida K, Kawamoto H (1996)[10]	Assessment of postoperative gonadal function following transsphenoidal resection of pituitary adenomas in premenopausal women	Therapeutic / III	Preoperative menstrual disturbance was observed in 15 of 19 (79%) of women with NFPA. Following transsphenoidal resection, regular menstruation was restored in 7 (46%) women. Gonadotropin secretion returned to normal in 2 of 7 patients with baseline disturbance, while 4 of 6 patients with preoperative elevations of prolactin achieved normalization. The lack of an appropriate control group renders this study Class III evidence.
Messerer M, De Battista JC, Raverot G, Kassis S, Dubourg J, Lapras V, Trouillas J, Perrin G, Jouanneau E (2011)[45]	Retrospective case series comparing the sublabial microscopic approach to the endonasal endoscopic approach (82 cases done by surgeon A) for resection of NFPA	Therapeutic / III	Eighty-two microscopic surgeries were performed by 2 surgeons (A, B) compared to 82 endoscopic surgeries performed by a single surgeon (A). At 1-year postoperative interval, gross total resection was observed in 50% of patients utilizing the sublabial microscope approach compared to 74% utilizing the endonasal endoscopic approach. No significant difference in postoperative complications was observed. The retrospective design of the study and lack of blinded evaluation renders this Class III evidence.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Dallapiazza R, Bond AE, Grober Y, Louis RG, Payne SC, Oldfield EH, Jane JA Jr (2014)[46]	Retrospective comparison of surgical outcomes following endoscopic vs microscopic resection of Knosp grade 0-2 NFPA	Therapeutic / III	Comparison of the microscopic and endoscopic transsphenoidal cohorts revealed no significant differences in extent of resection or endocrinologic complications. Intraoperative placement of lumbar drains were used more commonly with the microscopic approach (70%) compared to the endoscopic approach (1.7%), although no significant difference in postoperative CSF leakage (12% vs 7%) was observed.
Dallapiazza RF, Grober Y, Starke RM, Laws ER Jr, Jane JA Jr (2014)[42]	Retrospective analysis of clinical and radiographic outcomes following endoscopic resection of NFPA with at least 5 years of follow-up	Therapeutic / III	The overall rate of GTR was 71% with NFPA with Knosp grade 0-2 and tumor volume <10 cc more likely to result in GTR. The observed recurrence rate following GTR was 12% with an overall progression rate of 61% observed following subtotal resection, although only 17% required further surgical intervention. Knosp grade was the only independent predictive factor associated with subtotal resection.
Chone CT, Sampaio MH, Sakano E, Paschoal JR, Garnes HM, Queiroz L, Vargas AA, Fernandes YB, Honorato DC, Fabbro MD, Guizoni H, Tedeschi H (2014)[43]	Retrospective analysis of 30 patients with NFPA following endoscopic resection	Therapeutic / III	Small study (N = 30) demonstrating a GTR of 94% for NFPA using endoscopic transsphenoidal resection. Surgical complications occurred in 10% of patients, including 2 carotid artery lesions, 2 cerebrospinal fluid leaks, and 1 death.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Paluzzi A, Fernandez-Miranda JC, Tonya Stefko S, Challinor S, Snyderman CH, Gardner PA (2014)[44]	Retrospective review of clinical and radiographic outcomes in 550 patients who underwent endoscopic resection of NFPA	Therapeutic / III	Among NFP macroadenomas without cavernous sinus (CS) invasion, GTR was achieved in 84% and near-total resection (NTR) in 9%. Visual impairment improved in 82%. Among NFP macroadenomas with CS invasion, GTR was achieved in 35% and NTR in 42%. Visual impairment improved in 81%. For all NFPA, the rate of GTR was 65.3%, NTR 20%, and visual impairment improvement was 82%. Among recurrent adenomas, the rate of GTR was 45%, with GTR achieved in 74% of patients with macroadenomas without CS invasion (n = 34) and 19% with CS invasion (n = 37)
