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Safety and efficacy of mini doppler in recurrent pituitary tumours. Report of 12 cases

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Keywords
mini doppler, pituitary, endonasal, tumour

ABSTRACT

Background: Pituitary surgery is the most common surgery used to remove pituitary tumours. The use of mini doppler in surgical removal of an endonasal pituitary tumour has shown good short-term clinical outcomes and few complications in patients. Cavernous sinus invasion limits the surgical excision and still a challenge of gross total resection.

Objective: The main objective of this study is to evaluate the outcome of surgical removal of an endonasal pituitary tumour using mini doppler.

Method: A total of 12 patients were studied retrospectively from 2012 to 2018 in a single institution (Private hospital) in Dhaka, Bangladesh. The male and female ratio was 7:5.

Results: 92% of cases of the total number of patients had satisfactory removal/ neurological improvement/hormonal improvement. Among 12 cases, 8 cases had transient diabetes insipidus and one patient had CSF leak.

Conclusion: The intraoperative Doppler is a useful tool to localize the carotids, which provides safer resection of endonasal pituitary tumours. Thus, it is very safe and effective for laterosellar resection of recurrent pituitary tumours and for cavernous sinus invasions.

INTRODUCTION

Pituitary tumours are unusual growths that occur in your pituitary gland. Recurring pituitary adenomas can cause visual problems to re-emerge, as well as the loss of pituitary function. It is generally divided into three categories depending upon their biological functioning: benign adenoma, invasive adenoma, and carcinomas. Most adenomas or tumours are benign, about 35% are invasive and just 0.1% to 0.2% are carcinomas.1 Since the initial description of a transnasal method for pituitary tumour care in 1907, transsphenoidal surgery has undergone continuous development, marked by close collaboration between neurosurgeons and otolaryngologists. Painful excentric muscle training

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and ultrasound (US) and doppler-guided sclerosing injections of polidocanol have shown good clinical results, and the traditional surgical approaches have been less necessary.[1-3] In 1910, Oskar Hirsch developed a lateral endonasal approach which he initially conducted as a five-step procedure over several weeks before simplifying the procedure with a single step submucosal transseptal approach.[4] For many years, the conventional surgical treatment of mid-stage Achilles tendinosis consisted of a dorsal approach with central longitudinal tenotomy and tea excision.[5-7] A pilot study using an US and dopplerguided scraping technique combined with a short rehabilitation period showed promising results.[8] The scraping technique is based on the same findings that started the sclerosing polidocanol injection treatment, where gray-scale Us and doppler showed a relationship between vessels and nerves on the ventral side of the Achilles and chronic tendon pain. [9-11] Endoscopic endonasal pituitary surgery for the treatment of recurrent pituitary tumours is becoming increasingly common. The endoscopic endonasal transsphenoidal approach (eTSS) allows for more panoramic viewing and wider access to the base of the skull.[12] Pituitary adenomas are most often classified as functional or non-functional, depending on their pattern of hormonal secretion. We addressed the safety and effectiveness of mini doppler in recurrent pituitary in this study and this doppler is commonly used in neurosurgical practice at present. It is a safe and non-invasive testing tool for cerebrovascular diseases. It is used to examine parameters of the blood flow, to diagnose stenosis, occlusion, and deformity of major head and neck arteries. Doppler ultrasound in carotid and measures both qualitative and quantitative blood flow parameters vertebral arteries, and other forms of care. [13-14] Nowadays the application of Doppler ultrasonography is becoming increasingly important in endoscopic transsphenoidal surgery. And that is indeed a safe and effective strategy. This study aims to evaluate the outcome of surgical removal of an endonasal pituitary tumour using mini doppler.

Methods

A retrospective chart review was performed on 12 patients who underwent surgical removal of an endonasal pituitary tumour using mini doppler between 2012 and 2018 in a single institution (Private hospital) Dhaka, Bangladesh. Informed consent from the patients to archive and process personal data in anonymous form was obtained.

