Pilot Study on Early Postoperative Discharge in Pituitary Adenoma Patients: Effect of Socioeconomic Factors and Benefit of Specialized Pituitary Centers

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Abstract

Keywords

- ▶ pituitary adenoma
- ▶ specialized pituitary centers
- ▶ skull base surgery
- ▶ endoscopic surgery
- ▶ socioeconomics
- ▶ early discharge

Introduction Pituitary neoplasms are benign entities that require distinct diagnostic and treatment considerations. Recent advances in endoscopic transsphenoidal surgery have resulted in shorter lengths of stay (LOS). We implemented a postoperative day (POD) 1 discharge paradigm involving a multidisciplinary approach and detailed preoperative evaluation and review of both medical and socioeconomic factors.

Methods The experience of a single neurosurgeon/ears, nose, throat (ENT) team was reviewed, generating a preliminary retrospective database of the first 30 patients who underwent resection of pituitary lesions under the POD 1 discharge paradigm. We assessed multiple axes from their preoperative, in-house, and postoperative care.

Results There were 14 men and 16 women with an average age of 53.8 years (range: 27–76 years). There were 22 nonsecretory and 8 secretory tumors with average size of 2.80 cm (range: 1.3–5.0 cm). All 30 patients underwent preoperative ENT evaluation. Average LOS was 1.5 ± 0.7 days. A total of 18 of 30 patients were discharged on POD 1. The insurance status included 15 with public insurance such as emergency Medicaid and 15 with private insurance. Four patients had transient diabetes insipidus (DI); none had permanent DI. Overall, 28 of 30 patients received postoperative steroids. Factors that contributed to LOS > 1 day included public insurance status, two or more medical comorbidities, diabetes mellitus, transient panhypopituitarism, and DI.

Conclusion The implementation of a POD 1 discharge plan for pituitary tumors is feasible and safe for elective patients. This implementation requires the establishment

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of a dedicated Pituitary Center model with experienced team members. The consistent limitation to early discharge was socioeconomic status. Efforts that incorporate the analysis of social disposition parameters with proper management of clinical sequelae are crucial to the maintenance of ideal LOS and optimal patient outcomes.

Introduction

Pituitary neoplasms of the sellar and parasellar regions are benign entities that require unique and distinct diagnostic and treatment considerations. Their clinical presentation and treatment outcomes have been well described.^{1–5} The incidence of diagnosis has been increasing in the United States.⁶ Optimal outcomes are portended by multidisciplinary efforts in which endocrine, ophthalmologic, and neurosurgical recommendations are reviewed. Advances in endoscopic transsphenoidal surgery as well as neuroimaging have further helped in the evaluation and management of these lesions. Several case series over the past few years have demonstrated comparable, if not greater, efficacy of the endoscopic technique to that of the microscopic route of pituitary resection.^{7–12} The literature describes decreased rates of complication, greater extent of resection, and decreased hospital stay with increasing experience with the approach.^{13–18} Two recent meta-analyses of 821 and 1,014 patients, respectively, suggested an advantage of the endoscopic approach when compared with historical data in achieving gross tumor resection and improved endocrinologic outcomes of hormone-secreting tumors. Perhaps most importantly, the complication results were comparable with similar rates of cerebrospinal fluid (CSF) leak and permanent diabetes insipidus (DI).^{8,19} An additional advantage of the endoscopic approach maybe the shortened recovery time and postoperative management of the patient. A review of prior studies comparing the length of stay (LOS) of the microscopic approach versus the endoscopic approach demonstrates a range of 5.3 to 8.3 days for various microscopic approaches and 3.1 to 3.7 days for the endoscopic endonasal approach.^{13,15,20–25} Some centers have recently demonstrated a shortened stay of 2.5 days.¹⁹ Studies have shown that various factors prolong overall LOS including old age, greater than two medical risk factors, diabetes mellitus, and lack of employment.^{26,27} In our institution, we have begun a pilot program of discharging patients on postoperative day (POD) 1 when clinically applicable.

This article analyzes a single-institution patient cohort in which multiple variables are examined to prescribe a treatment regimen that optimizes patient outcome and respective LOS. The treatment paradigm has been aided by the many recent advances in endoscopic transsphenoidal surgery and neuroimaging. This has resulted in shorter LOS and quicker recoveries. At our institution, we have implemented a POD 1 discharge paradigm through detailed preoperative evaluation and review of both medical and socioeconomic factors. This

paradigm involves a multidisciplinary approach including contributions from endocrine, neuro-ophthalmology, and ears, nose, throat (ENT) specialties. A recent study of 50 patients demonstrated a short stay protocol with the goal of discharge on POD 1 with low readmission and complication rates.²⁸ Most studies indicate that LOS is the most important contributor to hospital cost per procedure.^{29–31} In this study, we analyze our initial pilot series of POD 1 pituitary patients and their clinical outcome with attention to the global limitations to discharge.