McLaughlin N, Eisenberg AA, Cohan P, Chaloner CB, Kelly DF (2013)[48]	Retrospective case series of 140 pituitary tumors, including 71 NFPA, that underwent endoscopic visualization after initial microscopic resection. Residual tumor identified in overall 40% (56/140), leading to further resection in 36% (50/140 cases)	Therapeutic / III	Among NFPA, residual adenoma found on endoscopy in 46% (33/71) of patients with further resection utilizing endoscopic visualization performed in 29/33 (88%)
Barazi SA, Pasquini E, D'Urso PI, Zoli M, Mazzatenta D, Sciarretta V, Frank G (2013)[40]	Retrospective review of 22 extended endoscopic transplanum-transtuberculum approach (ETTA) procedures in 19 patients, including 15 NFPA	Therapeutic / III	Six (40%) of 15 NFPA patients had GTR. Complications occurred in 6/15 (40%) patients, including 2 CSF leaks, 1 chronic subdural hematoma, 1 episode of epistaxis, 1 surgical cavity hematoma, and 1 capsular ischemia.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Hwang JM, Kim YH, Kim JW, Kim DG, Jung HW, Chung YS (2013)[41]	Retrospective evaluation of 27 patients with NFPA who underwent repeat endoscopic transsphenoidal resection following prior microscopic transsphenoidal resection	Therapeutic / III	GTR was achieved in 50% of patients, with a mean volumetric extent of resection of 90%. Vision improvement occurred in 79%, while 2 patients experienced complications from the endoscopic surgery.
Lampropoulos KI, Samonis G, Nomikos P (2013)[27]	Retrospective evaluation of 184 patients, including 97 NFPA patients, who underwent microscopic transsphenoidal resection	Therapeutic / III	GTR was achieved in 63%. Factors associated with subtotal resection and overall worsened outcome included cavernous sinus invasion, tumor size >25 mm, and reoperation. Visual improvement occurred in 21/55 (38%). Endocrinologic evaluation demonstrated normalization of anterior pituitary function in 14/75 and improvement in 24/75. Anterior pituitary function remained unchanged in 36/75.
Alahmadi H, Dehdashti AR, Gentili F (2012)[23]	Retrospective review of 39 (19 NFPA) patients with residual or recurrent pituitary tumors after prior microscopic surgery.	Therapeutic / III	Limitations of prior microscopic resection included inadequate sphenoid or sellar exposure in 30/39 (77%) cases. Gross total resection was achieved in 6 of 7 recurrent NFPA without cavernous sinus invasion. Subtotal resection in 12/19 recurrent NFPA with cavernous sinus invasion.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Chen L, White WL, Spetzler RF, Xu B (2011)[49]	Prospective case series of 355 NFPA with mean follow-up period of 5.5 years including patients who underwent microscopic transsphenoidal resection and endoscopic-assisted transsphenoidal resection	Therapeutic / III	Overall gross total resection in 306 (79.5%). No comparison of outcomes among microscopic vs endoscopic-assisted transsphenoidal resection.
Leung GK, Law HY, Hung KN, Fan YW, Lui WM (2011)[57]	Retrospective series of 11 patients with NFPA who underwent simultaneous supratentorial (subfrontal or anterior interhemispheric) craniotomy and sublabial transsphenoidal resection of large and giant macroadenomas	Therapeutic / III	Among NFPA >4 cm in height, 5/11 (45%) had GTR, with 5 of 7 patients experiencing full visual field recovery. Seven patients underwent subsequent radiotherapy. The supratentorial craniotomy was found helpful for dissection from the optic and vascular structures and delivering the tumor down into the sella.
Gondim JA, Schops M, de Almeida JP, de Albuquerque LA, Gomes E, Ferraz T, Barroso FA (2010)[37]	Retrospective review of 228 consecutive patients (93 NFPA; 3 cm mean size) following endoscopic transsphenoidal resection with mean follow-up period of 61 months.	Therapeutic / III	Among 93 NFPA, 70 (75%) achieved gross total resection. Ten patients required a second surgery for additional resection for an overall 83% remission rate.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Leach P, Abou-Zeid AH, Kearney T, Davis J, Trainer PJ, Gnanalingham KK (2010)[38]	Retrospective series of 67 NFPA comparing clinical and radiographic outcomes between early (0-15 months) and delayed (15-30 months) experience utilizing endoscopic transsphenoidal resection	Therapeutic / III	Additional experience with endoscopic transsphenoidal resection leads to decreased operative times (120 minutes vs 90 minutes).
