Eight Years of Neuroendoscopy Practice at the University Hospital Center of Yaounde: Indications, Procedures and Results

Aurélien Ndoumbe¹*, Chantal Simeu² and Bonaventure Jemea³

¹Medical Doctor, Neurosurgeon, Senior Lecturer (1, 2). (1) Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Po Box 2701, Douala, Cameroon. (2) Service of Surgery, University Hospital Center (UHC) of Yaoundé, Cameroon

²Medical Doctor, Anesthesiologist, Head, Service of Anesthesiology & Surgical Intensive Care Unit, University Hospital Center (UHC) of Yaoundé, Cameroon

³Medical Doctor, Anesthesiologist, Service of Anesthesiology & Surgical Intensive Care Unit, University Hospital Center (UHC) of Yaoundé, Cameroon

*Corresponding Author: AurélienNdoumbé, Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Po Box 2701, Douala, Cameroon; Tel: (+237) 696346359/691485567/671041677; E-mail: aurelien.ndoumbe@gmail.com/aurelen@yahoo.fr

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Abstract

Objective
The author is reporting on an eight year experience of neuroendoscopy practice in Cameroon.

Methods
Indications, clinical manifestations, procedures and outcome data of patients who underwent neuroendoscopy were retrospectively reviewed.

Results
Thirty four patients (21 men and 13 women) were enrolled. Their ages ranged from 03 months to 50 years. The main clinical manifestations were related to raise intracranial pressure. Preoperative computed tomography was done in all patients and magnetic resonance imaging in nine. Indications for neuroendoscopy were obstructive hydrocephalus in 30 cases and pituitary macro adenomas in four. The causes of hydrocephalus were; aqueductal stenosis in 17 cases, posterior fossa tumors in 8, stenosis of fourth ventricle outlets in two, two communicant hydrocephalus, and one shunt dysfunction. Procedures were endoscopic third ventriculostomy in 30 cases and endoscopic transphenoidal pituitary surgery in 4 cases. Four intraoperative bleedings lead to abortion of procedure in two cases. Except for these 2 cases, endoscopic third ventriculostomy was efficient in 85.71 % (24/28) of cases. For the pituitary adenomas, total removal was done in 3 cases and partial in one. But in all cases, we observed disappearance of symptoms and normalization of
visual and hormonal parameters. There was no death related to these procedures. Five patients (14.70%) had postoperative transitory complications including 4 cerebrospinal fluid leaks and 1 meningitis. Endoscopic third ventriculostomy reduced the cost of treating obstructive hydrocephalus by 600 $.

Conclusions
Even in poor areas, neuroendoscopy can be practiced regularly with clinical and financial benefits.

Keywords: Cameroon; Indication; Neuroendoscopy; Procedure; Result; Sub-Saharan Africa.

Abbreviations: CSF: Cerebrospinal Fluid; CT: Computed Tomography; ETV: Endoscopic Third Ventriculostomy; EVD: External Ventricular Drain; ICP: Intracranial Pressure; MRI: Magnetic Resonance Imaging; UHC: University Teaching Hospital Center of Yaoundé; USD / $: United States Dollar.

1. Introduction
The purpose of this work is to report on eight years of neuroendoscopy practice at the University Teaching Hospital Center (UHC) of Yaoundé. Neuroendoscopy is a mini-invasive or less-invasive neurosurgical procedure [1-18], with endoscopic third ventriculostomy (ETV) being the most frequent operation for the treatment of obstructive hydrocephalus [19-22]. Endoscopic endonasal transsphenoidal surgery had also revolutionized the treatment of pituitary adenomas [23-27]. Nevertheless, indications of neuroendoscopy are not limited to those two entities but they are being more and more diversified [1-13,15-16,28-35]. In spite of its numerous advantages, neuroendoscopy is still less used in Africa, particularly in the Sub-Saharan part and most publications are related to the treatment of hydrocephalus. Besides the works from Benjamin C. Warf in Uganda, reports on neuroendoscopy in Africa are rare [36-41]. In Cameroon, the UHC of Yaoundé was the only hospital where neuroendoscopy was regularly practiced between June 2006 and December 2014. Indications, procedures and results of this experience were retrospectively reviewed.

