surgical procedure and we have observed that the adequate results have maintained in time.

This is a case report; more studies are needed to confirm our results. A great advantage of our proposed surgical management is that the donor site is avoided, a vital reason when talking about a child. In this patient, that was not true because the patient arrived to our clinic when he had already undergone a free flap, which failed to achieve its purpose.

A disadvantage of our proposed surgical management is the cost of the Integra and in a less amount the HarvestPRP. But once again, when we plan to treat a child the cost should not be an important factor when it implies less surgical times and less morbidities with excellent results that persist in time.

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Acute Hemorrhagic Apoplectic Pituitary Adenoma: Endoscopic Management, Surgical Outcomes, and Complications

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Objective: To assess safety and effectiveness of endoscopic transsphenoidal surgery (ETS) for acute hemorrhagic apoplectic pituitary adenoma.

Methods: Eighty nine patients with hemorrhagic apoplectic pituitary tumor undergoing endoscopic transsphenoidal surgery were included into a retrospective chart of this study. Charts were reviewed for patient age, sex, presentation, lesion size, surgical procedure, extent of resection, clinical outcome, and surgical complications.

Results: Seventy eight (87.7%) patients achieved total resection, 9 (10.1%) had subtotal resection, and 2 (2.2%) patients had partial resection; no patient experienced insufficient resection. After surgery, 65 (90.3%) of 72 patients who had visual acuity deterioration preoperatively normalized and improved significantly; the rate for remission of visual field was 87.7%. All other acute symptoms,
such as severe headache, nausea, vomiting, alteration of mental status, and loss of consciousness, vanished postoperatively. Twenty-eight (90.4%) of 31 patients with active secreting adenoma had hormonal remission based on endocrinological evaluation. Three (3.4%) patients incurred CSF leakage which was managed with lumbar drainage. Nine (10.1%) patients incurred transient DI postoperatively, and 2 (2.2%) of them developed permanent DI. Seven (7.9%) patients developed hypopituitarism which was treated with replacement therapy of hormone. One (1.1%) experienced craniotomy for intracranial hemorrhage and died from severe surgical complications postoperatively. There were no patients of meningitis or carotid artery injury.

Conclusion: Early detection and emergent endoscopic transsphenoidal surgery provided a safe and effective surgical option for hemorrhagic apoplectic pituitary tumor with a low morbidity and mortality.

Key Words: Acute, complications, endoscope transsphenoidal surgery, hemorrhage, outcomes, pituitary adenoma, pituitary apoplexy

Pituitary tumor apoplexy, especially acute hemorrhagic apoplexy, is infrequent and life-threatening medical condition that requires emergent neurosurgical intervention, which may lead to catastrophic consequence, such as permanent blindness, coma, and even death if misdiagnosed and untreated. An appropriate and effective approach is crucial to manage the lesion with better outcomes. The original introduction into resection for the pituitary region of endoscopic transsphenoidal surgery (ETS) can be backed to the last half of the 20th century; now ETS has obtained significant popularity for the management of pituitary lesions. Is ETS also an option to treat hemorrhagic apoplectic pituitary adenoma that carries significant morbidity and mortality if untreated, especially for patients with altered consciousness, and visual loss? There was little information in the literature which exists applying ETS for management of hemorrhagic apoplectic pituitary adenoma in a high-volume series. In this study, we presented a series of 89 patients who were diagnosed hemorrhagic apoplectic pituitary adenoma and underwent an emergent operation through ETS for resection of the lesion with favorable results in a period of 10 years, which may answer the above question.

METHODS

Experimental Design

A retrospective chart analysis was performed to identify 89 patients who presented acute symptoms due to hemorrhagic pituitary adenoma and underwent a TTEA for resection of the lesion at Qilu Hospital of Shandong University between July 2004 and June 2014. Records of those patients were evaluated for patient age, sex, presentation, tumor size, extent of resection, clinical outcomes, and surgical complications. Patients without any acute symptom who preoperatively, however, informed apoplexy intraoperatively were excluded from this study, because those patients were asymptomatic and treated as general pituitary adenoma. The protocol for this study was reviewed and approved by the Ethics Committee of Qilu Hospital of Shandong University (No. KYLL-2013-010).

Endoscopic Technique

Patients were diagnosed as having acute symptoms of headache and visual loss, signs of hemorrhage on imaging examinations, and subsequent course, such as informed findings intraoperatively. All the patients were performed emergent ESETA for resection of hemorrhagic pituitary adenoma in 24 hours of initial symptoms. The detailed endoscopic procedure was described in our previous report. In most patients, the dural of the sellar floor was bluish violet and under high tension. Cruciate durotomy followed with drainage of dark red bloody fluid from sella turcica. Tumor with old blood clot was removed with curettage and/or suction, and a 30° endoscope was used to inspect the sellar region for residual tumor—which was removed. Skull base was reconstructed by the multilayered technique.