Santos AR, Fonseca Neto RM, Veiga JC, Viana Jr J, Scaliassi NM, Lancellotti CL, Lazarini PR (2010)[39]	Retrospective review of 30 consecutive (12 NFPA) endonasal endoscopic surgeries	Therapeutic / III	Gross total resection was achieved in 3/12 NFPA and <80% resection in 6/12 patients.
Dehdashti AR, Ganna A, Karabatsou K, Gentili F (2008)[36]	Retrospective review of 200 consecutive endonasal endoscopic surgeries (111 NFPA)	Therapeutic / III	Endonasal endoscopic approach is successful and safe with median 22 month follow-up (range 4-34 months). GTR was achieved in 98/111 (88%) of NFPA. Among patients without cavernous sinus invasion, 97% had gross total resection. Full visual field (VF) recovery was observed in 36 (57%) patients, while partial VF was observed in 21 (34%) patients. Only 6 (9%) patients had no VF recovery.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Honegger J, Ernemann U, Psaras T, Will B (2007)[24]	Prospective case series of 105 NFPA who underwent transsphenoidal removal of NFPA to determine MRI characteristics favorable for transsphenoidal resection	Therapeutic / III	Eighty-seven of 105 (83%) patients with NFPA with suprasellar extension underwent surgical intervention via a transsphenoidal approach. Statistically significant MRI predictors of incomplete resection included tumors with >2 cm suprasellar extension and multilobulated or irregular shape.
Schwartz TH, Stieg PE, Anand VK (2006)[35]	Retrospective review of 15 (11 NFPA, 3 acromegaly, 1 resistant PRL) patients who underwent endoscopic transsphenoidal surgery with low-field 0.12T iMRI.	Therapeutic / III	iMRI demonstrated residual tumor in 3 patients with NFPA leading to further endoscopic resection of tumor. In patients with 4 NFPA, iMRI suggested the presence of residual adenoma; however, further endoscopic evaluation revealed these to be normal postoperative changes.
Frank G, Pasquini E (2006)[34]	Retrospective review of 35 NFPA with cavernous sinus invasion who underwent endoscopic endonasal resection from the cavernous sinus between 1998 and 2005.	Therapeutic / III	Among 35 NFPA patients with cavernous sinus invasion, 20 (60%) had their tumor completely resected, with an additional 9 (25.5%) patients achieving subtotal resection.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Mattozo CA, Dusick JR, Esposito F, Mora H, Cohan P, Malkasian D, Kelly DF (2006)[25]	Retrospective review of 30 (16%) of 188 consecutive NFPA patients who had repeat transsphenoidal surgery via a repeat transsphenoidal approach.	Therapeutic / III	Initial transsphenoidal resection was performed via the sublabial approach in 23 (77%) patients, while 6 patients had an endonasal approach and 1 had a lateral rhinotomy approach. Anatomic factors felt to contribute to the need for repeat surgery included suboptimal bony sphenoid keel (97%) and sella (93%) removal. Residual adenoma >1 cm also contributed to the need for repeat surgery.
Kabil MS, Eby JB, Shahinian HK (2005)[33]	Retrospective case review of 161 NFPA patients who underwent endoscopic transsphenoidal resection	Therapeutic / III	At a mean follow-up time of 38 months, 149/161 (93%) patients showed no evidence of residual tumor.
