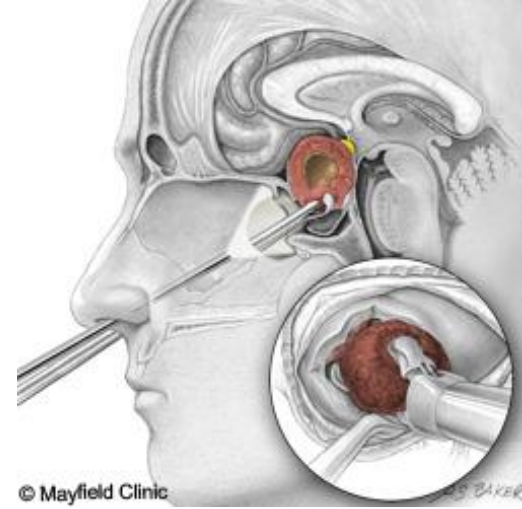


**TRANSPHENOIDAL ENDOSCOPY FOR
PITUITARY ADENOMAS AND ITS
ASSOCIATED LEARNING CURVE – AN
INSTITUTIONAL REVIEW**



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INTRODUCTION



- Pituitary adenomas traditionally operated **microscopically**
- **Halstead and Hirsch** – trans-sphenoidal approach
- **Harvey Cushing** – sub-labial trans-septal approach
- **Hardy** – operating microscope in 1960's
- Since **1990's endoscopic** approach has come into vogue

INTRODUCTION

- **Endoscopic** technique considered **superior** due to:
 - Better anatomic visualization
 - **Greater tumor resection**
 - **Decreased trauma** to nasal mucosa
 - **Reduced complications** and shorter postoperative **stay**
- However, endoscopy still not widespread adopted due to certain **limitations**:
 - **2-D view**
 - Operating with **single hand**
 - Intraoperative **bleeding control difficult**

AIMS AND OBJECTIVES

- Previous studies support existence of learning curve for this technique for single surgeon experience
- We investigated the learning curve for endoscopic approach at our centre since the advent of this procedure in 2009

MATERIALS & METHODS

- **Retrospective Observational Study**
- Conducted at Tertiary Level Neurosurgical Centre
- Duration of study: **November 2009 to March 2017**

- **Inclusion Criteria:**
 - Diagnosis of pituitary adenoma on preop MRI / CECT
 - Operated using the endoscopic trans-nasal trans-sphenoidal approach

- **Exclusion criteria**
 - Combined approach – endoscopy and craniotomy
 - Microscopy with endoscopic assistance

- >80% cases - operated by **2 principal surgeons**
- Surgeon 1 :> 24yrs as faculty, >600 microscopic cases
- Surgeon 2 :>10yrs as faculty, >300 microscopic cases
- Patients divided into **3 series** - **primary** adenomas, **recurrent** adenomas and **giant** adenomas
- **All series** chronologically divided into **early** and **late** groups
- All groups compared for intraoperative and postoperative parameters to look for a learning curve
- Both surgeon's individual cases also divided into groups and subjected to internal comparison

Pre-operative Parameters

Clinical

- Presenting Complaints
- Comorbidities
- Pre-Op CSF Rhinorrhoea
- Apoplexy
- Dopamine Agonist Use
- Visual Acuity And Perimetry
- Previous Surgery

Hormonal

- Complete Hormone Analysis

Radiological (CEMRI)

- Tumor Class
- Multi Compartment involvement
- Carotid Encasement
- Tumor Volume (ml)

Intraoperative parameters

- Operative time
- Blood Loss
- CSF Leak
- ICA Injury
- Conversion to Microscopic technique

Post-operative parameters

- Percentage of Excision
- Gross Total Excision
- CSF leak / lumbar drain placement
- Visual Improvement / Deterioration
- Postop hypopituitarism
- Postop hormone status (for functional adenomas)
- Postop DI
- Meningitis
- Neurological deterioration / mortality

Surgical Technique

- 2 surgeon – 3 handed technique
- Surgeon standing at the patient's right side
- 0 degrees Karl Storz 2-D endoscope used for initial resection
- Followed by 30/45 degrees scope for final inspection
- Sellar packing with gelatin sponge, and in case of CSF leak, with peri-umbilical fat + oxidized cellulose +/- fascia

