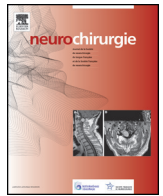




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Report 2013: Tumors of the pineal region

## Interest and limits of endoscopic approaches for pineal region tumours

### *Approche endoscopique des tumeurs de la région pinéale : intérêts et limites*

D. Chaussemy, H. Cebulla, A. Coca, S. Chibarro, F. Proust\*, P. Kehrli

Department of neurosurgery, Strasbourg university hospital, hôpital Hautepierre, avenue Molière, 67000 Strasbourg cedex, France

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#### ABSTRACT

Endoscopy of pineal region tumours has been developed since the year 2000 either via a transventricular or extracerebral approach. The initial purpose of applying neuroendoscopy in the management of pineal region tumours was to resolve the obstructive hydrocephalus, and identify the pathological characteristics of the tumour. Based on this approach, a piecemeal resection of the tumour can be performed. The approaches, derived from the microsurgical pathway using an endoscope to expose the operative field, have been proposed either via an infratentorial supracerebellar approach or posterior transtentorial interhemispheric approach. Neuroendoscopic procedures can be considered as a therapeutic alternative to the microsurgical approach when CSF markers are negative. This procedure is considered mini-invasive for the approach along the surgical corridor access but extensive and in depth at the interface between the tumour and the surrounding neurological parenchyma. The limitations and complications are related to the type of procedure (mono- or bimanual) as well as the tumoral characteristics. Different approaches are presented in detail in order to avoid the occurrence of any surgical complications.

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#### RÉSUMÉ

L'endoscopie des tumeurs de la région pinéale est proposée depuis les années 2000, que ce soit par voie transventriculaire ou extracérébrale. Au départ, l'objectif était de résoudre l'hydrocéphalie obstructive par perforation du plancher du 3<sup>e</sup> ventricule. Utilisant cet accès pour réaliser des biopsies, la possibilité de résection tumorale a été rapidement proposée par cette voie transventriculaire. Les approches extracérébrales, dérivées des voies microchirurgicales supracérébelleuses ou transtentorielles permettent de travailler selon une dissection bimanuelle comparable à celle réalisée sous microscope opératoire. Ces procédures considérées comme mini-invasives le sont uniquement pour l'approche réduisant à son strict minimum les dissections tissulaires mais en profondeur, la largeur du champ opératoire en fait une procédure extensive à haut risque fonctionnel pour les structures environnantes. La difficulté opératoire est liée à la procédure selon l'usage de procédure mono- ou bimanuelle mais aussi aux caractéristiques de la tumeur en termes de vascularisation, de consistance, de taille et de risque de dissémination liquidienne de cellules tumorales. Le futur serait un système hybride entre le microscope opératoire et l'endoscopie.

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## 1. Introduction

Pineal region tumours are rare, accounting for 0.4% of neoplasms found in the central nervous system [1]. Overall treatment

strategies for these tumours vary significantly depending on the histological diagnosis and the midbrain compression responsible for obstructive hydrocephalus. Except for patients where elevated serum or CSF markers levels are diagnostic, histopathological identification is the answer to the management involving surgical resection or biopsy, radiation therapy and chemotherapy. The biopsy may be performed via open surgery, stereotactic or an endoscopic approach.

\* Corresponding author.

E-mail address: f.proust@neurochirurgie.fr (F. Proust).

Endoscopy of pineal region tumours has been developed since the year 2000 [2–4] either via transventricular or extracerebral approach sometimes in complement to the microscopic exposure. Based on the literature, we review the different approaches and discuss the indication and limitations.

## 2. Different endoscopic procedures

Neuroendoscopic procedures for brain tumours were initially developed as an approach to intraventricular lesions, in particular third ventricular tumours. However, progressively the endoscopic exposure of brain tumours used the anatomical fissure and the microscopic approaches either isolated or in combination with conventional optical magnification.

### 2.1. Transventricular technique

The initial purpose of applying neuroendoscopy in the management of pineal region tumours was to resolve the obstructive hydrocephalus, and identify the pathological characteristics of the tumour [3]. Thus, the anterior neuroendoscopic approach is suitable not only to obtain tissue samples from multiple parts of the tumours but also to sometimes complete the procedure by a complete debulking of the tumour [5].