Methods

The experience of a single neurosurgeon/ENT surgeon team was reviewed, and a comprehensive retrospective database was generated to identify the first 30 patients who underwent the resection of pituitary lesions during the implementation of our pilot POD 1 paradigm. This study was approved by the institutional review board (Study HSM14–00346/GC014–0688). These first 30 patients had the following parameters: any pituitary tumor (secretory or nonsecretory), elective admission, adult population (age 25–76 years), of which we were able to find pre- and postoperative data outcomes of at least 3 months of follow-up. We assessed multiple axes of this patient population from their preoperative, in-house, and postoperative care (►Table 1). We evaluated each patient's medical record for age, gender, tumor characteristics, LOS, complications, detailed neuro-ophthalmologic evaluation (preoperative and postoperative visual defects), insurance type, 30-day readmission, and medical comorbidities including diabetes mellitus, hypertension, hyperlipidemia, obesity (defined as body mass index > 30), preexisting sinus disease, cardiac disease, and cerebrovascular accident. Additional variables that were also analyzed include postoperative steroid use, antibiotic dosing, and development of central DI (defined as sodium > 140 mEq/L). Statistical analysis via Statistical Analysis System (SAS Institute Inc., Cary, North Carolina, United States) was used to assess the significance of the results.

For this preliminary pilot series, we devised an algorithm to promote safe discharge on POD 1 for our endoscopic pituitary adenoma resections (►Fig. 1). All patients referred for pituitary adenoma evaluation are scheduled for an appointment with both the neurosurgeon and the ENT surgeon. If a surgical procedure is indicated, the procedure and expectations of surgery that include the endoscopic approach, the need for DI and endocrine function postoperative monitoring, and visual examination assessments

Table 1 Demographics/multiple axes of patient population

Age	
Male (n = 14)	56.0 ± 13.7 y
Female (n = 16)	51.9 ± 14.2 y
Overall (n = 30)	53.8 ± 13.9 y
Tumor type	
Nonsecretory	22
Secretory	8
Growth hormone	4
Prolactin	3
Gonadotropin-releasing hormone	1
Tumor size	
Nonsecretory (n = 22)	2.7 ± 0.9 cm
Secretory (n = 8)	3.1 ± 1.4 cm
Overall (n = 30)	2.8 ± 1.1 cm
Comorbidities	
Diabetes mellitus	5/30
Hypertension	10/30
Hyperlipidemia	9/30
Obesity (BMI > 30)	5/30
Cardiac disease	1/30
Length of stay	
	1.5 ± 0.7 d
Insurance status	
Public	15
Private	15
Diabetes insipidus (sodium > 145 mEq/L)	4/30 (transient); 0/30 (permanent)
Preexisting sinus disease	12/30
Postoperative steroids	28/30
Postoperative endocrine abnormalities	5/30
30-d readmission	1 (SIADH)

Abbreviations: BMI, body mass index; SIADH, syndrome of inappropriate antidiuretic hormone.

are discussed at this neurosurgery preoperative appointment. It is at this time that the expectation of a postoperative discharge on day 1 is explained barring any major complications from surgery. In addition, each patient undergoes a preoperative ENT evaluation that includes evaluation of the sinus anatomy and any preexisting sinus disease. If any sinus infection is found, a preoperative antibiotic regimen is prescribed. A preoperative ophthalmologic evaluation is also conducted. Finally, an endocrine assessment is obtained if not already completed.

On the day of surgery, both the neurosurgeon and ENT surgeon meet with the patients in the preoperative holding area. The surgery is again explained, all questions are answered, and the expectation of POD 1 discharge is reiterated.

Fig. 1 Algorithm for safe discharge on postoperative day (POD) 1. ENT, ears, nose, throat.

Surgical technique was standard using the endoscopic endonasal transsphenoidal approach using a high-definition three-dimensional endoscope and the use of both nasal passages. Nasal septectomy and sphenoidotomy were performed to access the sella to perform gross total tumor resection. In routine surgeries where no CSF was encountered, a measured DuraGen XS (Integra LifeSciences Corp., Plainsboro, New Jersey, United States.) graft was used as an overlay repair of the dura. In surgical cases where a low-flow CSF leak was identified in the diaphragm, we used a combination layer of AlloDerm (LifeCell Corporation, Bridgewater, New Jersey, United States) as an inlay graft combined with

DuraGen XS (Integra LifeSciences Corp.) as an overlay graft. This was sealed with fibrin glue. MeroCel (Medtronic, Inc., Mystic, Connecticut, United States) was then used as a support for the graft and posterior septum. In surgical cases where a high-flow leak was identified, we applied a nasal septal flap³² to the previously described repair. No lumbar drains were used throughout the series.