Postoperative Management

Intravenous infusion of a third-generation cephalosporin was continued for 3–7 days. Fluid intake and urine output were monitored. Hormones were replaced as necessary. MR imaging was performed within 1–3 days and at 3 months after surgery to evaluate the extent of tumor resection. Extent of resection was classified into 4 categories: total resection, subtotal resection, partial resection, and insufficient resection. Nasal packing was generally removed endoscopically 1–3 days after surgery. Patients were instructed to avoid any activity that can raise intracranial pressure such as Valsalva maneuvers or nose blowing. Lumbar drainage was applied for patients who developed CSF leakage postoperatively. Early postoperative diabetes insipidus (DI) was treated with substitution injection of Hypophysin for 3 days. Persistent DI was treated with daily administration of Minirin. We do not use controlled released vasopressin tannate because its effects may be difficult to control, and because it is an inconvenient method of treatment for patients.

Illustrative Case

This 43-year-old female patient presented with severe headache and acute deterioration of visual acuity and field. Visual acuity was 0.1/0.3 bilaterally, with bitemporal hemianopia. Admission T1-weighted MR imaging demonstrated hemorrhage in a pituitary tumor and obvious compression of the optic chiasm (Fig. 1A-B). The patient was treated with emergent endoscopic transsphenoidal surgery within 24 hours of initial presentations. Intraoperative endoscopic views showed dural of the sellar floor was bluish violet and under high tension (Fig. 1C-D). After surgery, her headache disappeared and visual acuity obviously improved to 0.5/0.8 bilaterally, with resolution of hemianopia. On follow-up at 6 months postoperatively, MR imaging demonstrated no recurrence or residual adenoma (Fig. 1E-F).
RESULTS
Cohort consisted of 37 (41.6%) male and 52 (58.4%) female patients aged 14–73 years (mean 41.8 years). Follow-up ranged from 6 to 125 months (mean 51 months). The most frequent clinical presentation was onset of severe headache, 86 (96.6%) patients experienced headache in this series, followed by nausea and vomiting (93.3%), and then deterioration of visual acuity and visual field with rates of 80.9% and 73.0%, respectively. As results of the preoperative radiological study, 46 (51.7%) showed suprasellar extension, 15 had cavernous sinus invasion, 20 showed suprasellar and cavernous sinus extension, and only 8 patients were intrasellar. Thirty one (34.8%) of the 89 adenomas were active secreting, most of which were PRL-secreting adenoma, accounting for 19.1% of 89 patients (Table 1).

Seventy eight (87.7%) patients achieved total resection, 7 (7.9%) had subtotal resection, and 2 (2.2%) patients had partial resection; no patient experienced insufficient resection. After surgery, 57 (90.5%) of 63 patients who had visual acuity deterioration preoperatively obtained visual acuity improvement and normalization, and the rate for visual field improvement was 87.5%. Other symptoms, such as severe headache, mental status alteration, and loss of consciousness, had recovery with 100% of the rates. Endocrinological remission encountered in 28 (90.4%) of 31 patients with active secreting adenoma. Three (3.4%) patients incurred CSF leakage which was managed with lumbar drainage. Nine (10.1%) patients incurred transient DI postoperatively, and 2 (2.2%) of them developed persistent DI. Seven (7.9%) patients developed hypopituitarism which was treated with replacement therapy of hormone. One (1.1%) experienced craniotomy for intracranial hemorrhage and died from severe surgical complications postoperatively. There were no patients of meningitis or carotid artery injury (Table 2).

DISCUSSION
Apoptotic pituitary adenoma consists of approximately 10% of pituitary adenoma, and is associated with severe morbidity and potential fatality. The pathophysiological mechanism of the lesion is not being explained clearly, although pregnancy, trauma, surgery, dynamic endocrine testing, and stress can be precipitating factors. Apoptotic pituitary adenoma was classified into hemorrhagic and infarcted. Hemorrhagic apoptotic pituitary adenoma may consist of majority of these fatal clinical syndromes, and may present a series of acute symptoms including onset of severe headache, sudden decreased vision, nausea and vomiting, altered consciousness, and infrequently cranial nerve palsy. Most pituitary tumor apoplexy occurs in pituitary adenoma, although ectopic pituitary apoplexy has been described in the cavernous sinus and the clivus. The management of hemorrhagic pituitary adenoma usually involves medical treatment and emergent transsphenoidal resection of lesion, early detection and effective decompression of the optic chiasm and optic nerve may be crucial to prevent mortality.

