

Observation on curative effect of two kinds of surgical methods of pituitary adenoma resection

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Abstract: Objective: To compare the clinical data of pituitary adenoma resection with pterional approach and transsphenoidal approach, to analyze its advantages and disadvantages, and to provide reference for clinical diagnosis and treatment. **Methods:** From March 2010 to March 2014, 54 patients with pituitary adenoma were randomly divided into microscopy pterional group (31 cases) and microscopy nasal sphenoid sinus group (23 cases). Using a microscope under the pterional approach and a single nasal sphenoid sinus approach to the surgical operation of the microscope. The results showed that the operation time, intraoperative blood loss, hospitalization time, effective resection rate and postoperative complications (mainly after a transient diabetes insipidus and transient electrolyte disorder) were observed. Hormone levels and the patient's 1-year follow-up results of the comparison. **Results:** There was no significant difference in the clinical data between the two groups. The average operative time (121.3 ± 19.4) min in the pterional group was significantly higher than that in the nasal sphenoid sinus group (78.5 ± 7.8) mL compared with the nasal sphenoid sinus group (50.3 ± 3.2) mL, statistically significant ($P < 0.05$). There was no significant difference in the effective resection rate (91.3% vs 93.5%, $P > 0.05$), and the postoperative complications (including one hyperthyroidism and transient electrolyte imbalance) occurred no significant difference. All patients 1 year follow-up results can be seen, the two groups of long-term efficacy are better. Comparison between different type of tumors showed that there were some changes when pterional pterional and transsphenoidal pre-surgery and post-surgery, secretion of PRL are [(387.3 ± 100.8) ng / mL vs (145.3 ± 27.4) ng / mL] and [(390.2 ± 133.7) ng/ml vs (148.4 ± 57.2) ng/ml]、GH [(63.4 ± 5.7) ng/ml vs (10.6 ± 2.4) ng/ml] and [(65.6 ± 6.2) ng/ml vs (12.4 ± 1.6)ng/ml]、ACTH [(202.9 ± 73.7) ng/l vs (38.5 ± 4.6) ng/l] and [(206.8 ± 78.6) ng/l vs (35.6 ± 2.5) ng/l], the difference was significant ($P < 0.05$). There was no significant difference between the two groups ($P > 0.05$). **Conclusion:** There is no significant difference in the curative effect of two groups of surgical treatment of pituitary adenoma. The operation time and operation blood loss of

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pituitary adenoma resection are superior to those of pterional infusion, which is minimally invasive, safe and effective, the clinical efficacy of the exact, worthy of further promotion.

Keywords: Pituitary adenoma resection; via pterional approach; transnasal approach; prospective study

Pituitary adenoma is one of the more common endocrine neoplasms, is a benign tumor, exists in the brain, slow growth, so the early onset of the disease is often no obvious signs and symptoms. With the development of the disease, intracranial nerve will be compressed gradually and pituitary adenoma will be dysfunction, then patients often show neurological and endocrine dysfunction¹⁻³. In clinical, the effective method of pituitary adenoma treatment is surgical treatment. With the continuous development and application of minimally invasive technology, neuroendoscopic transsphenoidal approach pituitary adenoma resection gradually applied to the treatment of pituitary adenomas, it was very effective, contribute to the prognosis of patients⁴⁻⁶. In clinical, pituitary adenoma treatment requires not only surgical treatment, but also need to radiation therapy and drug treatment to be assisted. The main purpose of surgical treatment is to remove the tumor, reduce the pressure of the visual pathway, and restore the function of the nervous system and pituitary. Major surgical procedures include pterygoid approach and transsphenoidal resection of pituitary adenomas, if the tumors grew larger and in the back of the brain, transsphenoidal resection is very difficult, so the tumor will be cut by using pterional approach. In recent years, with the continuous progress of medical technology and the continuous development of the nasal transsphenoidal approach pituitary adenoma resection, this technique has been gradually adopted by domestic and foreign surgeons. Currently widely used in clinical treatment for the pterional approach and transnasal approach to pituitary adenoma resection. According to the data of clinical cases in this unit, the authors analyze the advantages and disadvantages of these two, and provide some references to the majority of clinical workers.