On the morning after surgery, a member of the surgical team visited the patient, and a visual and endocrinologic assessment was obtained in addition to monitoring for DI. If a sodium (Na) level > 145 mEq/L was noted, one dose of desmopressin was administered, and a prescription was given per endocrinology. At this time, a social worker with the ability to make appointments met with all patients to ensure proper postoperative care. When the patient is deemed ready, he or she was discharged home with a low-dose glucocorticoid prescription if there were no contraindications through the guidance of endocrinology. As evidenced by a recent survey, there is great variability with regard to prescribing postoperative steroids to patients with pituitary adenomas.³³ Our belief is that the use of glucocorticoids helps with postoperative sinonasal inflammation and reduces postoperative discomfort and pain. On the day after discharge, a pituitary nurse called the patient at home for assessment and ensured the proper appointments and prescriptions have been obtained. Their first outpatient follow-up appointment is held within 7 to 10 days after surgery with the first postoperative magnetic resonance imaging scheduled at 3 months. With this algorithm, we were able to safely discharge 18 of 30 patients on POD 1.

Results

Of these first 30 patients in our pilot series, 14 were men and 16 were women. The average age was 53.8 years (range: 27–76 years). All 30 patients underwent preoperative ENT evaluation to investigate sinus anatomy and any sinus pathology. There were 22 nonsecretory tumors and 8 secretory tumors. Of the secretory type, four were growth hormone-secreting tumors, three were prolactinomas, and one was a gonadotroph-secreting tumor. The average size of the tumors was 2.80 cm (range: 1.3–5.0 cm). The average LOS for the patient cohort ($n = 30$) was 1.5 ± 0.7 days. Eighteen of the 30 patients were discharged on POD 1. Medical comorbidities are presented in ►Fig. 2. The insurance status of the patients ranged from 15 with public insurance including emergency Medicaid and 15 with private insurance (►Fig. 3). No postoperative CSF leaks were identified in our series. There was only one 30-day readmission for syndrome of inappropriate antidiuretic hormone. There were four patients with transient DI as defined by a sodium (Na) value > 145 mEq/L, and there were no patients with permanent DI. Overall, 28 of 30 patients were administered postoperative steroids. The two who were not had poorly controlled diabetes. Based on our analysis of this pilot study, the factors that contributed to LOS > 1 day included public insurance status, two or

Fig. 2 Medical comorbidities. CVD, cerebrovascular disease; DM, diabetes mellitus; HLD, hyperlipidemia; HTN, hypertension.

more medical comorbidities, diabetes mellitus, transient panhypopituitarism, and DI (►Table 2). Interestingly, the most significant correlative factor in their delay in discharge was their socioeconomic disposition and not their medical or surgical status.

Discussion

The recent advances in pituitary surgery have led to improved patient outcomes in different parameters.^{8,19} The specific advantages of the endoscopic approach appear to be promising although not yet fully studied. What remains true throughout, however, is that management regimens that incorporate endocrine, ophthalmologic, and neurosurgical consultation are crucial to optimal patient outcomes in pituitary surgery.³⁴ For our initial pilot series, we devised an algorithm to promote safe discharge on POD 1 for our endoscopic pituitary adenoma resections. Although this algorithm is meant to apply to elective patients, many of the principles set forth do also apply to emergent or transfer patients.

Importance of Specialized Pituitary Centers: Hospital Cost

With the growing utilization of quality assessment and health care cost analysis, socioeconomic factors will become even more relevant for improved patient outcomes. Subspecialized surgical care incorporating a tested algorithm for treatment of a specific pathology will help increase quality and lower

Fig. 3 Insurance status.