Nomikos P, Ladar C, Fahlbusch R, Buchfelder M (2004)[53]	Comparison of transsphenoidal vs transcranial surgery on endocrine outcome	Therapeutic / III	Analysis of endocrinologic outcome for 721 patients who underwent transsphenoidal (n = 660) or transcranial (n = 61) removal of an NFPA demonstrated improved anterior pituitary function following transsphenoidal resection. Preoperative deficits were present in approximately 85% of both groups, with normalization of pituitary function observed in 20% of the transsphenoidal group postoperatively compared to 0% in the transcranial group. Any improvement in pituitary function was observed in 30% vs 11%, respectively. Deterioration of pituitary function was noted in 1% vs 15%.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Wichers-Rother M, Hoven S, Kristof RA, Bliesener N, Stoffel-Wagner B (2004)[54]	Comparison of transsphenoidal vs transcranial surgery on endocrine and clinical (headache, visual) outcome	Therapeutic / III	Analysis of endocrinologic outcome for 130 patients who underwent transsphenoidal (n = 109) or transcranial (n = 21) removal of a non-functioning macroadenoma. No improvement in anterior pituitary function following resection was observed in either group. Postoperative deficits in the adrenal and thyroid axes were significantly increased at 2 years in the transcranial resection cohort. Significant visual improvement was observed in both groups, with earlier (within 3 months) improvement more frequent following transsphenoidal resection. Similarly, improvement in headache symptoms occurred in both groups, with earlier improvement observed in the transsphenoidal cohort.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Greenman Y, Ouaknine G, Veshchev I, Reider-Groswasser II, Segev Y, Stern N (2003)[28]	Evaluation of characteristics associated with postoperative tumor progression and recurrence following transsphenoidal resection of NF pituitary macroadenomas	Therapeutic / III	One hundred twenty-two patients with nonfunctioning macroadenomas underwent transsphenoidal resection. Gross total tumor removal was achieved in 30 (25%) patients based on 3-month follow-up MRI. With a mean follow-up time of 51 months, subsequent tumor enlargement occurred in 41/78 (53%) patients with radiographic residual tumor and in 6/30 (20%) patients without apparent residual tumor at 3 months. Factors associated with tumor progression included increased suprasellar and infrasellar extension of the residuum and cavernous sinus invasion.
Lasio G, Ferroli P, Felisati G, Broggi G (2002)[32]	Assessment of image guidance for endoscopic resection of recurrent pituitary adenomas	Therapeutic / III	Surgical morbidity and operative time were assessed in 19 patients undergoing re-resection of recurrent pituitary adenomas. Image guidance was utilized in 11 patients with no significant difference in extent of resection or morbidity between the 2 cohorts. Mean OR setup time was 13 minutes faster in the non-image guided procedures, while operative time was 36 min shorter with image guidance.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Alleyne CH Jr, Barrow DL, Oyesiku NM (2002)[56]	Assessment of extent of resection and clinical outcomes using a simultaneous combined transsphenoidal and transcranial approach for resection of giant pituitary adenomas	Therapeutic / III	Retrospective review of 10 patients undergoing simultaneous transsphenoidal and transcranial (pterional approach) resection of giant pituitary adenomas. Gross total resection was achieved in 4/10 patients with near total resection in an additional 2 patients. Visual improvement occurred in all patients presenting with impairment (n = 9). Complete visual recovery occurred in 5 of 9 patients at 6-month follow-up. Complications included transient oculomotor nerve palsy (n = 3) and mild hemiparesis (n = 3). Postoperative seizures occurred in 2 patients, and 1 patient expired secondary to pulmonary embolism at 3 months postoperatively. No cases of cranial infection were observed.
Meij BP, Lopes MB, Ellegala DB, Alden TD, Laws ER Jr. (2002)[18]	Comparison of tumor progression following transsphenoidal resection of pituitary adenomas with and without dural invasion	Therapeutic / III	Three hundred fifty-four patients underwent transsphenoidal resection of pituitary adenomas with sampling of the sellar dura for tumor invasion. Evidence of dural invasion was present in 46 of 81 (57%) patients with NFPA, with the frequency of dural invasion increased in accordance with tumor size. Dural invasion was significantly associated with the presence of residual tumor following transsphenoidal resection, although recurrence following apparent gross total resection was not associated with dural invasion.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Scheithauer BW, Jaap AJ, Horvath E, Kovacs K, Lloyd RV, Meyer FB, Laws ER Jr, Young WF Jr (2000)[19]	Retrospective analysis of clinical outcomes following transsphenoidal resection of clinically silent corticotroph adenomas	Therapeutic / III	Twenty-three cases of clinically silent corticotroph-staining adenomas were reviewed. All cases were associated with absence of any clinical signs of Cushing's syndrome and normal cortisol levels. Tumors were associated with a high rate of residual tumor or progression following resection.