1. Materials and Methods

1.1 General information

A prospective study was conducted in 54 cases, 31 cases of pterional pterional approach (14 males and 17 females), and 23 cases of nasal transsphenoidal approach (19 males and 10 females). Aged 18 to 56 years old with history of 3 months to 6 years.

1.2 Clinical manifestations

All cases of tumor size around 24mm, accompanied by lactation in 8 cases, menstrual disorders in 11 cases, 23 cases associated with visual field reduction, 4 patients with finger hypertrophy. (See Table 1 for specific data)

1.3 Endocrinology and imaging examination

All patients were preoperative and postoperative endocrine examination, the main analysis of PRL, GH and ACTH changes. Preoperative, postoperative and follow-up were performed by MRI with enhanced MRI.

1.4 Surgical methods

1.4.1 Pterional pterional operation

The group of patients were under the general anesthesia under the supine position, head to the left side, the head frame fixed head, through the pterional approach pterional, began microsurgery from the subarachnoid cistern in the sellar region and Sylvius area, then released of cerebrospinal fluid and easier to open meninges. Opened the brain then the brain showed four sellar area anatomical space: bilateral optic nerve between the gap; optic nerve and internal

carotid artery gap; between the internal carotid artery and cerebellar scratches gap; open the end plate of the gap. Tumor resection: first determine the gap between the bilateral optic nerve, then burned the tumor capsule in the gap and used the "cross" shape of the incision to cut the capsule, cut the tumor into small pieces and remove it. Checked the gap between the optic nerve and the internal carotid artery; line tumor incision, removal of the right optic nerve and internal carotid artery at the bottom of the tumor. Because the tumor tissue is easy to be removed by sucker, therefore needed to use tumor clamp and tumor curette, after the last two steps, the tumor basically easy to remove totally. Then, in order to burn the capsule with a bipolar coagulator, the capsule was divided into sections and resected surgically. When the tumor capsule protruding and adding pressure to the third ventricle, there was a choice of resection the tumor above the optic chiasm, local decompression and relaxation after the slow pull and remove the tumor into the second ventricle, attention to the pituitary stalk and the protection of the lower part of the hypothalamus. If the tumor and the two structures of the adhesion is too tight, not forced to perform total resection. After the tumor was successfully removed, then stopped bleeding and closed back the skull.

1.4.2 Nasal sphenoid sinus surgery

Strict implementation of surgical indications and contraindications, gave antibiotic intranasal 3 days before surgery, cut the nose hair 2 days before surgery, clean the nasal cavity, preoperative antibiotics to prevent infection, patients with tracheal intubation had general anesthesia with high positioned head low positioned leg about 20 ° tilt, the head slightly over the extension, cannula fixed position in the left side of the mouth, so as not to affect the operation of the surgical approach. Conventional iodophor disinfection, disinfection range, including facial skin and bilateral nasal cavity. According to the specific location of the tumor and surgical habits to choose the nasal approach, looking for the antero-posterior sphenoid sinus anterior wall and sphenoid sinus before the midline opening, home retractor in the sphenoid sinus ventral wall, so that the front of the retractor close to the sphenoid sinus, from the nasal septum root with the retractor front to the opposite side of the broken part of the vomer bone direction to expand, widen the surgical field of vision. Arc cut the nasal septum root and sphenoid sinus ventral wall mucosa, the lateral flap, removed the antero-posterior sphenoid sinus bone, and expand the bone window to around 1.5 cm × 1.5 cm. After entered the sphenoid sinus, cleaned the sinus mucosa after the bottom of the sellar, with long needle puncture sellar, if the extraction of fresh arterial blood, alert to the possibility of aneurysm sellar. Cut the dura mater after microscopic resection of the tumor, while the need to remove the development of the cavernous sinus and sellar on the regional development of the tumor. Resection of the tumor need to curettage and aspirator, as far as possible the tumor completely removed, showing sellar diaphragm moving downward, filled the wound with gelatin sponge, closed the base of subarachnoid cistern, when the mucosal flap returned to its original position, applied the sponge that fully infiltrate with erythromycin eye cream on the upper part bilateral nasal cavity and upper part of nasal, in order to promote hemostasis and mucosal healing.