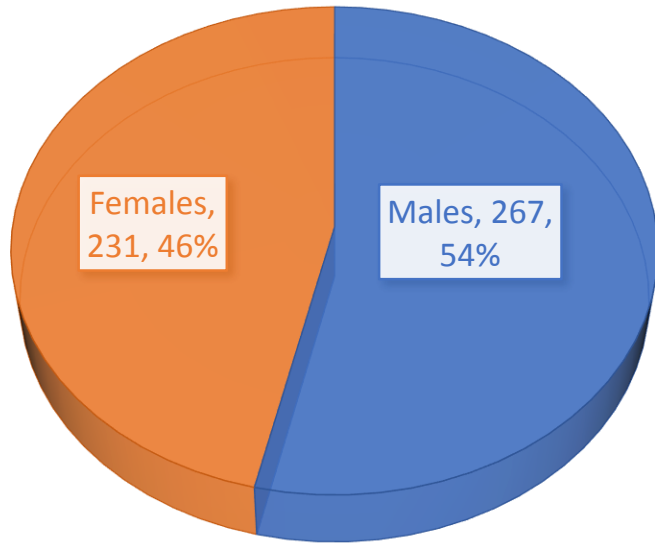
RESULTS



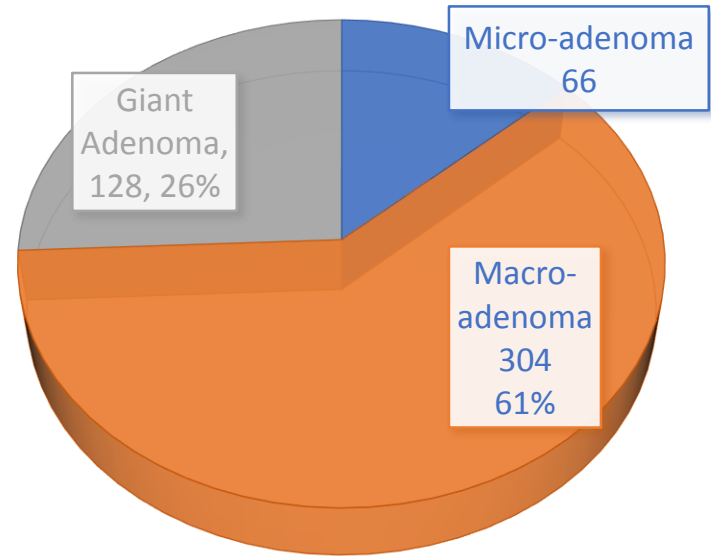
PATIENT CHARACTERISTICS

Characteristics	No. of Patients	Hormonal status	
Total	498	Functional	225 (45.2%)
Surgeon 1	212 (42.57%)	Cushings	64 (12.9%)
Surgeon 2	180 (36.14%)	Acromegaly	117 (23.5%)
Other surgeons	106 (21.29%)	Prolactinoma	83 (16.7%)
Class of lesion		Nonfunctioning	273 (54.8%)
Giant Adenoma	128 (25.7%)	Sex	
Microadenoma	66 (13.3%)	Male	267 (53.6%)
Macroadenoma	304 (61.0%)	Female	231 (46.4%)
Nongiant tumors	370	Age, mean (years)	39.71±14.04
Primary tumors	310 (83.78%)		
Recurrent tumors	60 (16.22%)		