| Table 1. Summary of Clinical Characteristics in 89 Patients |
| No | Rate |
| --- | --- |
| Sex | |
| Male | 37 | 41.6% |
| Female | 52 | 58.4% |
| Age group | |
| <20 | 3 | 3.4% |
| 20–29 | 12 | 13.5% |
| 30–39 | 34 | 38.2% |
| 40–49 | 21 | 23.6% |
| 50–59 | 9 | 10.1% |
| 60–69 | 6 | 6.7% |
| >70 | 4 | 4.5% |
| Presentations | |
| Headache | 86 | 96.6% |
| Nausea and vomiting | 83 | 93.3% |
| Visual acuity deterioration | 72 | 80.9% |
| Visual field deterioration | 65 | 73.0% |
| Alteration of mental status | 5 | 5.6% |
| Loss of consciousness | 2 | 2.2% |
| Extent of adenoma | |
| Intrasellar | 8 | 9.0% |
| Suprasellar extension | 46 | 51.7% |
| Cavernous sinus extension | 15 | 16.8% |
| Suprasellar and cavernous sinus extension | 20 | 22.5% |

| Table 2. Surgical Outcomes and Complications |
| No | Rate |
| Extent of resection | 78 | 87.7% |
| Subtotal resection | 9 | 10.1% |
| Partial resection | 2 | 2.2% |
| Pathologic type | |
| Active secreting | 31 | 34.8% |
| PRL | 17 | 19.1% |
| GH | 7 | 7.9% |
| ACTH | 4 | 4.5% |
| No secreting | 3 | 3.4% |
| Initial symptom | 58 | 65.2% |
| Headache | |
| Normalized | 86/86 | 100% |
| Nausea and vomiting | |
| Normalized | 83/83 | 100% |
| Visual acuity deterioration | |
| Normalized | 40/72 | 55.6% |
| Improved | 25/72 | 34.7% |
| No changed | 7/72 | 9.7% |
| Visual field deterioration | |
| Normalized | 43/65 | 66.2% |
| Improved | 14/65 | 21.5% |
| No changed | 8/65 | 12.3% |
| Alteration of mental status | |
| Normalized | 5/5 | 100% |
| Loss of consciousness | |
| Normalized | 2/2 | 100% |
| Endocrinologic recovery | |
| Normalized | 10/31 | 32.3% |
| Improved | 18/31 | 58.1% |
| No changed | 3/31 | 9.6% |
| Surgical complication | |
| CSF leakage | 3 | 3.4% |
| Hypopituitarism | 7 | 7.9% |
| Transient DI | 9 | 10.1% |
| Persistent DI | 2 | 2.2% |
| Intracerebral hemorrhage | 1 | 1.1% |
| Meningitis | 0 | 0% |
| Carotid artery injury | 0 | 0% |
| Death | 1 | 1.1% |

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Surgical Results

Hemorrhagic apoplectic pituitary adenoma can occur in any age group; the majority of this population was middle-aged patients who aged 30–49 years, which accounted for 61.8% of 89 patients and was consistent with prior reports. The most frequent complaint was onset of severe headache, 86 (96.6%) patients presented above symptom in this series, followed by nausea and vomiting with rate of 93.3%, headache and nausea were associated with rapid compression of sellar and parasellar structures due to expansion of hemorrhagic pituitary adenoma, and headache may also have resulted from meningeal irritation. Optic chiasm and optic nerve compression from hemorrhagic pituitary adenoma also result in sudden deterioration of visual acuity and visual field, with rates of 80.9% and 73.0%, respectively, in our series. Alerted mental status was uncommon, which occurred in 5 (5.6%) patients in the current study, but more likely to indicate damage to hypothalamus and emergent surgical management. Apoplectic hemorrhage of pituitary adenoma most typically encountered in macroadenoma, with predominance of inactive secretting adenoma. The rates of macroadenoma and inactive secretting adenoma were 91% and 65.2% in the present study in agreement with prior reports. Of active secreting adenomas accounted for 34.8% of the pituitary adenomas with hemorrhagic apoplexy, the majority was prolactin (PRL) secreting adenomas with a rate of 19.1%, which is correlated with the high prevalence of PRL-adenoma. The rate of biochemical remission for active secreting adenoma was 90.4% in our series.