Kurosaki M, Lüdecke DK, Flitsch J, Saeger W (2000)[30]	Retrospective evaluation of safety and efficacy of transsphenoidal resection of NFPA in elderly (>70 years) patients	Therapeutic / III	Transsphenoidal resection of NFPA was performed in 32 patients >70 years of age. Complete surgical removal was achieved in 24 (75%) cases. Visual disturbances were improved in 19 of 23 (83%) patients with preoperative visual impairment. Complications included new adrenocorticotropic impairment in 5 of 11 (45%) patients, transient oculomotor nerve palsy in 1 patient, and CSF leakage in 5 (16%) patients (2 requiring reoperation). Patients with American Society of Anesthesiologists (ASA) Grade 4 and 5 were excluded from this study and not considered candidates for surgery.
Shen CC, Wang YC, Hua WS, Chang CS, Sun MH (2000)[31]	Retrospective evaluation of clinical outcomes following endoscopic transsphenoidal resection of pituitary adenomas	Therapeutic / III	Fifteen patients with NFPA underwent resection via an endoscopic transsphenoidal approach. Gross total resection was achieved in 12 of 15 patients (80%). Visual improvement was noted in all patients with preoperative disturbance and no complications were reportedly encountered.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Zhang X, Fei Z, Zhang J, Fu L, Zhang Z, Liu W, Chen Y (1999)[17]	Retrospective assessment of extent of resection following transsphenoidal resection of NFPA with suprasellar extension with use of a lumbar drain catheter for intraoperative saline administration	Therapeutic / III	Gross total removal of adenoma was achieved in 146 of 208 (70%) patients with NFPA with suprasellar extension using the transsphenoidal approach. Resection of suprasellar tumor was facilitated by injection of 20-80 mL of saline solution and the sella packed with adipose or muscle tissue to prevent CSF leakage. Postoperative complications occurred in 48 (23%) patients, most commonly diabetes insipidus (14%) and CSF leakage (5%). Twenty-seven patients required craniotomy for further tumor resection.
Sheehan MT, Atkinson JL, Kasperbauer JL, Erickson BJ, Nippoldt TB (1999)[47]	Comparison of clinical outcomes following endoscopic resection of NFPA vs sublabial transseptal approach	Therapeutic / III	Retrospective review of 26 patients with NFPA who underwent endoscopic resection compared to 44 matched control patients who underwent transsphenoidal resection via sublabial transseptal approach. No significant difference in extent of resection, visual or endocrinologic outcome, or surgical complications were detected between the 2 surgical groups. The endoscopic approach was associated with a significantly decreased operative time (2.7 vs 3.4 hours). Septal complications occurred in 2 patients treated with the sublabial transseptal approach. No sinonasal complications were reported in the endoscopic group.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Colao A, Cerbone G, Cappabianca P, Ferone D, Alfieri A, Di Salle F, Faggiano A, Merola B, de Divitiis E, Lombardi G (1998)[52]	Long-term assessment of tumor control, endocrine function, and visual recovery following resection of NFPA via either the transsphenoidal or pterional approach.	Therapeutic / III	Eighty-four patients with NFPA were followed for 1-10 years' follow-up. Transsphenoidal resection of NFPA was performed in 69 patients, and resection using a pterional approach was performed in 15 patients. Complete surgical removal was achieved in 14% of patients, and postoperative radiotherapy was performed in 82% of patients with incomplete tumor removal. No significant difference in tumor regrowth was detected between irradiated and nonirradiated patients. The prevalence of hypopituitarism following radiotherapy increased from 29% at 1 year to 92% at 10 years' follow-up. Visual deterioration occurred in only 1 patient following radiotherapy.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Abe T, Iwata T, Kawamura N, Izumiyama H, Ikeda H, Matsumoto K (1997)[20]	Evaluation of staged transsphenoidal resection in 7 patients with non-functioning pituitary macroadenomas	Therapeutic / III	Staged transsphenoidal resection was performed in 7 patients with fibrous or dumbbell-shaped NF resulting in residual suprasellar adenoma following initial resection. Serial postoperative MRI were performed in 2-week intervals following initial resection with descent of the residual tumor into the sella observed within 2 months in 5/7 patients. Partial descent was observed in an additional patient by 3 months. Re-resection was performed within 5 months in all patients, with gross total resection achieved in 6 of 7 patients using a staged approach. No complications were reportedly encountered.