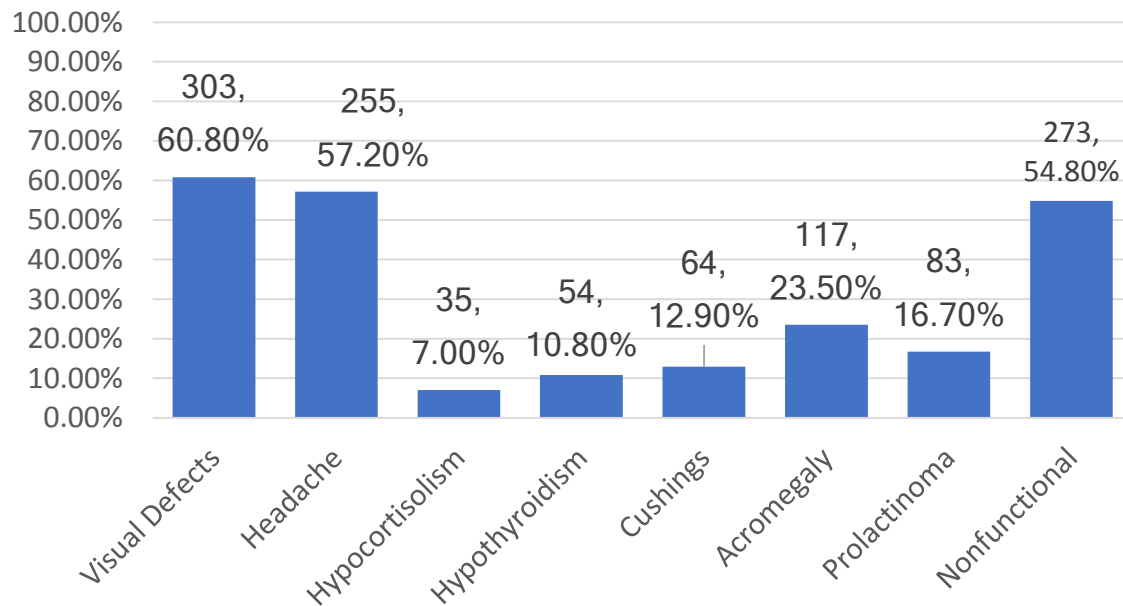
SEX DISTRIBUTION



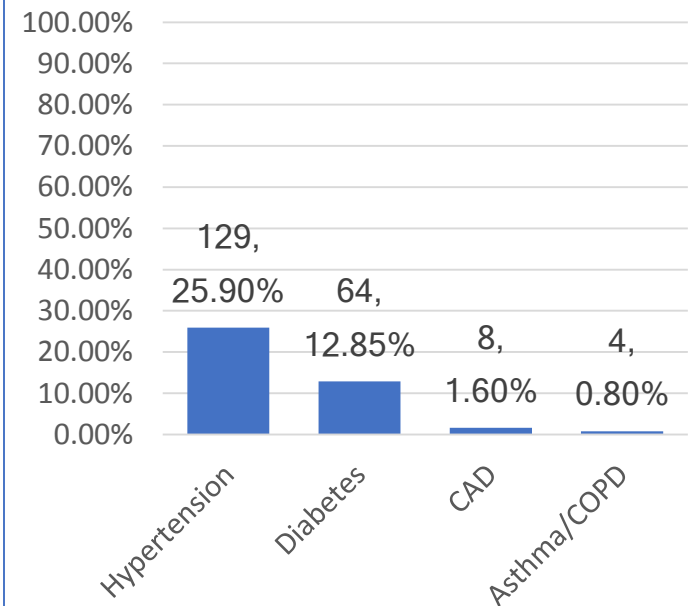
CLASS OF LESION



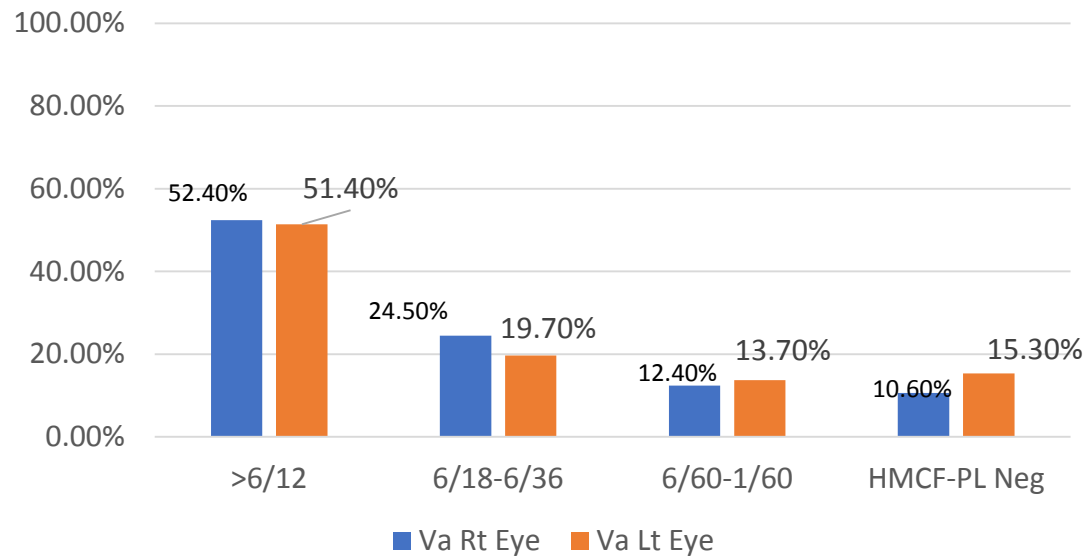
PRESENTATION



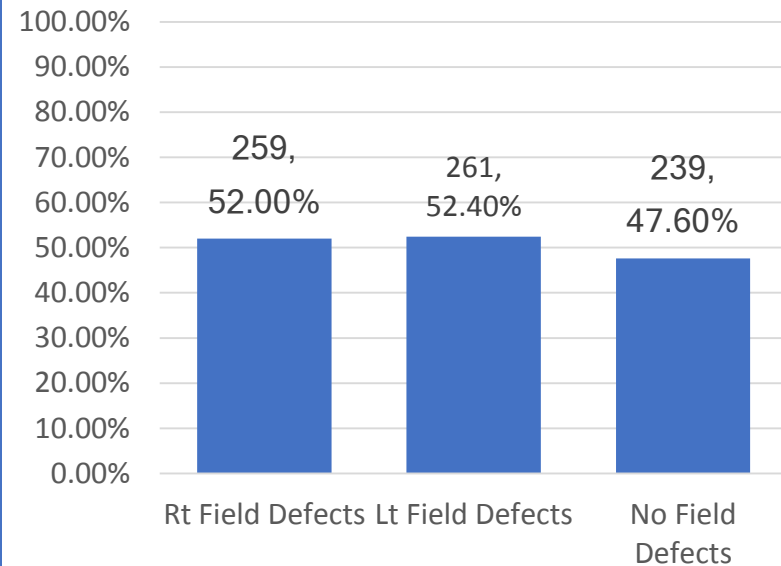
CO-MORBIDITIES



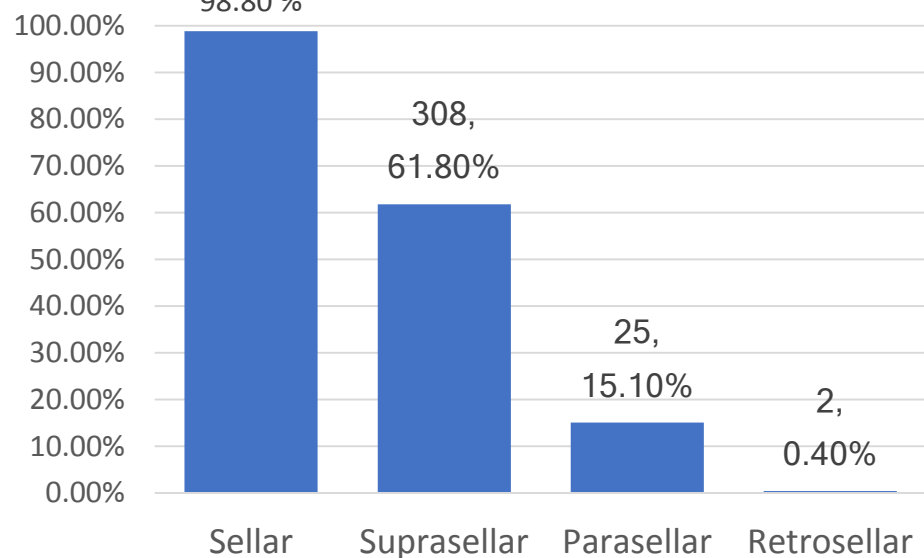
VISUAL ACUITY



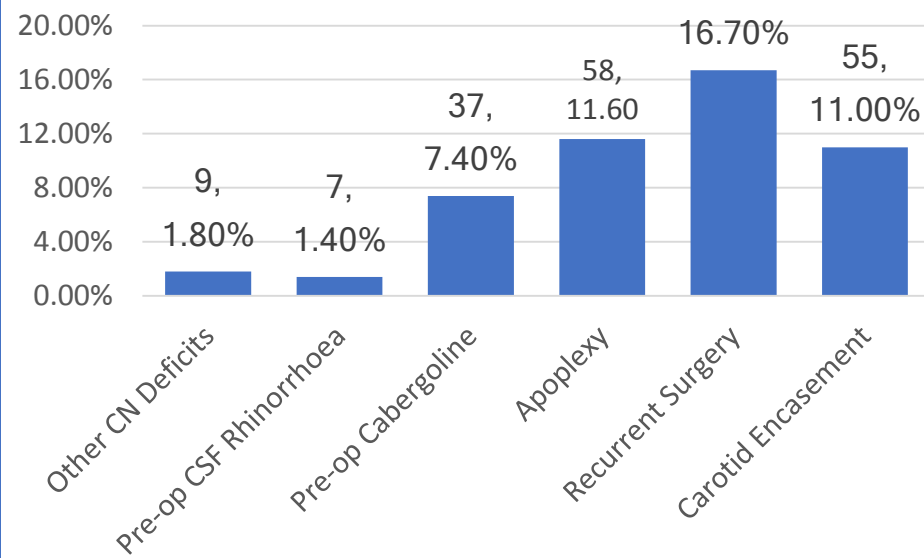
Visual Field



COMPARTMENT DISTRIBUTION



OTHER CHARACTERISTICS



LEARNING CURVE



PRIMARY ADENOMAS

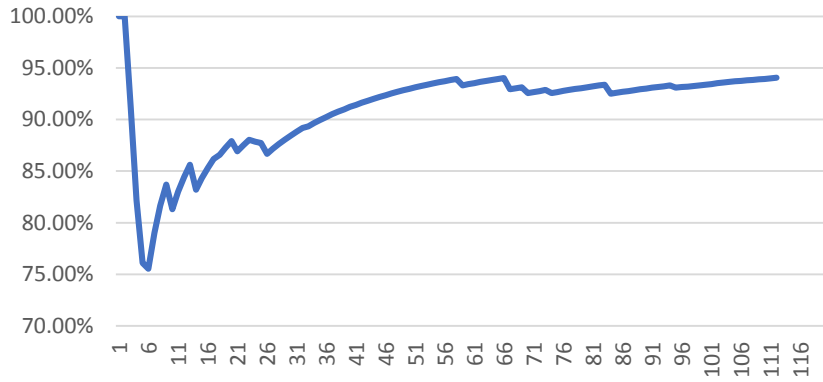


n=120	Group 1 (Early 40)	Group 2 (Mid 40)	Group 3 (Late 40)	P-value
Operative time (mean, mins)	152.25	123.75	122.5	0.001
Blood loss (mean, ml)	421.25	220	196.25	<0.001
Tumor resection (mean, %)	90.79	95.64	96.36	0.207
Postop stay (mean, days)	8.68	6.1	5.4	0.043
Gross total resection (n,%)	27(67.5%)	36(90%)	36(90%)	0.009
Conversion to microscopy	4(10%)	0(0%)	0(0%)	0.016
ICA injury	1(2.5%)	0(0%)	0(0%)	0.365
CSF leaks	17(42.5%)	13(32.5%)	13(32.5%)	0.560
Lumbar drain	14(35%)	8(20%)	2(5%)	0.004
Postop vision				0.683
Improved	5(12.5%)	4(10%)	4(10%)	
Worsened	2(5%)	1(2.5%)	0(0%)	
Postop Hormone status (n=53)				0.406
Normalised/ Improved	9 (56.3%)	14 (70%)	14 (82.3%)	
Postop hypopituitarism	14(35%)	13(32.5%)	8(20%)	0.286