Table 2 Factors leading to length of stay > 1 day

Reasons for length of stay > 1 d	12 patients
Insurance/Social disposition	8
Two or more medical comorbidities	5
Diabetes mellitus	3
Polyuria/Polydipsia or concern for diabetes insipidus	3
Panhypopituitarism	2
Age > 70 y	2
Hyponatremia	1
Other (e.g., nausea, vomiting, rhinorrhea, blurry vision)	1

costs. A recent national study of transsphenoidal surgery for Cushing disease demonstrated increased costs associated with low-volume centers and small hospitals compared with high-volume centers and large hospitals, as well as with as low as a 1% increase in LOS.³⁵ The importance of developing an algorithm at large academic centers is again demonstrated by a study showing lower costs associated with the endoscopic approach compared with the microscopic approach. The average LOS was the number-one factor affecting total cost.³⁶ Additional studies of transsphenoidal surgeries comparing the two techniques once again established LOS as the most significant factor influencing hospital costs.³⁷ Surveys have shown that the average neurosurgeon only performs 4.45 pituitary tumor surgeries per year.³⁸ Therefore, to maximize optimal outcomes, we agree with the notion of regionalization of care to centers specializing in high-volume cases for various pathologies.^{39,40}

Importance of Dual Neurosurgery/ENT Team Approach

For a treatment paradigm to be successful, we believe in a strong multidisciplinary approach. A component of that approach is a strong dual neurosurgical/ENT surgical team with combined experience in treating pituitary pathology. Studies have shown a decreased rate of complication and morbidity with an experienced collaboration.^{39–41} A 2013 study comparing pituitary surgery done by the neurosurgery team alone or a combined neurosurgery/ENT team demonstrated greater extent of resection and less blood loss with the combined team approach.⁴² Within our algorithm, all patients undergo a preoperative ENT evaluation of their sinus anatomy to prepare them for the surgical procedure. We believe that this preparation allows minimal nasal manipulation to achieve surgical exposure needed to resect the pituitary pathology. This leads to less postoperative nasal discomfort and pain, a significant factor that leads to early discharge. A nasal quality-of-life 12-item questionnaire was validated to help investigate this important factor.⁴³ The use of such tools will further aid in improving any safe and early discharge algorithm. Overall, a well-structured team with good organization not only increases quality of care but also improves outcomes. To build a successful collaboration, time

and effort for training as well as institutional support is needed.⁴⁴

Importance of High-Quality Social Work/Services

A central part of any early and safe discharge paradigm is the value of high-quality social services. Our paradigm includes a social worker meeting with all patients immediately postoperatively to ensure that they obtain proper postoperative care with the ability to maintain and attend all appointments. A recent study of medication use among inner-city patients demonstrated that ~40% of patients did not fill their prescription or waited 3 to 9 days before filling their postdischarge prescriptions. When surveyed, > 60% of the patients reported that medication counseling and follow-up telephone calls would improve their use of the medication.⁴⁵ We believe this is a crucial part in achieving optimal postoperative outcomes. Additionally, a study of 99 patients demonstrated the need for a discharge home care referral system especially for elderly patients and those with low socioeconomic social status because those without referrals were at greater risk for poor discharge outcomes and readmissions.⁴⁶ Although this may initially increase costs somewhat, we believe overall cost is less due to better postoperative outcomes and fewer hospital readmissions.

Limitations

We recognize this is a limited pilot study. Statistical analysis of any of this data are therefore limited and may be anecdotal; however, within this data set were clear trends that were observed and consistent relative to many other varied parameters. We believe it is the detail of the clinical parameters analyzed that gives our study some validity. Among these 30 patients, Cushing disease was not noted. Therefore, testing of this protocol in such patients was not undertaken. However, we believe close collaboration with endocrinology and monitoring of cortisol levels with proper replacement dosing can lead to the implementation of our protocol in Cushing disease as well. In this report, we attempted to establish a pilot study that can then be refined in methodology to be used in a larger study at our institution.

Conclusion

Based on our structured pilot study, the implementation of a POD 1 discharge plan for pituitary tumors is feasible and safe for elective patients. This implementation requires establishing a dedicated Pituitary Center model with experienced team members. Multidisciplinary team efforts that incorporate analysis of social disposition parameters, such as medical insurance, postoperative follow-up plan, and medication education, are crucial to maintaining reasonable LOS and optimal patient outcomes. In our pilot study, no increased morbidities or follow-up complications were encountered as compared with the standard in the literature. The thorough evaluation by a multidisciplinary team enables identification of appropriate risk factors, which can almost all be addressed.

In our study, the consistent limitation to early discharge was patients' socioeconomic status. Efforts that incorporate analysis of social disposition parameters, such as insurance status, with proper management of clinical sequelae and close in-home management are crucial to the maintenance of ideal LOS and optimal patient outcomes. In the growing model of quality assessment and health care cost analysis, we believe socioeconomic factors will become even more relevant for improved patient outcomes. Further detailed prospective studies are warranted to investigate barriers preventing postoperative discharge.

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