Benbow SJ, Foy P, Jones B, Shaw D, MacFarlane IA (1997)[55]	Retrospective assessment of clinical outcomes following transsphenoidal and transcranial resection of pituitary adenomas in the elderly (>64 years)	Therapeutic / III	Visual outcomes and perioperative complications were assessed in 38 elderly patients (>64 years of age) with pituitary adenomas (37 NFPA). Transsphenoidal resection was performed in 32 patients and transcranial resection in 6 patients. Perioperative complications were significantly more frequent in the transcranial group (5/6) compared to the transsphenoidal group (6/32).

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
Young WF Jr, Scheithauer BW, Kovacs KT, Horvath E, Davis DH, Randall RV (1996)[21]	Retrospective review of clinical outcomes of 100 patients with non-secretory gonadotroph adenomas.	Therapeutic / III	One hundred patients with non-secretory gonadotropin-producing adenomas were randomly selected for review. Transsphenoidal resection was performed in 98 patients and transcranial resection in 2 patients. Gross total removal was reported in 90% of cases, although residual or recurrent tumor was observed in 42% of patients with at least 5-year follow-up based on CT imaging. One death occurred due to intracerebral hemorrhage, and new hypopituitarism developed postoperatively in 24% of patients.
Greenman Y, Tordjman K, Kisch E, Razon N, Ouaknine G, Stern N (1995)[22]	Comparison of anterior pituitary function preoperatively and postoperatively in patients with NFPA and growth-hormone secreting adenomas	Therapeutic / III	Anterior pituitary function was compared in NFPA (n = 26) vs GH-secreting adenomas (n = 15). Preoperative endocrine disturbances (other than GH levels) were significantly more frequent in patients with NFPA compared to acromegalics, with the prevalence unrelated to tumor size or extension. Postoperative anterior pituitary deficiency remained significantly increased in NFPA patients (68% vs 17%).
Petruson B, Jakobsson KE, Elfverson J, Bengtsson BA (1995)[26]	Retrospective study of 48 patients with NFPA who underwent resection using a lateral rhinotomy incision with at least 5 years of follow-up	Therapeutic / III	Using the lateral rhinotomy transsphenoidal approach, 1 tumor recurrence was observed by CT imaging at 5 years. New pituitary dysfunction occurred in 12% of patients while visual improvement was noted in 79%.

Author (Year)	Study Description	Classification Process/ Evidence Class	Conclusions
van Lindert EJ, Grotenhuis JA, Meijer E (1991)[51]	Retrospective evaluation of 53 patients who underwent craniotomy for resection of NFPA	Therapeutic / III	Among 53 patients who underwent transcranial resection of NFPA, symptomatic improvement occurred in 81% of patients and 6% surgical mortality rate. Of patients who were felt to have undergone gross total resection, 36% had delayed recurrence.
Ebersold MJ, Quast LM, Laws ER Jr, Scheithauer B, Randall RV (1986)[16]	Retrospective analysis of 100 patients with NFPA who underwent surgical resection with median follow-up period of 73 months	Therapeutic / III	Transsphenoidal surgery was performed in 100 patients with NFPA with use of intraoperative fluoroscopy in all cases. Surgically related mortality was 3%. One postoperative CSF leak required repeat surgery, while 2 patients required permanent CSF diversion for acquired hydrocephalus related to subarachnoid hemorrhage. Among the 72 patients who presented with visual impairment, 53 had improvement and 3 had visual worsening related to the surgery. 84% GTR.