Inclusion criteria were, namely: patients developed recurrence of the tumour with symptoms like headache, vomiting, visual disturbances or hormonal imbalances. Exclusion criteria were, namely: Asymptomatic recurrence of the tumour. Follow up was carried out with routinely MRI of the brain with contrast performed in 1, 6 and 12 months. Then yearly for all patients. Minimum follow up in this study was 2 years. The hormonal study was assessed by an endocrinologist for functional tumours monthly for the first few months and then every 6 months and according to clinical manifestations.

Operative procedure

For all 12 patients, the same procedure was carried out as follows. The endonasal transsphenoidal approach was done using the binostril technique. Anatomical landmarks are posterior choana on both sides, from there 1.5 cm above the mucosal flap with scar tissue were separated and in the midline part of the keel of the sphenoid and the sphenoidal bony defects were identified. A high-speed drill to enlarge the defect and to localize the internal carotid arteries mini doppler was used. For recurrent tumours it's difficult to localize particularly in the cavernous sinus and with the help of mini doppler medial opticocarotid recess (MOCR) can be identified and hence the tumour removal became safer. In some cases, where the tumour extended beyond the carotid, the whole of the artery was exposed by drilling and the tumour was removed from the lateral side. Cavernous sinus invasions were removed by localisation of carotid through mini doppler and opening up of cavernous sinus and through two suckers in two hands, along the longitudinal axis of artery tumour was removed to avoid injury to the cranial nerves. Bleeding from cavernous sinus was stopped by using fibrillar surgicel. A fascia was taken from the thigh and fibrin glue was used for dural closure.

Postoperative complications and management

Diabetes insipidus (DI)

- If the consecutive three hours the urine output ≥ 250 ml then injection Vasopressin 5 IU intramuscular was given.

- After 48 hours when the nasal pack was removed Desmopressin nasal spray was used 2 puff in one nostril and according to urine output.
- Half strength normal saline IV was used to reduce the sodium level.
- Avoidance of Hydrocortisone IV to minimize the DI except for those cases where the cortisol level was low.
- In all cases the DI was transient and over one to two weeks the urine output became normal.

For the CSF leak, the patient was managed with lumbar drainage with bed rest which was failed and re-exploration was done through an endoscopic approach to seal the leak with dural substitute and glue.

Patient with little residual tumour was followed up with contrasted-MRI of the brain every 6 months and found no recurrence of size nor symptoms for the last 3 years.

Results

Characteristics of patients are summarized in Table 1. It was reported that 8.33% of patients had a residual tumour and 91.67% total removal of tumours among all patients. Among 12 cases, 8 cases had transient diabetes insipidus and one had CSF leak (Figure 1).

Table 1. Characteristics of patients.

Pt	Sex, age	Surgery year	Clinical presentation	Type of tumour	Complication	Follow-up
1	Male,45	2012	Headache, visual disturbance	Non-functional adenoma	Transient DI	No residual
2	Male,38	2013	Weight loss, tachycardia, irritability	TSH secreting tumour	Transient DI	No residual Normal level of hormone
3	Male,28	2014	Headache, Vomiting, visual loss	Non-functional tumour apoplexy	Transient DI	No residual
4	Male,32	2015	Abnormal growth of hands and feet	Growth hormone-secreti ng tumour	Transient DI	No residual Normal level of hormone
5	Male,52	2016	Headache	Non-functional tumour	CSF leak VIth nerve palsy	No residual
6	Male,36	2017	Headache, visual disturbance	Non-functional tumour	Transient DI	No residual
7	Male,26	2017	Headache, vomiting	Non-functional tumour apoplexy	Transient DI	Small residual

8	Female,25	2012	Amenorrhoea	Prolactinoma	None	No residual Normal level of hormone
9	Female,30	2013	Infertility	Prolactinoma	None	No residual Normal level of hormone
10	Female,42	2017	Headache	Non-functional tumour	Transient DI	No residual
11	Female,24	2018	Headache	Cortisol secreting tumour	None	No residual
12	Female,43	2018	Headache	Non-functional adenoma	Transient DI	No residual

Table 2. Complication rates in male and female patients.