During follow-up period of mean 51 months, 87.7% patients obtained total resection (Table 2), which is comparable with prior reports of endoscopic transspHENoidal surgery. The rate of resection may be associated with appropriate approach, surgeon’s experience, morphological and biological characteristics of tumor, such as volume, location, and adherence. In our opinion, good lighting and panoramic view provided by the endoscope allow the neurosurgeon to obtain a better surgical condition, which together with meticulous and precise manipulation permits the neurosurgeon to resect lesion more extensively with less injury. During the operation, the use of angled endoscopes allows the surgeon to remove the tumor around corners of surgical field. Moreover, hemorrhage from pituitary adenoma apoplexy may be helpful to resection with lower risk of impairment to parasellar neurovascular anatomy. Acute deterioration of visual acuity and visual field may be associated with rapid compression of chiasm and optic nerve due to sudden extension of the adenoma caused by intratumoral hemorrhage. Cardoso et al indicated in a review that the level of visual recovery depended mainly on early and effective transsphenoidal decompression rather than on the severity of initial visual loss. All the patients underwent emergent endoscopic transsphenoidal decompression of optic chiasm or nerve in 24 hours of onset of initial symptoms. Preoperative deterioration visual acuity and visual field were normalized or improved significantly with 90.5% and 87.5% of rates respectively, which supported previous reports. As our experience, timely and effective endoscopic transsphenoidal decompression facilitated improvement of visual symptoms.

Morbidity Related to Surgery

Despite techniques of skull base reconstruction, CSF leak remains a considerable associated complication of ETS. Three (3.4%) patients in this series experienced postsurgical CSF leak which was managed successfully with lumbar drainage, which is comparable to previously reported rates of CSF leak from ETS for the sellar and parasellar region. Factors that may lead to CSF leak include surgical manipulation, surgeon’s experience, tumor’s location, volume, and relationship to surrounding neurovascular structures. The most important factor that leads to postoperative CSF leakage might be repair technique of the skull base, although feature of the tumor and surgeon’s preference may affect surgical result. In our institute, we routinely used reconstruction of skull base on the basis of the multilayered technique with or without PNSF resulting in an excellent result, which showed that hemorrhage from pituitary tumor apoplexy did not affect reconstruction of the skull base or increase occurrence of CSF leakage. Furthermore, the unparalleled panoramic endoscopic view in ETS enables detection of tiny fistulas which can be repaired with skull base reconstruction.

Transient DI also is a common complaint related to endoscopic approach. It is possible that surgical manipulation to the sellar in the context of preexisting compromise of the blood supply to the magnocellular neurons of the hypothalamus from apoplexy manifested as a reversible disturbance of arginine vasopressin (AVP) transport to the posterior pituitary gland. In this study, transient DI was 10.1% which was consistent with most reported results. However, the presence of permanent DI (2.2%) is lower than most reported rates, and indicates that most surgical injury is reversible. Pituitary dysfunction may be associated with compression or destruction of the posterior lobe of pituitary gland from hemorrhagic apoplexy. Chowdhry et al observed in a series of 152 patients that 71% of the patients with apoplexy encountered postoperative DI. Also, 16% incidence of transient DI in patients of pituitary apoplexy was reported in a series of Randeva et al. The above observations may indicate that incurrence of DI was associated with pituitary apoplexy; therefore, timely decompression was crucial for saving endocrinological function of pituitary gland. Besides interruption of the blood supply to pituitary gland due to hemorrhage, injury or edema of pituitary stalk is an important reason that results in postoperative DI. Nemergut et al found that postoperative DI, both transient and permanent, may be associated with intraoperative leak resulting from aggressive manipulation; however, our results did not support the above conclusion. Meticulous manipulation to avoid track injury of pituitary stalk may decrease the risk of postoperative endocrinological complication. All the patients encountering hypopituitarism postoperatively were managed by replacement of hormone with better outcomes.

Intracranial hemorrhage after endoscopic resection of acute hemorrhagic pituitary tumor is uncommon and lethal, which often occurs in 12 hours after surgery, and also often encounters in the patients who experienced subtotal removal of macroadenoma. Patel and colleagues reported a patient of delayed postoperative pituitary hemorrhagic apoplexy treated by emergent reexploration. In our series, 1 (1.1%) patient incurred postoperative intracranial hematoma and died following transcranial approach. Any acute complication from hemorrhagic apoplectic pituitary tumor can lead to death; cares should be taken to prevent perioperative hemorrhage.