2. Material and Methods
2.1 Materials
2.1.1 Equipment for Neuroendoscopy
Comprised: 0° and 30° rigid endoscopes with 2.7 millimeters outer diameter; a ventriculoscope with 6 mm outer diameter with 3 channels (working, irrigation, suction), micro biopsy forceps; micro scissors; micro holding forceps; monopolar and bipolar coagulation probes (Aesculap, Tuttlingen, Germany). An analogic screen (Sony, Tokyo, Japan).

Equipment for Transsphenoidal Pituitary Surgery (Aesculap, Tuttlingen, Germany).

2.2 Methods
2.2.1 Patients’ selection
All patients who benefited from a neuroendoscopic procedure as total or partial treatment in their management were recruited consecutively. Patients who did not have a neuroendoscopic procedure were excluded.

3. Procedures
All patients were operated under general anesthesia with oral endotracheal intubation.

Endoscopic Third Ventriculostomy (ETV): ETV has been thoroughly described in the medical literature [9, 22]. It was the procedure used to treat hydrocephalus. To fenestrate the 3rd ventricle floor, we used the micro biopsy forceps. Its teeth were open to enlarge the stoma. We used to pass the ventriculoscope through the stoma to look for Liliequist’s and other arachnoid membranes which might cause failure of the procedure. Most often, the 0° endoscope was used, but sometimes we used the 30° endoscope to look in the posterior 3rd ventricle (Figure 1).
Figure 1: Endoscopic third ventriculostomy. a: precoronal skin incision, b: precoronal burrhole, c: localization of the interventricular foramen by identifying the choroid plexus, septal and thalamostriate veins, d: stoma made on the midline just before the mammillary bodies, e: visualization of the clivus dura matter.

Endoscopic endonasal transsphenoidal removal of pituitary adenomas [1, 16]

It was done via the rhinoseptal approach in 3 cases and the sub labial approach in one case under fluoroscopy. For this operation, we used the 30° endoscope in most cases.

3.1 Patients follow up

After surgery, patients were hospitalized for 2 to 3 days after ETV and at least one week after resection of pituitary adenomas. Removal of nasal padding was done between 3rd and 5th postoperative days. Local and systemic complications were systematically checked. For pituitary adenomas, patients were screened for diabetes insipidus, diuresis was evaluated every 3 hours, urinary density and blood electrolytes once a day. Clinical and neurological status of all patients was evaluated at least 3 times a day every day until discharge. Patients were then seen on consultation once a month during 3 months and then once every six months. Thereafter, patients were seen once a year. The follow up was considered until the last visit. Patients who underwent ETV were aware that in some cases, late closure of the stoma may occur with possible rapid deterioration. Postoperative computed tomography (CT) scan was systematically prescribed to all patients at one month after surgery or earlier in absence of clinical improvement and when complications were suspected. Magnetic resonance imaging (MRI) was prescribed postoperatively to all patients with pituitary adenomas.

4. Results

4.1 Clinical and Radiological Data

Thirty four patients had a neuroendoscopic procedure during the study period. They were 21 males and 13 females and their ages ranged from 03 months to 50 years. Most clinical findings were due to raised intracranial pressure (ICP) (as detailed on Tables 1 and 2). Preoperative radiological tools used were CT scanning which was done in all patients and MRI practiced in nine.
Table 1: Clinical manifestations of hydrocephalies.

