

# Postoperative CSF Leaks in 1,119 Transsphenoidal Surgery Patients: A Single Institutional Experience Over Time



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Introd	luction

Postoperative CSF leaks remain a significant source of morbidity after transsphenoidal surgery (TSS). However, with improvements in sellar reconstruction methods and increased utilization of techniques such as fat grafting and vascularized nasoseptal flaps the incidence of postoperative CSF leaks has been expected to decrease over time.

We aimed to characterize the clinical outcomes and factors predictive of postoperative CSF leaks in patients with symptomatic sellar pathologies who underwent TSS.

### **Methods and Materials**

### **Baseline Characteristics**

	No CSF Leak (n=1086)	CSF Leak (n=33)	
Female Gender	607 (55.9%)	20 (60.6%)	
Age	49.56 ± 16.7	55.3 ± 17	
Pituitary Adenoma	777 (71.5%)	14 (424%)	
Apoolexy	54 (5%)	4 (12.1%)	
Hypopituitarism	99 (9.1%)	8 (24.2%)	
Headache	544 (50.1%)	16 (48.5%)	
Tumor Induced Visual Loss	398 (36.6%)	21 (63.6%)	
CN III Palsy	34 (3.1%)	1 (3%)	Dr
CN VI Palsy	32 (2.9%)	0 (0%)	Pie
Diabetes Mellitus	145 (13.4%)	1 (3%)	
Hypertension	337 (31%)	9 (29.3%)	
Coronary Artery Disease	33 (3%)	1 (3%)	
Stroke	4 (0.4%)	0 (0%)	
Hyperlipidemia	219 (20.2%)	7 (21.2%)	
Tobacco	61 (5.6%)	3 (9.1%)	
Obesity	71 (6.5%)	3 (9.1%)	
Synthroid	239 (22.9%)	9 (27.3%)	
Cytomel	1 (0.1%)	0 (0%)	
Diabetes Mellitus Oral	97 (9%)	0 (0%)	
Insulin	34 (3.2%)	2 (6.1%)	
GH	9 (0.8%)	0 (0%)	
Testosterone	58 (5.4%)	2 (6.1%)	
Desmopressin	34 (3.1%)	4 (12.1%)	Pos
HTN	263 (24.4%)	8 (24.2%)	
Beta Blocker	142 (13.1%)	6 (18.2%)	
Statins	190(17.6%)	10 (30.3%)	
Cabergoline	68 (6.3%)	1 (3%)	
Somatostatin Analogues	18 (1.7%)	0 (0%)	
Prior Radiation	42 (3.9%)	1 (3%)	
Prior Pituitary Surgery	228 (21.2%)	9 (27.3%)	

### **Pre and Postoperative Labs**

		No CSF Leak (n=1086)	CSF Leak (n=33)
	Hyponatremia	37 (3.6%)	2 (6.5%)
	Hypernatremia	18 (1.7%)	2 (6.5%)
	Hypothyroidism	336 (32.9%)	14 (42.4%)
	Hyperthyroidism	18 (1.8%)	0 (0%)
	Hypoadrenalism	185 (18.2%)	10 (31.3%)
	Hyperadrenalism	125 (12.3%)	3 (9.4%)
	Hypogonadism	222 (22.8%)	9 (29.6%)
Prooperativo	Hypergonadism	17 (1.7%)	0 (0%)
Preoperative	Hypoprolactinemia	39 (3.9%)	1 (3.1%)
	Hyperprolactinemia	369 (36.9%)	4 (12.5%)
	Low GH	67 (7%)	2 (6.7%)
	High GH	174 (18.2%)	0 (0%)
	Low ADH	54 (21.8%)	3 (25%)
	High ADH	3 (1.2%)	0 (0%)
	Hypocortisolism	180 (19%)	11 (37.9%)
	Hypercortisolism	166 (17.6%)	4 (13.8%)
	Hyponatremia	329 (31.2%)	19 (63.3%)
	Hypernatremia	81 (7.7%)	9 (30%)
	Hypocortisolism	218 (25%)	11 (47.8%)
	Hypercortisolism	490 (56.3%)	11 (47.8%)
	Hypothyroidism	316 (31.6%)	20 (64.5%)
	Hyperthyroidism	4 (0.4%)	1 (3.1%)
Postonorativo	Hypoadrenalism	281 (27.5%)	14 (43.8%)
Postoperative	Hyperadrenalism	33 (3.2%)	0 (0%)
	Hypogonadism	120 (17.8%)	5 (20%)
	Hypergonadism	7 (1%)	0 (0%)
	Hypoprolactinemia	47 (5.7%)	3 (9.7%)
	Hyperprolactinemia	76 (9.2%)	4 (12.9%)
	Low GH	26 (3.8%)	3 (13.6%)
	High GH	61 (8.8%)	0 (0%)

In this single institution, retrospective study, a large cohort of 1,119 patients diagnosed with sellar pathologies by MRI and who underwent transsphenoidal surgery between 2008 and 2019 were examined. Lesion, surgical technique, clinical, and endocrinological characteristics at baseline and postoperatively were tracked. Hormone values were measured at baseline and up to 3 years postoperatively. Lesion size and location were determined using preoperative magnetic-resonance-imaging (MRI) and computerized-tomography (CT) imaging.

### Results

The overall postoperative CSF leak rate was 2.9%. The CSF leak rate overtime decreased from 7% in 2008 to below 4% by 2019 with an overall downward trend. Pathologies with the highest postoperative CSF leak rates included craniopharyngioma (22%), abscess/meningitis (50%), and meningiomas (14%). Nonfunctioning pituitary adenomas, despite having a high rate of intraoperative CSF leaks (40%) were among the lowest rates of postoperative CSF leaks after the index operation (2%).