Postop DI	8(20%)	3(7.5%)	8(20%)	0.209
Postop meningitis	1(2.5%)	0(0%)	0(0%)	0.365
Need for reoperation	6(15%)	0(0%)	0(0%)	0.002
Death	0(0%)	0(0%)	1(2.5%)	0.365

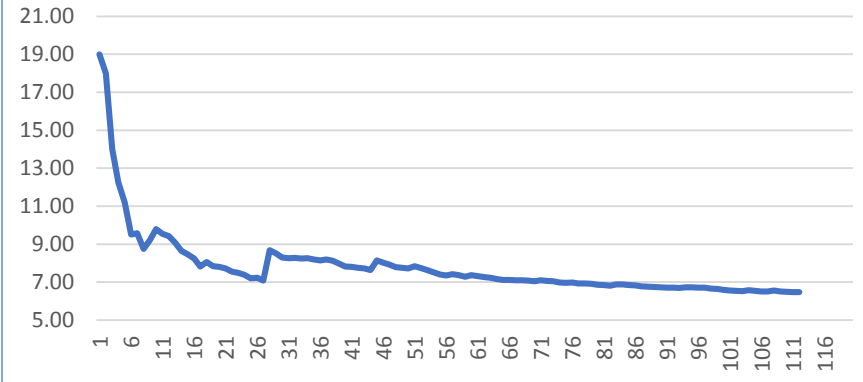
SURGEON 1

Surgeon 1

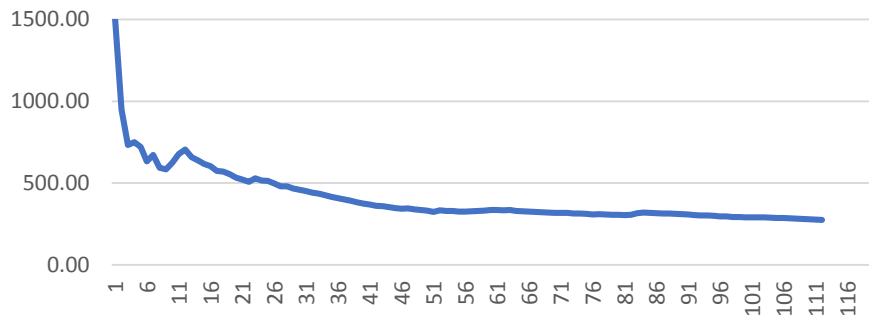
PERCENTAGE EXCISION



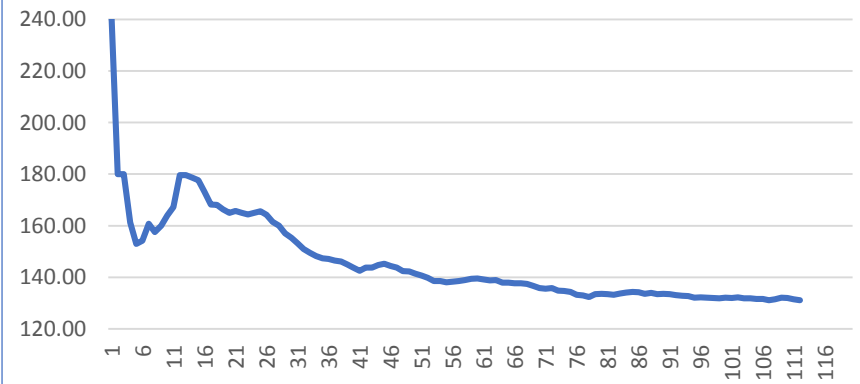
POST-OP STAY



INTRA-OPERATIVE BLOOD LOSS



DURATION OF SURGERY

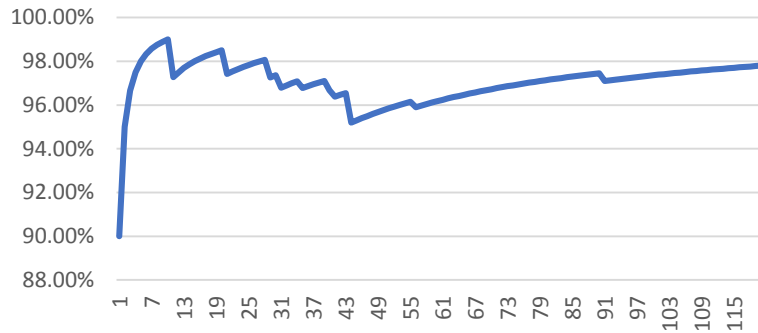


n=120	Group 1 (Early 60)	Group 2 (Late 60)	p-value
Operative time (mean, mins)	120.42	114.83	0.422
Blood loss (mean, ml)	310	324.17	0.74
Postop stay (mean, days)	5.98	5.42	0.567
Tumor resection (mean, %)	96.99	99.41	0.088
Gross total resection (n,%)	51 (85%)	59 (98.3%)	0.008
Conversion to microscopy	4 (6.7%)	0(0%)	0.042
CSF leaks	24 (40%)	31 (51.7%)	0.200
Lumbar drain	15 (25%)	19 (31.7%)	0.418
Postop vision improvement	6 (10%)	8 (13.3%)	0.191
Postop Hormone status (n=84)			<0.001
Normalised	3 (7.3%)	29 (67.4%)	
Improved	2 (4.9%)	7 (16.3%)	
Postop hypopituitarism	28 (46.7%)	10 (16.7%)	0.001
Postop DI	11 (18.3%)	12 (20%)	0.817
GCS deterioration	1 (1.7%)	0(0%)	0.315
Need for reoperation	1 (1.7%)	1 (1.7%)	>0.999
Death	0	0	>0.999