<table>
<thead>
<tr>
<th>Clinical manifestations</th>
<th>N(30)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>17</td>
<td>56.66</td>
</tr>
<tr>
<td>Visual disturbances*</td>
<td>13</td>
<td>43.33</td>
</tr>
<tr>
<td>Macrocrania</td>
<td>10</td>
<td>33.33</td>
</tr>
<tr>
<td>Sunset gaze</td>
<td>09</td>
<td>30.00</td>
</tr>
<tr>
<td>Suture diastasis</td>
<td>07</td>
<td>23.33</td>
</tr>
<tr>
<td>Vomiting</td>
<td>06</td>
<td>20.00</td>
</tr>
<tr>
<td>Scalp veins bulging</td>
<td>05</td>
<td>16.66</td>
</tr>
<tr>
<td>Disequilibrium</td>
<td>05</td>
<td>16.66</td>
</tr>
<tr>
<td>Cerebellar syndrome</td>
<td>05</td>
<td>16.66</td>
</tr>
<tr>
<td>Difficulty to concentrate</td>
<td>04</td>
<td>13.33</td>
</tr>
<tr>
<td>Memory disturbance</td>
<td>03</td>
<td>10.00</td>
</tr>
<tr>
<td>Vertigo</td>
<td>03</td>
<td>10.00</td>
</tr>
<tr>
<td>Upward gaze paralysis</td>
<td>02</td>
<td>06.66</td>
</tr>
<tr>
<td>Psychomotor delay</td>
<td>02</td>
<td>06.66</td>
</tr>
<tr>
<td>Sphincter disturbances</td>
<td>01</td>
<td>03.33</td>
</tr>
<tr>
<td>Seizures</td>
<td>01</td>
<td>03.33</td>
</tr>
<tr>
<td>Insomnia</td>
<td>01</td>
<td>03.33</td>
</tr>
<tr>
<td>Consciousness disturbance</td>
<td>01</td>
<td>03.33</td>
</tr>
<tr>
<td>Cervicalgia</td>
<td>01</td>
<td>03.33</td>
</tr>
</tbody>
</table>

N= number of cases.

*: diplopia, blurred vision, decreased visual acuity, papilledema.

Table 2: Clinical manifestations of pituitary adenomas.

<table>
<thead>
<tr>
<th>Clinical manifestations</th>
<th>N (4)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Bitemporal hemianopia</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Decreased visual acuity</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Blurred vision</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Vertigo</td>
<td>1</td>
<td>25</td>
</tr>
</tbody>
</table>

N = number of cases.

4.2 Indications for Neuroendoscopy

The indication for neuroendoscopy was hydrocephalus in 30 cases and pituitary adenomas in four. The causes of hydrocephalus were idiopathic (congenital) aqueductal stenosis in 17 cases, posterior fossa tumor in 8 cases, stenosis of foramina of Luschka and Magendie in 2, two cases of communicating hydrocephalus and one shunt dysfunction (Table 3).

Table 3: Hydrocephalus etiology.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>N (30)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic (congenital) aqueductal stenosis</td>
<td>17</td>
<td>56.66</td>
</tr>
<tr>
<td>Posterior fossa tumor*</td>
<td>8</td>
<td>26.66</td>
</tr>
<tr>
<td>Stenosis of fourth ventricle outlets</td>
<td>2</td>
<td>06.66</td>
</tr>
<tr>
<td>Communicating†</td>
<td>2</td>
<td>06.66</td>
</tr>
<tr>
<td>Shunt failure</td>
<td>1</td>
<td>03.33</td>
</tr>
</tbody>
</table>

N = number of cases

*: fourth ventricle ependymoma (5), cerebellar medulloblastoma (2), pinealoblastoma (1).

†: undetermined origin.
4.3 Neuroendoscopy Procedures

The neuroendoscopic procedures practiced were ETV in 30 cases and endoscopic endonasal transsphenoidal removal of pituitary adenomas in 4. Operation duration varied from 22 minutes for ETV to 125 for adenomas surgery. We had 4 intraoperative bleedings that lead to abortion of the procedure in 2 cases. Excepting these two abandonments, ETV was efficient in 85.71% (24/28) of cases and inefficient in 4 cases (2 communicating hydrocephalus, 3 months old infant and pinealoblastoma case). Concerning the 4 pituitary adenomas, all were macroprolactinomas and removal was total in 3 cases and subtotal in one. But in all 4 patients, disappearance of symptoms and normalization of visual and hormonal parameters were observed.

4.4 Follow up

Mean and median follow up duration were 4.22 and 4.19 years respectively (range: 5.5 months-7.94 years). Mean and median hospital stay were 6.17 and 11.5 days respectively (range: 2-21 days). There was no death related to neuroendoscopy but, two cerebellar medulloblastomas and pinealoblastoma patients died few months after neuroendoscopy from progression of their cancers. Five patients (14.70%) had postoperative complications including 4 cerebrospinal fluid (CSF) leaks and 1 meningitis. We calculated that ETV diminished the treatment cost of obstructive hydrocephalus by $600.