Gender	DI	Postoperative hormonal deficiency	Residual Tumour
Male	6	None	1
Female	2	None	0

Table 3. Tumour resection types.

Tumour type	Cavernous Sinus invasion	Gross total removal	Cranial Nerve Injury
Non-Functional	4	3	1(VIth nerve)
Functional	None	All	None

*Incomplete removal of one non-functional tumour was due to adherence of tumour with cranial nerve inside the cavernous sinus.

Complications

The total number of patients was 12 in this study and among them, 8 patients had Diabetes Insipidus and 1 patient had CSF leak. There were 6 male patients and 2 female patients having DI.

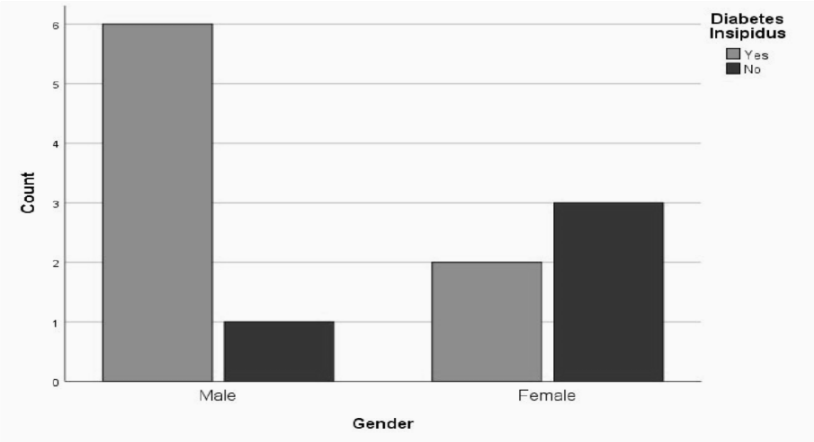

Figure 1. Bar charts showing the number of patients having diabetes insipidus.

In the figure (2A), intraoperative image showing the safe incision line in the midline and the probe, blue arrow touched is the safe incision line. And in figure (2B), contrast MRI brain T1 weighted image in sagital section is showing recurrent pituitary tumour.