Under general anaesthesia, the patient is placed in a supine position with the head secured in a three-pin head holder. The patient's head is not rotated and kept exactly vertical at 0°. The midline, as well as the coronal suture, is identified to create a hole giving access to both the third ventricle floor as well as the most posterior part of the third ventricle. This hole is performed on the pupillary line, 3 cm anterior to the coronal suture [6]. The choice of this burr hole can be determined using neuronavigation in order to obtain an optimal trajectory for both targets. The endoscope is then methodically checked with the scrub nurse (enlightenment, status of the instruments, balloon inflation). After subcutaneous adrenalin infiltration, a vertical skin incision will permit to perform a burr hole, bone cut waxed, dural opening and substantial washing with physiological serum.

The endoscope cannula is gently implanted perpendicularly to the cortex toward the frontal horn of the right lateral ventricle. After obtaining cerebrospinal fluid (CSF), a rigid endoscope of 30° is introduced and secured into its holder. A CSF sample is then obtained for the dosage of pineal region tumour markers. Under endoscopic view, the anatomical landmarks of the lateral ventricle enabled to push the endoscope through the Monro foramen toward the third ventricle floor. The first step was to perform a ventriculostomy at the floor between the infundibular recesses anteriorly and the mammillary bodies posteriorly. Once the ventriculostomy is done, the endoscope should be gently rotated to the posterior part of the third ventricle in order to identify the anterior pole of the tumour. The neuronavigation could be helpful to confirm the good position of the endoscope tip in front of the tumour. After a careful coagulation of its surface, a biopsy of the tumour is performed using a biopsy rongeur.

In case of removal of the tumour, some authors recommended a primary resection under careful haemostasis combining gentle irrigation and coagulation by bipolar coagulation. After, a standard endoscopic third ventriculostomy is completed via a second standard coronal burr hole [5].

### 2.2. Extracerebral approaches

These approaches are derived from the microsurgical pathway using an endoscope to expose the operative field in complete replacement of the operative microscope and sometimes in combination.

The endoscopic supracerebellar infratentorial approach was initially described to resect a pineal cyst [7], then applied to remove the tumour [8–10].

In the sitting position, the patient is secured to the rigid Mayfield frame. A 3-cm vertical incision followed by a microcraniotomy placed at the inferior margin of the transverse sinus permits a dural opening in a semi-lunar fashion. The gravity-based retraction of the superior surface of cerebellar hemisphere permits to position the endoscope in the infratentorial space via its holder.

The endoscope is then advanced along the lower margin of the tentorium. The tentorial bridging veins are respected. On arrival at the deep venous confluence, the endoscope is directed towards the level of pathological entity and the coronally-oriented arachnoid adhesions opened and the dissection started using a bimanual technique.

The instruments are independently used and do not pass through the endoscopic ports. Standard microsurgical instruments are used allowing a bimanual dissection under endoscopic view for optical magnification. Then, microdissectors, pituitary forceps, ultrasonic dissector can be conventionally used in order to perform a dissection. The principles of microsurgical resection can be proposed: Telfa cottonoids, gentle dissection, bimanual haemostasis, and use of haemostatic agents. Some authors have reported the use of 3D endoscopic technology (6.5 mm outside diameter, 0° and 45° endoscopes).

The endoscopic approach for this indication has been considered a complement of the optic magnification to verify the complete characteristics of the resection. An interhemispheric transtentorial approach has been reported using the endoscopic procedure [9,11]. This latter mentioned procedure is the one most often proposed in complement to the microsurgical exposition.

## 3. Indications

If the tumour markers AFP and HCG are undetected in serum and ventriculomegaly is found on imaging, neuroendoscopic surgery can be applied at least to resolve the CSF obstruction as well as to obtain a biopsy. The decision between biopsy and tumour removal is based on the tumour intrinsic characteristics such as bleeding, adherence and consistency. Neuroendoscopic procedures can be considered as a therapeutic alternative to the microsurgical approach.

## 4. Advantages

The endoscopic approach is considered a minimally invasive procedure because of the usefulness of the corridor up to the tumoral target, whether it is transgyral or not. These small corridors permit to respect the bridge veins through the pathway, contouring these obstacles to the tumour. The corridors, which condition an accurate view trajectory, require only a small craniotomy and minimal brain retraction. Neuronavigation is a useful tool to optimize the optical view.

This procedure decreases the exposure of the functional area as well as the risk of neurological consequences related to the approach. The tip of the endoscope located close to the tumoral process provides an excellent view for intraoperative diagnostic analysis. This type of optical magnification allows resection control behind the venous structures, i.e., internal cerebral veins and optimization of the microdissection.

As regards bimanual dissection, under endoscopic control, the overload of the operative field is reduced. Exoscope systems or VITOM-90 are hybrid devices inspired by a combination of quality from the endoscope and operative microscope [12]. The VITOM-90 is a rigid rod lens system that looks and functions much like

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