5. Discussion

5.1 Rarity of Publications on Neuroendoscopy from Africa

Publications in English or in French reporting neuroendoscopy practice are rare from Africa especially from the Sub-Saharan region. Most reports concern those from Benin C. Warf in Uganda and are limited to the treatment of hydrocephalus [36-41]. In all, we found two reports from Nigeria [36, 40], one from Malawi [38], one from Piquer et al. in Kenya and Zanzibar [37], one from Egypt [39] and one from South Africa [41]. Of the two articles from Nigeria, one compared ETV versus shunting in terms of efficacy, complications and cost and concluded that ETV was efficient as shunting for obstructive hydrocephalus with less long term morbidity and significantly cheaper. It is important to emphasize that the comparison was made with the low cost Chhabra shunt [40]. The other report studied efficiency of ETV in children aged 2 years or less [36]. The article from Piquer et al. reported training in neurosurgery and neuroendoscopy in Kenya and Zanzibar [37]. To the best of our knowledge, our study is the first to report on endonasal endoscopic surgery of pituitary adenomas.

Nevertheless, it is possible that we missed articles published in languages other than English or French or not cited in data bases.

5.2 Neuroendoscopy Indications

Neuroendoscopy practice in this series was essentially limited to the treatment of obstructive (non-communicating) hydrocephalus and accessorially to transsphenoidal removal of pituitary adenomas. We also successfully treated a case of shunt failure. Neuroendoscopy indications have been diversified in the last decades but the two most common remain obstructive hydrocephalus [1-3,9,13,17-22,33] and pituitary adenomas [1,23,24]. But indications for neuroendoscopy also extend to: lesions of anterior skull base and petroclival area [25,27], removal or biopsy of tumors within or close to ventricles [4,5,12,34], frameless biopsy of brain tumors, arachnoid cysts [8,11,29,30], encephaloceles and osteodural fistula [43], aspiration of capsulothalamic or intraventricular hematomas [4,5,12,34], syringomyelia and intraspinal adhesions [7,35]. In one study, neuroendoscopy allowed identification of meningeal seeding of carcinomatous cells well before it could be evidenced by MRI [10]. Although communicating hydrocephalus was considered a contraindication for ETV, many works have reported its efficiency in 17-40% in this indication [9,19]. ETV failed in 2 cases of communicating hydrocephalus of this series. But, these failures may be explained by the fact that we did not cauterize the choroid plexuses as preconized. Shunt failure was also considered a contraindication for ETV. But, reports from Chhun et al.in 2015, Brichtova et al. in 2013 and Lee et al. in 2011 yielded ETV success rates for shunt failure around 70% [28,31,32]. And efficiency of ETV was not correlated with patient age, cause of hydrocephalus or the number of previous shunt revisions before ETV. Therefore, these authors drew the following conclusions: “ETV should be the method of choice for treating shunt failure in obstructive hydrocephalus”. We successfully treated a case of shunt dysfunction in this series. ETV has made obsolete the paradigm “once a shunt, always a shunt”.

5.3 Some Advantages of Neuroendoscopy

Neuroendoscopy has many advantages compared to other microsurgical techniques: it is less invasive, has less mid and long terms complications and is costless [2,6,8,10-12,15]. In our setting, ETV reduced treatment cost of obstructive hydrocephalies by 600USD. This cost reduction is due to avoidance of purchasing the shunt hardware (shunt hardware prices in Cameroon range between 300 to 1000 USD). In Brazil, De Lima BO and PatresiR showed that ETV is not more expensive than shunting regarding public insurance funding [44].

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5.4 Mortality and Morbidity of Neuroendoscopy

Neuroendoscopy mortality remains very low. Most deaths related to ETV reported occurred after late closure of the stoma. Therefore, it is important to inform patients and families of this late threat [31]. Some authors’ preconize implantation of an Omaya reservoir or a ventricular catheter to some patients treated with ETV to palliate the risk from late failure [31]. We did not have death related to neuroendoscopic procedures or late failure in this series.