1.4.3 Postoperative treatment

Postoperative attention to observe the patient's mental status, bilateral pupil size, vital signs. Record the amount of urine output per hour and 24 h urine output. Such as urine output per hour greater than 300 mL and/ or 24 h urine output greater than 5000 mL, can be used to correct pituitary gland. Postoperative 6 h and 24 h review of head CT, to check whether the hematoma in the brain, the disease changes at any time review. Nasal stuffing gauze was removed on day 3 postoperatively.

1.5 Statistical methods

The use of SPSS20.0 software for statistical analysis, the mean with $\bar{x} \pm s$ said, using t test, $P < 0.05$ for the difference

was statistically significant, $P > 0.05$ was not significant.

2. Results

The two groups of surgery and postoperative comparison in Table 1.

There were significant differences in the levels of PRL, GH and ACTH between the two groups before and after operation ($t = 1.456, 1.301, 0.973, 1.034, 0.774, 0.732$, all $P < 0.05$) (Table 2).

Table 1 Two groups of surgery and postoperative comparison

Group	N	Surgical period (min)	Intraoperative blood loss (mL)	Postoperative hospital stay (day)	Postoperative complications (case)		Effective resection rate (case/%)	One year follow-up (case)	
					Transient urine loss	Transient electrolyte disorder		Residual	Recurrent
Pterional group	31	121.3±19.4	78.5±7.8	9.1±2.3	3	4	21(91.3)	2	1
Nasal sphenoid sinus group	23	87.4±10.7	50.3±3.2	8.7±1.1	2	2	29(93.5)	2	0
T (X ²) value		0.993	1.032	2.897	-	-	(3.191)	-	-
P value		0.021	0.044	0.460	-	-	0.587	-	-

Table 2 Comparison of hormone levels before and after operation ($\bar{x} \pm s$)

Groups (number of cases)		GH (ng/mL)	PRL (ng/mL)	ACTH (ng/l)
Pterional group (n = 31)	Pre-surgery	63.4±5.7	387.3±100.8	202.9±73.7
	Post-surgery	10.6±2.4	145.3±27.4	38.5±4.6
Nasal sphenoid sinus group (n = 23)	Pre-surgery	65.6±6.2	390.2±133.7	206.8±78.6
	Post-surgery	12.4±1.6	148.4±57.2	35.6±2.5

Note: Group compared with pre-surgery ($P < 0.05$)

3. Discussion

Pituitary adenoma is one of the common tumor in the sellar area, the incidence of intracranial tumors accounted for 10% to 15%, mainly rely on surgical resection⁷. The decision for selection of surgical method for different type of pituitary adenoma need to combine the characteristics of the tumor after analysis, for the larger pituitary adenoma, the pterional approach is more suitable, and the nasal sphenoid approach compared with pterional approach, the surgical field exposure is limited, so the technical requirements of the surgeon is higher. The methods and pathways used in nasal sphenoid sinus surgery were due to: ① tumor grew towards sphenoid sinus, but confined to the sellar area. ② the tumor was vertical growth, the direction was upwards of the sellar area. ③ sphenoid sinus good degree of gasification, by the pterional point approach indications: ① tumor growth direction for the side, involving the

cavernous sinus and sellar area. ② Giant pituitary tumor grew towards the sellar area, sellar area does not expand or slightly expansion. ③ Sellar hole narrow, tumor morphology was honeycomb or gourd-like shape. ④ Tumor grew to one-side. ⑤ Tumor texture tough, rich blood supply. ⑥ When the growth to the posterior fossa. In the clinical treatment, the trauma in pterional approach was greater than the sphenoid sinus surgery, and the operation duration was longer, the proportion of pterional infeed decreased year by year. At the same time, due to the lower incidence of the complications of nasal sphenoid sinus approach for pituitary adenoma, this technique had been widely used in clinical practice. Wang Jinping et al⁸ mentioned that there was low incidence of postoperative complications of nasal sphenoid approach, and easy to be accepted by patients, should be widely used in clinical. Mu Chunlei et al⁹ said that the unilateral nasal sphenoid sinus pituitary adenoma resection had short duration, less trauma, fewer complications, but its shortcomings still cannot be ignored, such as surgical results are not ideal and often with serious complications. Studies had shown that pituitary adenoma surgery cure rate was generally 60% to 90%, but the recurrence rate was relatively high. Due to the different types of pituitary adenomas, the recurrence rate was also different.