Visual loss, as defined by tumor induced acuity or visual-field deficits, were more prevalent in patients with postoperative CSF leaks (63.6% vs. 36.6%). Patients with postoperative CSF leaks experienced lower rates of pituitary adenoma pathology (42.4% vs 71.5% respectively). Moreover, tumor induced hypopituitarism rates were higher among the CSF leak group (63.6% vs 36.6%). Preoperative desmopressin prescription rates were similarly higher in the group of patients experiencing postoperative leaks (12.1% vs 3.1%). The most common preoperative symptom was headache (50.1% vs 63.6% in patients without vs with postoperative CSF leaks respectively).

**Postoperative CSF Leak Rate By Year** 





Hyperprolactinemia and high GH preoperatively were more commonly observed in the no CSF leak group (36.9% vs 12.5%, and 18.2% vs 0%) respectively). However, preoperative hypocortisolism was more common in the postoperative CSF leak group (37.9% vs 19%). Multiple types of postoperative hormone dysfunction were noted in patients with CSF leaks postoperatively including low GH, hypothyroidism, hyperthyroidism, hypoadrenalism, hypernatremia, hyponatremia, and hypocortisolism.

Patients with postoperative CSF leaks had lesions with higher rates of suprasellar-extension and cystic morphology (75.9% vs 57.9%, and 55.6% vs 27.5%). Notably, the use of microscopic approach in comparison to endoscopic was associated with increased postoperative leak rates.

As expected, intraoperative leak was also a significant factor that correlated with increased rates of postoperative CSF leaks (54.5% vs 34.9%). Therefore, additionally the intraoperative leaks warranted increased utilization of closure methods such as fat grafts, fascia grafts, and nasoseptal-flap construction. Postoperative rates of infection, reoperation, and visual deficits were unsurprisingly higher in the CSF leak group.

Multivariate logistic regression demonstrated that having a pathology other than a pituitary adenoma (OR 0.13: 95% CI: 0.05-0.34), having received microscopic TSS (OR 3.89: 95% CI: 1.11-13.59), and having experienced intraoperative CSF leaks (OR 2.99: 95% CI: 1.15-7.75) as predictive of postoperative CSF leaks.

		No CSF Leak (n=1086)	CSF Leak (n=33)
Radiological Characteristics	Maximum Diameter	1.97 ± 1.2	2.4 ± 1.1
	ABC/2	4.46 ± 6.7	5.2 ± 4.4
	Size>1cm	796 (81.2%)	26 (92.9%)
	Cystic	256 (27.5%)	15 (55.6%)
	Invasive	179 (19.3%)	5 (19.2%)
	Intrasellar	903 (91.8%)	23 (82.1%)
	Suprasellar	558 (57.9%)	22 (75.9%)
	Parasellar	80 (8.4%)	1 (3.7%)
Pathology	Atypical	50 (5.2%)	3 (10%)
	FSH+	171 (17.4%)	4 (14.3%)
	LH+	136 (13.8%)	7 (25%)
	GH +	232 (23.6%)	6 (21.4%)
	ACTH+	238 (24.2%)	5 (17.9%)
	TSH+	92 (9.4%)	3 (10.7%)
	Prolactin+	271 (27.6%)	5 (17.9%)
	P53+	338 (41.4%)	8 (38.1%)
	MIB	3.6 ± 7.3	$1.8 \pm 1$

### Site Infection 1 (3%) 3 (0.3%) Visual Deficit 3 (9.1%) 10 (1.8%) 30 (2.8%) 23 (69.7%) Reoperation 18 (1.7%) 0 (0%) Hemorrhage 0 (0%) Sinusitis 12 (1.1%) 17 (51.5%) Readmission 88 (8.1%) 23 (2.2%) 1 (3%) **Dopamine Agonist** 23 (69.7%) Thyroid Hormone Replacement 315 (29.7%) 3 (9.1%) 77 (7.2%) Testosterone Replacement Estrogen Replacement 12 (1.1%) 0 (0%) 15 (45.5%) 332 (31.2%) Cortisol Replacement 10 (0.9%) 1 (3%) Sandostatin 11 (33.3%) Desmopressin 78 (7.3%)

### **Surgical Techniques**

### **Multivariate Regression**

**Odds Ratio** 

0.13

3.89

2.99

1.62

1.43

1.37

3.45

## Conclusions

Lesion type, surgical approach, and intraoperative CSF leak incidence were predictive of postoperative CSF leak occurrence in multivariate logistic regression analysis. Additionally, CSF leak rate has decreased overtime despite similar rates of intraoperative leaks likely due to improved repair by multiple techniques.

	No CSF Leak (n=1086)	CSF Leak (n=33)	
Microscopic	82 (7.6%)	6 (18.2%)	Path Pituitary Adenoma
Endoscopic	1037 (95.8%)	31 (93.9%)	, ,
Combined	65 (6%)	4 (12.9%)	Microscopic
Fat Graft	473 (43.6%)	25 (75.8%)	Intraoperative CSE Leak
Fascia	12 (2.7%)	6 (30%)	
Nasal Packing	362 (33.5%)	12 (36.4%)	PreOp Max Diameter
Lumbar Drain	40 (3.7%)	3 (9.1%)	Cuprocollor
Nasal Flap	59 (5.4%)	10 (30.3%)	Suprasellar
GTR	357 (65.9%)	13 (54.2%)	GTR
Intraoperative Leak	379 (34.9%)	18 (54.5%)	
Adherent Tumor	102 (9.7%)	5 (15.2%)	Endoscopic

Lower Bound

0.05

1.11

1.15

1.02

0.46

0.49

0.34

**Upper Bound** 

0.34

13.59

7.75

2.56

4.40

3.86

35.11