Many complications had been attributed to ETV [14,43,45-47,50]. They can be intraoperative like intraventricular bleeding or hemodynamic disturbances [14, 50]. Other can occur during the early postoperative period as CSF leaks, meningitis, ventriculitis, and injuries to fornix, thalami, hypothalamus or cranial nerves [14, 44, 45, 50]. Generally speaking, long term complications are not frequent and permanent disability is rare. In this series, two intraoperative ventricular bleeding imposed abortion of the procedure. But, even in this situation, it is possible to insert an external ventricular drain (EVD) and perform a successful ETV later. We had five postoperative transitory complications giving a morbidity of 14.70% which is low giving our limited equipment and is similar to ETV morbidity rates reported from literature. These complications included four CSF leaks and aseptic meningitis. CSF leaks were successfully managed by repeated lumbar punctures with compressive head dressings. Meningitis was cured with probabilistic antibiotics. We did not have a permanent disability in this series.

5.5 ETV Success

For obstructive hydrocephalus, ETV was efficient in 85.71% (24/28) of cases and inefficient in 4 cases (2 communicating hydrocephalus, 3 months old infant and pinealoblastoma case). Depending on etiology of obstructive hydrocephalus, reported success rates of ETV range from50-100% [14, 30, 36, 40, 42, 44, 50]. The best indication for ETV is idiopathic aqueductal stenosis. In this series, ETV was efficient in 16 out of 17 aqueductal stenosis cases (94.11%). The only failure occurred on a 3 months old infant. Many studies have shown that psychomotor development of children treated with ETV is similar to that of those treated with shunting [36, 38, 40, 46, 47]. The report from Wisniewska et al. revealed a statistically significant difference in favor of ETV for intellectual quotient and motor impairment in children [47].

5.6 Endoscopic Removal of Pituitary Adenomas

For the 4 macro adenomas of this series, all subjects were women. All adenomas were prolactinomas. Removal was total in 3 cases and partial in one. But, in all cases we had disappearance of symptoms and normalization of visual and hormonal parameters. The lady in whom removal was partial had normalization of vision and pituitary hormones after six months of treatment with Cabergoline (Dostinex®) with no progression of residual tumor since six years. These 4 patients are the only for whom we had postoperative MRI. Microsurgical or endoscopic transphenoidal approach is actually considered the gold standard for pituitary surgery. It has many advantages upon the trans cranialapproach. The transphenoidal approach was developed by pioneers like Halstead, Cushing or Hirsch. It was popularized by the Canadian neurosurgeon Jules Hardy with the use of the operating microscope at the end of sixties. The introduction of endoscopy by Jho, Carrau and Cappabianca [1,24] has extended transphenoidal surgery to parasellar (planumsphenoidale, clivus) and skull base lesions [1,24-27]. We used the endoscopic rhinoseptal approach in 3 cases and sub labial approach in one case. Endonasal endoscopy has undeniable advantages upon transphenoidal microsurgery: avoids sub labial incision, dissection of septal mucosa and fracture of nasal septum, thus decreasing postoperative morbidity. There is no need for the nasal speculum which narrows surgical field and limits visibility and manipulation of instruments. Endoscopes give a wider angle of view with better visualization of anatomic landmarks rendering intraoperative fluoroscopy unnecessary. Endoscopy gives better illumination and better control of nasal cavity than the microscope. At last, endoscopy allows looking around the corners of cavernous sinus and behind the carotid artery [1,24]. Controversy remains concerning superiority of endoscopy over microsurgery for pituitary adenoma surgery. But, benefits of neuroendoscopy need no further demonstrations [1,24].

5.7 Neuronavigation for Neuroendoscopy

It could be necessary to associate neuronavigation to neuroendoscopy in some circumstances to increase patient’s safety for example when anatomical landmarks are disorganized by the pathology [9, 15]. Our equipment did not have neuronavigation.

6. Conclusions

In spite of its numerous advantages recognized worldwide, neuroendoscopy still appear as a luxurious technique in Africa, especially in the Sub-Saharan part where its practice is rarely reported in scientific publications. Reports on neuroendoscopy from that area are limited exclusively to the treatment of hydrocephalus. In this region where management of shunt related problems (cost, complications) are much more difficult to face compared to developed countries, neuroendoscopy appears as an option to promote and vulgarize. Our work and those done in other Sub-Saharan African countries demonstrated without doubt, the benefits, either therapeutically and financially of neuroendoscopy, mainly in managing obstructive hydrocephalus. To the best of our knowledge, this series is the first reporting on endoscopic pituitary surgery from Sub-Saharan Africa where most neurosurgeons do not have operating microscopes.
References


tary adenomas. Technical aspects and report of casuistic.


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