The operation space of the nasal sphenoid sinus operation is relatively small, requiring the surgeon to be familiar with the nasal cavity, the sellar area and its surrounding, the skull base dissection, and the skill of the microscope and the endoscope operation. The main points are: ① correct to determine the location of the bottom of the sellar, which is the key to surgery. Because the dissection of local sphenoid sinus in different patients vary, so the transsphenoidal surgery to remove the pituitary adenoma to maintain the midline operation, to avoid damage to the lateral wall, to the lateral excision of the anterior sphenoid sinus should be limited to the sphenoid sinus opening 1 cm within the scope, to avoid damage to the optic nerve, internal carotid artery and other important structures¹⁰⁻¹¹. Sphenoid sinus crest is a more reliable midline positioning sign¹²; ② sphenoid sinus anterior wall and sellar at the end of bone resection, the area should be large enough to facilitate removal of the tumor and easy to stop bleeding; ③ attention to keep the surgical field of vision clear, cryopreservation and the residual tumor, timely detection of residual tumors, to achieve total resection of the tumor; ④ should first remove the tumor tissue that near to the bottom, followed by resection on both sides of the cavernous sinus wall, then removed the part at the postero-superior of sellar area, and finally antero-superior of sellar area. ⑤ tumor resection is completed, the diaphragm of sphenoid sinus dropped down to the sellar area, sometimes the diaphragm would be damaged, causing cerebrospinal fluid leakage, then need to repair the broken diaphragm, if necessary, sphenoid sinus bottom reconstruction will be more effective. If there is no cerebrospinal fluid leakage, generally do not deal with sphenoid sinus diaphragm. The main complications of nasal sphenoid sinus approach have the following circumstances, surgery should pay attention to prevention: ① bleeding, infection, cerebrovascular accident, and even death; ② endocrine disorders, including temporary or long-term diabetes insipidus; ③ cerebrospinal fluid leakage, meninges inflammation; ④ direct nerve, vascular damage; ⑤ early or delayed nasal bleeding, may be due to local vascular rupture or hemostasis is not complete; ⑥ sphenoid sinus complications, including sphenoid sinus mucosal cyst; ⑦ nasal septum perforation, mucosa damaged or hard palate, orbital plate, sieve plate fractures and may lead to loss of smell; ⑧ severe forehead headache, tension, and so on.

Researchers made a comparison between the two groups and the results showed as: (121.3 ± 19.4) min in the pterional group (78.5 ± 7.8) mL compared with the nasal sphenoid sinus group (50.3%) in the pterional group (121.3 ± 19.4) min, ± 3.2) mL, the difference was statistically significant (P < 0.05). There was no significant difference in the effective resection rate (91.3% vs 93.5%, P > 0.05), and the postoperative complications (including one hyperthyroidism and transient electrolyte imbalance) occurred no significant difference. All patients 1 year follow-up results can be seen, the two groups of long-term efficacy are better. Analysis of the levels of endocrine hormones in different types of tumors showed that there were significant differences between the pterional and the nasal sphenoid sinus group before and after operation (P < 0.05). There was no significant difference between the two groups (P > 0.05).

The results of the above description of the indications under the premise of the transsphenoidal approach pituitary adenoma resection compared with the pterional point approach pituitary adenoma resection endocrine hormone levels before surgery, after surgery were significantly different. There is no significant difference in the incidence of complications, said the two surgical methods can achieve better results, but the nasal sphenoid sinus approach for pituitary adenoma resection had lesser trauma, shorten the patient's treatment duration, fasten the recovery rate, can effectively improve the prognosis of patients, treatment better, more easily accepted by patients.

In summary, the current treatment of pituitary adenoma advocate the use of surgery, radiotherapy, chemotherapy and other methods of comprehensive treatment of pituitary adenoma, the author of the study by the pterional point approach and transnasal sphenoid sinus approach pituitary adenoma resection found, traumatic pituitary adenoma resection is still the appropriate indication of pituitary tumor resection, cannot be completely replaced by transsphenoidal surgery, but the skilled surgeon, the nasal passages of the pituitary adenoma resection of the operation time, surgical bleeding is better than the pterional point approach, the clinical efficacy of the exact, should be further promoted.

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