CONCLUSION

In the current series, we obtained excellent surgical outcomes and comparable lower complications after ETS for management of hemorrhagic apoplectic pituitary adenoma. Acute hemorrhage from apoplectic pituitary tumor is an emergent and life-threatening condition that may require surgical intervention to prevent progression and morbidity. On the contrary, ETS provided a safe and effective with prior reports for acute hemorrhagic apoplexy of pituitary adenoma. Early detection and timely emergent endoscopic transsphenoidal surgery resulted in a favorable surgical outcome with low rate of surgical complications.
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Electromyographic Evaluation of Temporalis Muscle Following Temporalis Tendon Transfer (Facial Reanimation) Surgery

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Abstract: Facial paralysis is a significant functional and aesthetic handicap. Many techniques have been defined for facial reanimation. The aim of the study was to evaluate postoperative electromyographical (EMG) activity of temporalis muscle to assess the potential neural impairments related to the surgical procedure.

Methodology: Four patients with facial paralysis were operated with the temporalis muscle tendon transfer technique. Simultaneous surface electromyographic (sEMG) activity at first postoperative year from the bilateral temporalis and masseter muscles was obtained at mandibular rest position and then during maximal clenching.

Results: Patients were followed for a minimum period of 18 months. Surface electromyographic evaluations during passive state revealed similar values for the operated and contralateral side. Measurements during active “clench-smiling” of the jaw revealed similar amplitudes for both muscles of the operated side in all cases except case #2. Case #2 revealed lower values for both measurements of temporalis and masseter muscles of the operated side compared with the contralateral side. Dissonant results of case #2 can be the consequence of impaired temporalis muscle activity because of the tension on the muscle as a consequence of overcorrection.

Conclusion: Temporalis muscle transfer to the perioral region does not hinder contractility of the muscle as long as the facial deformity is not overcorrected.

Key Words: Facial paralysis, facial reanimation, temporalis tendon transfer, electromyography

Facial paralysis is considered a significant functional and aesthetic handicap. It severely impairs mastication, speech production, and eye protection, but above all it deprives one of the essential means of mental and affective expressions: mimesis and the smile. Many operative techniques have been defined for facial reanimation. Rubin, Baker, and Conley popularized use of the temporalis muscle turn-down flap in reanimation of the paralyzed lower face in the early 1970s. The classic technique of temporalis muscle transfer described by Rubin and others has the disadvantages of donor site depression and midfacial widening. In addition, it depends on a nonanatomic contraction of the transposed muscle segment. McLaughlin described the orthodromic transoral technique for transferring the coronoid process with the attached temporalis tendon to the corner of the mouth. This process avoids the fullness over the zygomatic arch area and the temporal donor site depression that is produced by the turned-down temporalis muscle flap. Dynamic temporal muscle tendon transfer was recently reintroduced and refined by Boahene et al.

As with the other muscles of mastication, control of the temporal muscle comes from the third (mandibular) branch of the trigeminal nerve. Specifically, the muscle is innervated by the deep temporal nerves. Thorough dissection and freeing of the temporalis muscle required for complete releasing and transfer of the tendon with the coronoid process is needed during this procedure. Temporalis tendon transfer necessitates to stretching of the tendon along with the coronoid to the perioral region. It is necessary to mobilize the temporalis muscle by performing releasing dissections over and below the muscle and tendon. Temporalis muscle innervation has the potential to be injured because of exposure, release, and transfer of the temporalis muscle tendon.

Surface electromyography (sEMG) has been reliably used to evaluate the functional status and innervation of the facial musculature after surgery. The aim of this study was to evaluate postoperative electromyographical (EMG) activity of temporalis muscle in comparison with the unoperated contralateral side.

PATIENTS AND METHODS

Four patients who had facial paralysis >2 years were operated with the temporalis muscle tendon transfer technique as reported by Boahene et al.

Surgical Technique

Through the melolabial crease, an approximately 2-cm incision was made. Through this incision, dissection was bluntly performed in the buccal space, and deep retractors were placed to retain the buccal fat. By palpation and by manually opening and closing the jaw, the anterior edge of the ascending mandibular ramus was identified. Using an angled clamp, the mandibular notch was identified, and the coronoid process was exposed. Dissection was performed bluntly to expose the anterior edge of the ascending mandibular ramus. Using electrocautery, the periosteum was incised, and soft tissues enclosing the temporalis tendon were elevated from the medial and lateral aspects of the coronoid process and ascending ramus. The coronoid process was cut of using osteom and drill-burr at the level of incisura mandibula and kept attached with the temporal tendon. Temporalis tendon was isolated as medial as possible and down to the buccinator muscle to obtain adequate tendon length. The temporalis tendon was transposed through the buccal space and was secured to the orbicularis oris and zygomaticus muscle insertion. The tendon was then sutured into place with 3-0 taper mattress sutures. Incisions were meticulously