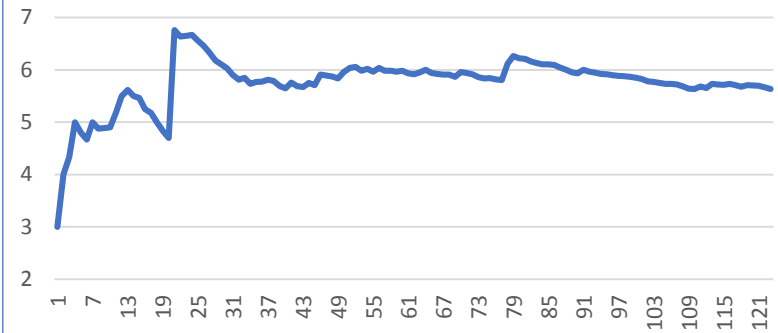
SURGEON 2

Surgeon 2

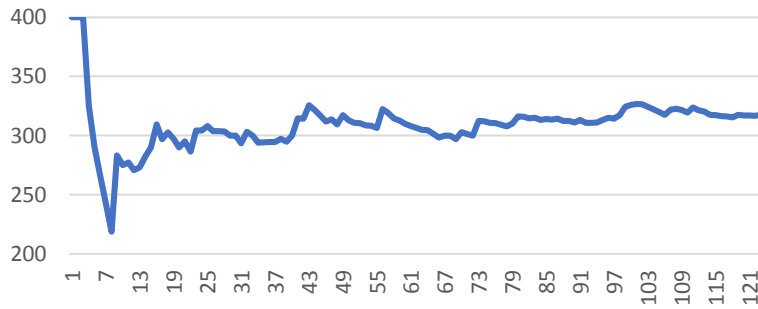
PERCENTAGE EXCISION



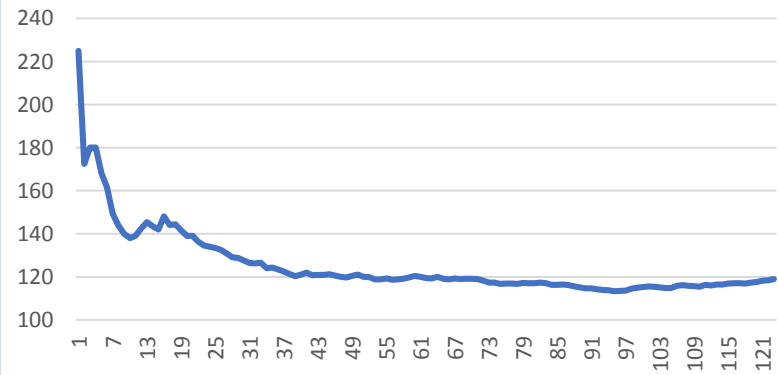
POST OP STAY



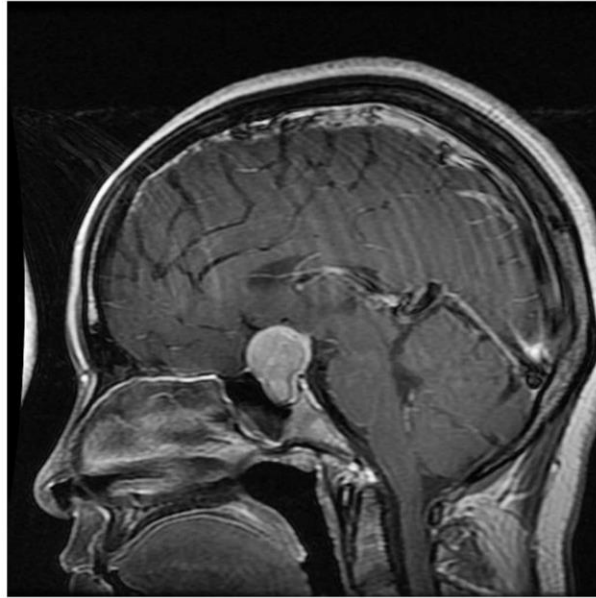
INTRA-OPERATIVE BLOOD LOSS



DURATION OF SURGERY



GIANT ADENOMAS

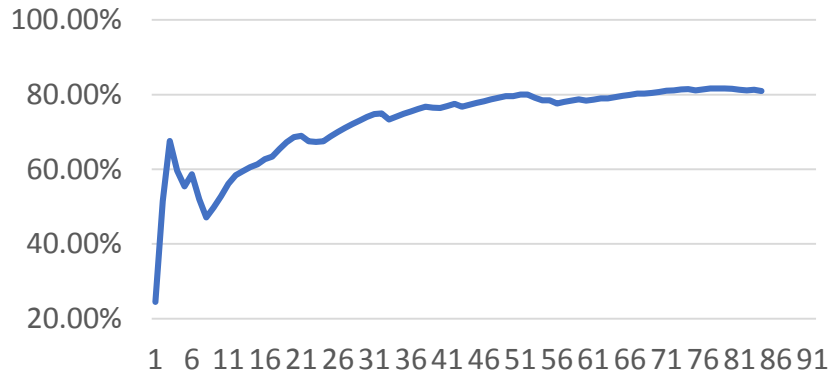


n=92	Group 1 (Early 46)	Group 2 (Late 46)	p-value
Operative time (mean, mins)	160.33	163.26	0.808
Blood loss (mean, ml)	685.87	459.78	0.095
Tumor resection (mean, %)	77.73	85.22	0.123
Postop stay (mean, days)	10.35	8.37	0.414
Gross total resection (n,%)	16 (34.8%)	23 (50%)	0.14
Conversion to microscopy	1 (2.2%)	0(0%)	0.315
CSF leaks	20 (43.5%)	21 (45.7%)	0.834
Lumbar drain	14 (30.4%)	11 (23.9%)	0.482
Postop vision			0.723
Improved	7 (15.2%)	9 (19.6%)	
Worsened	6 (13%)	4 (8.7%)	
Postop Hormone status (n=20)			
Normalised/ Improved	5 (41.7%)	6 (75%)	0.058
Postop hypopituitarism	25 (54.3%)	20 (43.5%)	0.297
Postop DI	11 (23.9%)	16 (34.8%)	0.252
Postop meningitis	6 (13%)	0(0%)	0.011
GCS deterioration	7 (15.2%)	3 (6.5%)	0.180
Need for reoperation	10 (21.7%)	3 (6.5%)	0.036
Death	5 (10.9%)	1 (2.2%)	0.091