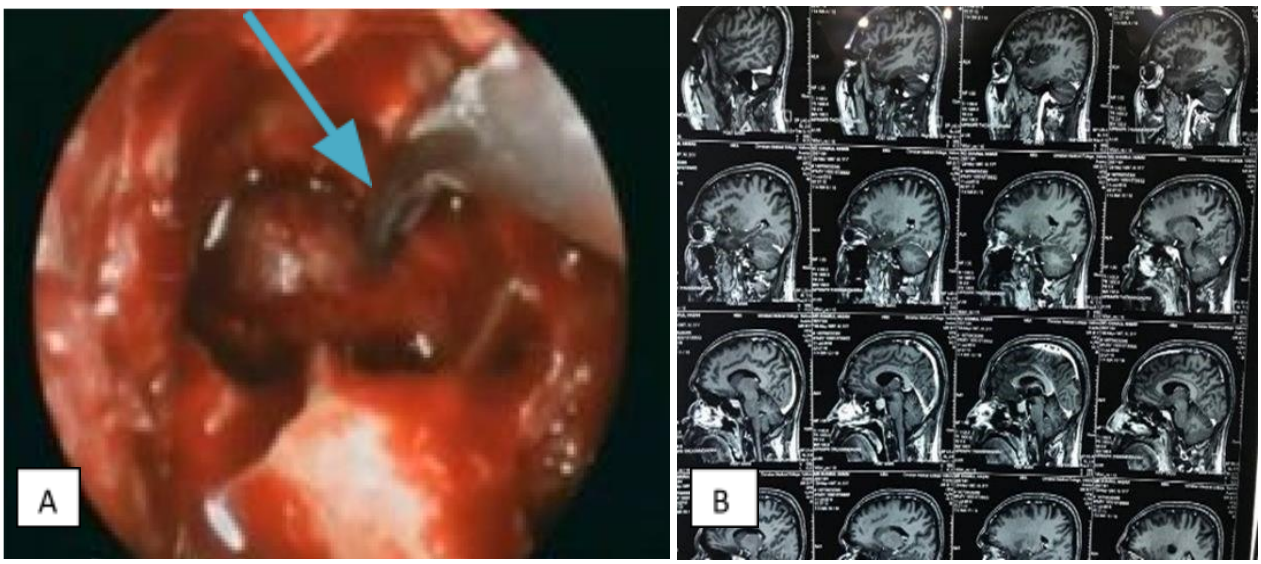

Figure 2 (A, B). Intraoperative image and MRI image of recurrent pituitary tumour.

Discussion

The mini doppler controlled surgical removal of an endonasal pituitary tumour has shown good short-term clinical outcomes and few complications in patients at varying levels of activity. With this treatment method, rapid pain relief and a return to even high-level sporting activity are feasible. The technique provides the greatest degree of freedom and efficiency at specific anatomical goals for sagittal surgery. This method is one step better for the treatment of recurrent pituitary tumours for improved quality and hospital stay time. More quantitative and qualitative data are required for calculating better results. In reaction to the procedure, athletes back in full pain-free training and competition are found to have a good result. The follow-up period after surgery was also not long, and with time, further failures could occur. Ongoing

research will concentrate on longer-term clinical outcomes and impacts on the thickness and function of the tendons. By using this strategy, since these lesions typically displace the optical apparatus away from the surgeon, tumour removal will begin craniopharyngioma and preexisting growth hormone and gonadal deficiencies experienced a complete failure of anterior pituitary function and DI following surgery immediately after opening the dura mater, resulting in prompt chiasm decompression. The early decompression probably allows the removal of any tumour adherent to the optical apparatus and/or its arachnoidal and vascular connections with less chance of visual degradation. This approach requires minimal nasal mucosal dissection, resulting in fewer sinonasal complications and a quicker and less painful rhinological recovery.[15-16]There are a variety of vascular problems associated with an approach through the nose and sublabial route use. The major drawback to the direct endonasal route is the fairly narrow and slightly off-midline direction of operation.[17] This issue was largely solved by several technical innovations, including the use of low-profile micro-dissection instruments and cutting blades and the use of mini-dopplers, the use of angled endoscopes for more panoramic cephalad and lateral visualization beyond the microscope's tunnel vision, and the use of intraoperative surgical navigation to validate surgical trajectory and main land making. [18] Unfortunately, the complete removal by any method in the three other patients was not a realistic goal given the size and invasiveness of the tumours. Some of the patients in this series encountered new permanent endocrinological abnormalities, with the new DI occurring in 8 cases. Preservation of pituitary function in such patients is challenging particularly those in whom the anterior pituitary function has already failed.[19] In our series of 12 patients, the complication rate was low. A common clinical complication in our series was a postoperative CSF leak that occurs in 1 patient who had neurological defcits, including new cranial nerve palsy. Skin incision or brain retraction is also no longer required. These benefits lead to a decrease in complications, faster patient recovery, minimal postoperative discomfort and a decrease in overall costs. The cavernous sinus extension limits the excision of tumour and adjuvant radiotherapy is the alternate choice of treatment.[20]

Conclusion

The intraoperative Doppler is a useful tool to localize the carotids, which provides safer resection of endonasal pituitary tumours. Thus, it is very safe and effective for laterosellar as well as removal of intracavernous portions of tumour by two hand technique.

Conflict of Interest

There is no potential conflict of interest relevant to this research.

Financial Disclosure

No specific funding was provided for this research.

Patient Consent

This study obtained patient consent directly from the patient.

Ethical Approval

As the authors, we hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed by the ethical standards laid down in the 1964 Declaration of Helsinki.

Author's Contributions

The author's contributions include manuscript preparation and editing. The manuscript has been prepared and approved by all the authors to be submitted and published.

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