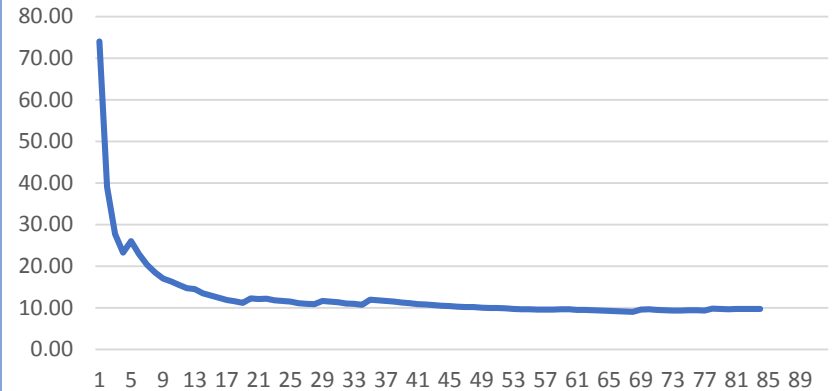
SERIES: GIANT ADENOMAS

Giant Pituitary Adenomas

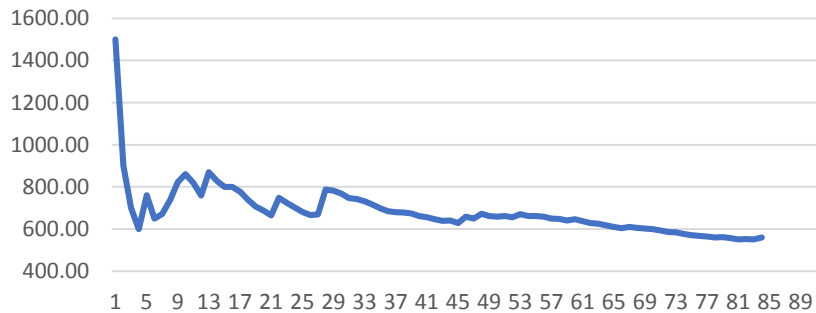
PERCENTAGE EXCISION



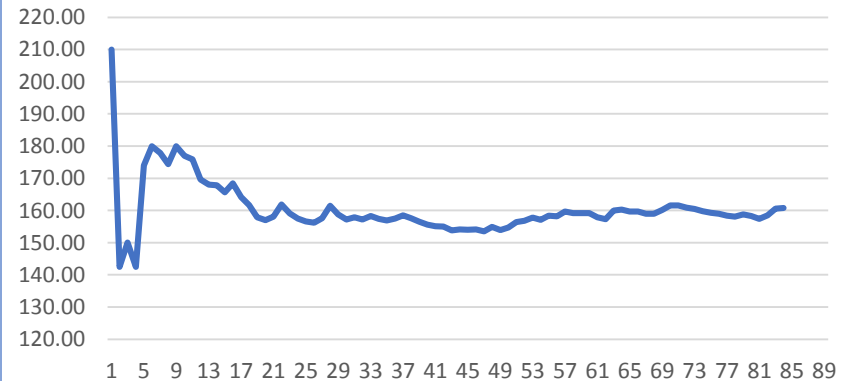
POST-OP STAY



INTRA-OPERATIVE BLOOD LOSS



DURATION OF SURGERY



RECURRENT ADENOMAS

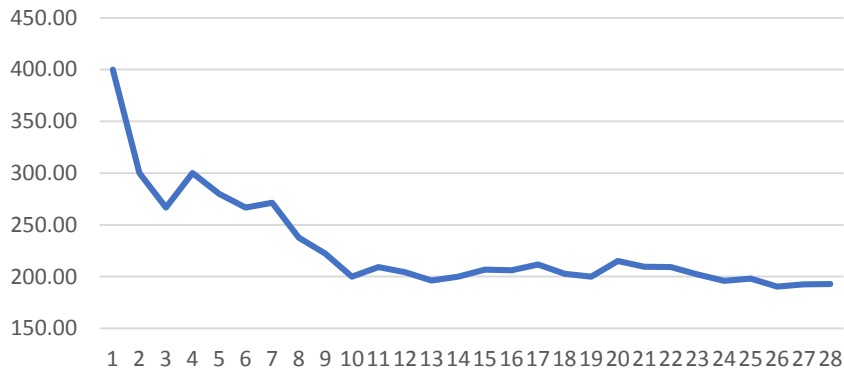


n=29	Group 1 (Early 15)	Group 2 (Late 14)	p-value
Operative time (mean, mins)	124.67	119.64	0.703
Blood loss (mean, ml)	190	185.71	0.931
Tumor resection (mean, %)	85.77	92.98	0.267
Postop stay (mean, days)	8.53	5.07	0.089
Gross total resection (n,%)	8 (53.3%)	9 (64.3%)	0.552
CSF leaks	9 (60%)	5 (35.7%)	0.191
Lumbar drain	4 (26.7%)	2 (14.3%)	0.411
Postop vision			0.145
Improved	0 (0%)	1 (7.1%)	
Worsened	1 (6.7%)	4 (28.6%)	
Postop Hormone status			0.465
Normalised	2 (33.3%)	3 (50%)	
Improved	3 (50%)	1 (16.7%)	
Postop hypopituitarism	8 (53.3%)	1 (7.1%)	0.007
Postop DI	3 (20%)	1 (7.1%)	0.316
Postop meningitis	0 (0%)	0 (0%)	>0.999
Need for reoperation	0 (0%)	0 (0%)	>0.999
GCS deterioration	1 (6.7%)	0 (0%)	0.326
Death	1 (6.7%)	0 (0%)	0.326

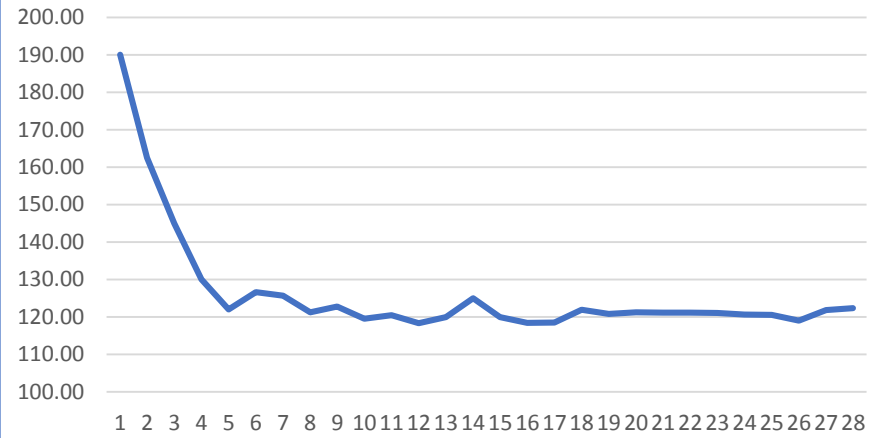
SERIES: RECURRENT ADENOMAS

Recurrent Pituitary Adenomas

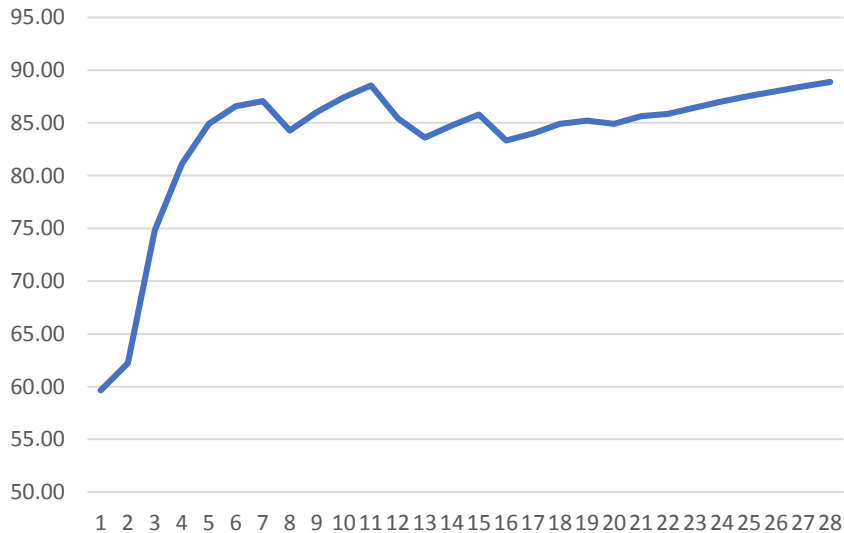
INTRA-OPERATIVE BLOOD LOSS



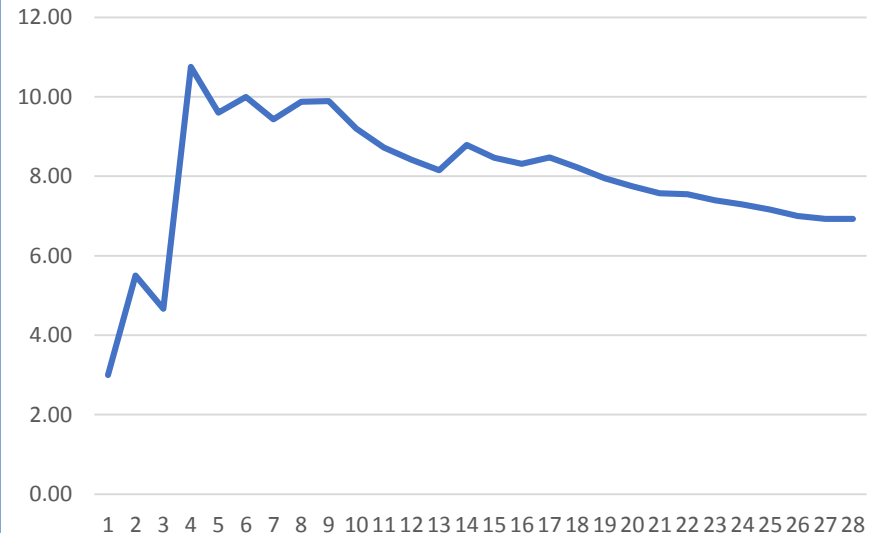
DURATION OF SURGERY

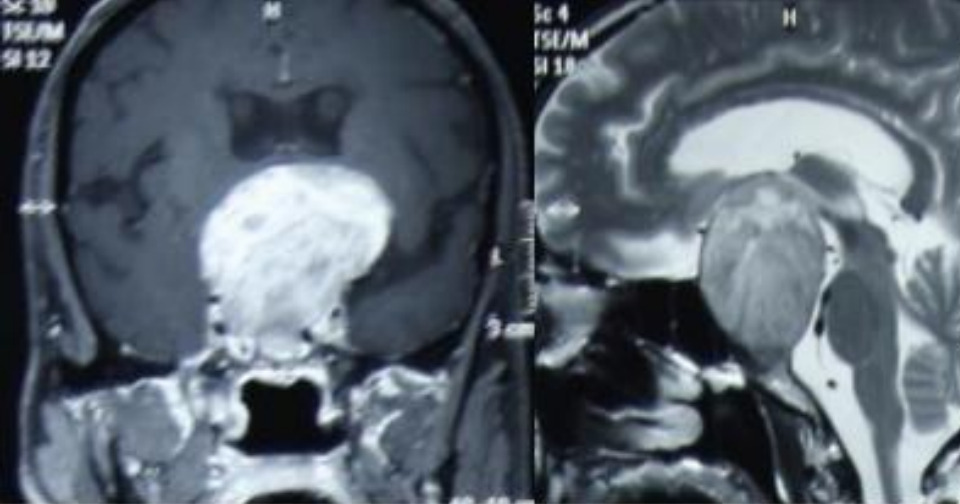


PERCENTAGE EXCISION

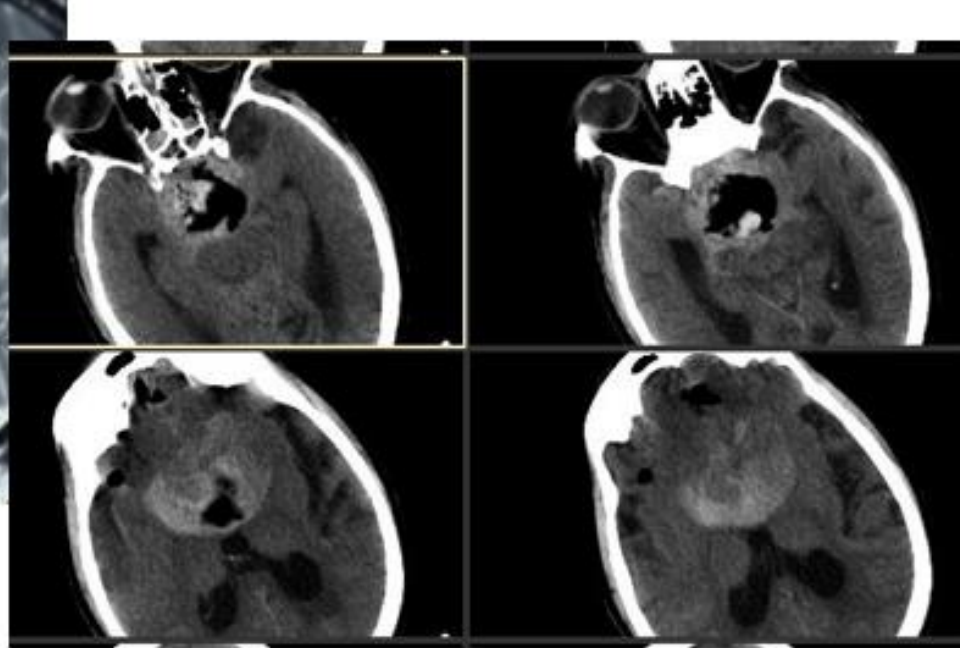


POST-OP STAY

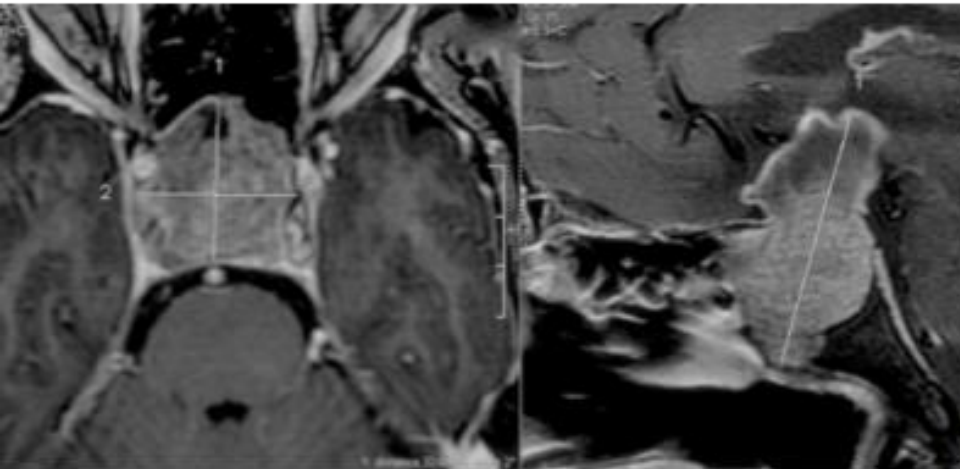




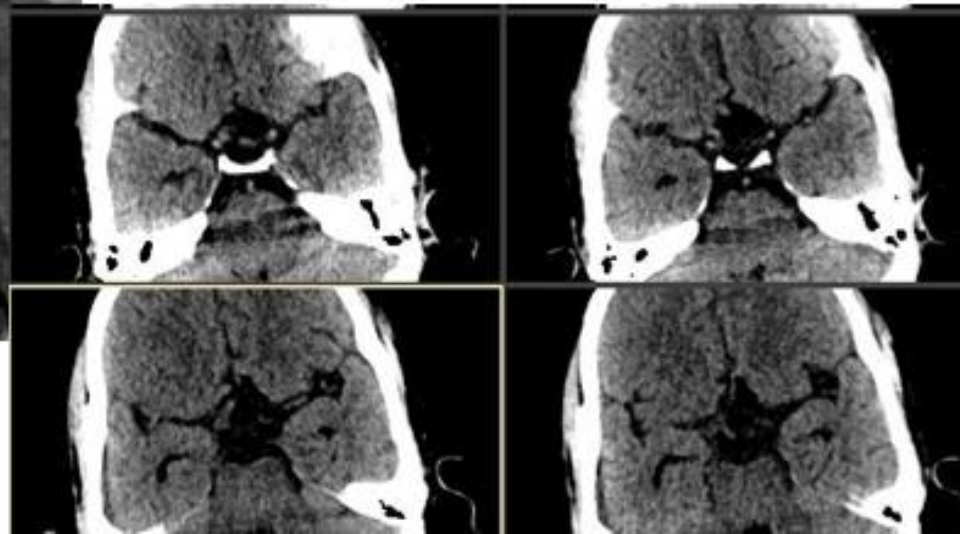
2012



LEARNING CURVE



2017



Previous studies

Study	Duration of study	Cases	Surgeons	Case Division	Learning curve after	Significant improvement
Sonnenburg et al (2004)	NA	45	1	Early 15 Middle 15 Late 15	No learning curve	none
O'malley et al (2008)	2003-2008	25	1	Early 9 Middle 8 Late 8	17 cases	Duration of surgery (3.42 hrs to 3.11 hrs to 2.22 hrs)
Leach et al (2010)	2005-2007	125	1	1 st half 53 2 nd half 72	50 cases	<ul style="list-style-type: none"> •Duration of surgery (120 to 91 mins) •Length of stay (6 to 4 days) •Visual improvement (80% to 93%)
Bokhari et al (2012)	1998-2010	79	1	Early 27 Middle 26 Late 26	30-40 cases	Endocrine Cure (15% to 41% to 78%)
Chi et al (2013)	2011-2013	80	1	Early 40 Late 40	40 cases	<ul style="list-style-type: none"> •Gross total resection (53% to 75%) •Endocrine cure (37% to 67%) •Duration of surgery (213 to 133 mins) •Length of stay (4.45 to 3.4 d)

CONCLUSIONS

- Endoscopic endonasal surgery is a novel technique that **requires technical expertise**
- Existence of **definite learning curve** for mastering its subtle nuances
- Giant pituitary adenomas and recurrent macroadenomas offer a unique surgical challenge
- With more case experience, operative outcomes show marked improvement
- Even surgeons with varying experience with microscopy previously can achieve similar learning curves



THANK YOU

