Brainstem (BS) tumors in adults focusing on direct microsurgery

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BS tumors: Overview
Differences by age

**Children**
- incidence: 10-15%
- diffuse intrinsic glioma
- specially affecting the pons
- typical MRI findings are common

**Adults**
- incidence: < 2%
- wider variety of pathological findings

Guillamo JS et al, 2001
Laigle-Donadey F et al, 2008
Age of presentation

- median: 32.5 years old
- age ranged: 16-70 years old

Overall survival

- median: 59-85 months
- range: 9-180 months

Bricolo A et al, 1991
Landolfi JC et al, 1998
Guillamo JS et al, 2001
Kesari S et al, 2008
Laigle-Donadey F et al, 2008
Salmaggi A et al, 2008
Symptomatology

- Headaches 44%
- Gait disturbances 61%
- Cerebellar symptoms 37%
- Weakness in both distal limbs 42%
- Cranial nerves impairment 87%
- Hydrocephalus 20-30%

Guillamo JS et al, 2001
Laigley-Donadey F et al, 2008
Classification

• **Historical review:** Epstein (1985); Epstein & McCleary (1986); Stroink et al (1987); Barkovich (1990); Albright (1996); Fischbein et al (1996)

• **Since 2000, Classification of Choux M et al is worldwide used:**
  
  I  Diffuse
  II  Focal intrinsic
  III  Exophytic
  IV  Cervicomedullary
Preoperative work-up

- MRI
- MR spectroscopy
- Systematic MRI exploration of the neuroaxis
- Angio-MRI or angiography are rarely necessary
MRI findings

- 50%  Diffuse infiltrating lesion without Gd-enhancement
- 31%  Focal lesion with Gd-enhancement
- 8%   Tectal lesion
- 11%  Other presentations

Guillamo JS et al, 2001
Diffusion tensor imaging and tractography

will contribute to surgical strategy ....

Phillips NS et al, 2005
Lui YW et al, 2007
Chen X et al, 2007
Helton K et al, 2008
Oppenheim C et al, 2007
Factors of better outcome

- < 40 years-old
- Duration of the symptoms > 4 months
- KPS =>70
- MRI: “no” Gd-enhancement and “no” necrosis
- Tectal localization

bad prognosis: tumor affecting more than one segment of the BS

Guillamo JS et al, 2001
Laigle-Donadey F et al, 2008
Controversies in the management of BS tumors in adult patients arise because of:

- Their low incidence.
- The dismal prognosis in children has probably discouraged treatment in adults for many years.
- The complexity of the brainstem surgery. It is assumed that the surgical neurological risk would be too high.
• Since the first article of resective surgery for BS tumors in the English literature (Bricolo A et al. Acta Neurochir Suppl (Wien) 53: 148-58, 1991); other reports about promising surgical outcome have been published.

• However, many centers persist unwilling to perform microsurgery or even stereotactic biopsy for BS tumors in adults.

• This concern and the rationale about surgical treatment led us to treat a group of patients.
Objectives of discussion: the surgical management

- microsurgery
- stereotactic biopsy
- empiric treatment

Comments differences, similarities?
Our Surgical Indications

Stereotactic biopsy for:
- diffuse infiltrative tumors

We will focus on:

Microsurgery for:
- focal tumors
- exophytic tumors
- with cystic component
- or for differential diagnosis
The principal factor determining which approach to choose is the location of the lesion.

Surgical planning focus on passing through as little normal tissue as possible and on avoiding critical structures.
Tumors of the Tectum

- Low grade glioma is the most frequent tumor
- Generally they have indolent behaviour
- 9-25% have calcifications

- Symptomatic patients or with growing lesion should be operated on.

- Surgical approaches:
  - infratentorial supracerebellar approach
  - occipito- transtentorial

Sun B et al, 1996
Lazaro BC et al, 2006
Chaddad Neto F et al, 2007
Ammirati M et al, 2002
Hauck EF et al, 2009
Illustrative Case 1

A 30-year-old patient was operated on by infratentorial supracerebellar approach with good results.
Tumors of the Mesencephalum

There are different surgical approaches according to the location of the tumor:

- anterior location: transsylvian-subtemporal (orbitozygomatic craniotomy)
- posterior location: infratentorial-supracerebellar (below the inferior colliculi and through the superior medullary velum)
- lateral location: subtemporal or transsylvian-subtemporal

Shi-Ting Li et al, 2007  
J.Zhong S et al, 2007  
Yeh DD et al, 2002.  
Smith ER et al, 2003  
Recalde RJ et al, 2008  
Hauck EF et al, 2009
29-year-old patient was operated on by infratentorial supracerebellar approach below the inferior colliculi. The tumor was partially removed.

Later on, disseminated gliomatosis cerebri was confirmed with bad outcome.
Tumors of the Pons

There are different surgical approaches according to the location of the tumor:

- for lateral or anterolateral lesions: retrosigmoid approach or subtemporal-presigmoid approach

- for posterolateral or posterior lesions: inferior to the level of middle cerebellar peduncle: telovelar approach

- for posterior lesions: transvermian (less used to avoid injury to the nuclei of the VI and VII cranial nerves).

Deshmukh VR et al, 2006
Sala F et al, 2007
A 38-year-old patient harboring a pontine tumor.

Pre-operatively, she had an intratumoral bleeding. So, angiography was performed.

Then, she was operated on by retrosigmoid approach without complications.
Suboccipital retrosigmoid approach was performed. Electrophysiological monitoring included the monitoring of cranial nerves, and somatosensory, motor, and brainstem evoked potentials.
Pathology: Cellular Hemangioblastoma

HE: cellular proliferation, atypias, xantomized cells

CD 34

Scarce perivascular reticulum

Pre op MRI

The patient in rehabilitation 10 days after surgery

24 hs post op MRI
Tumors of the medulla oblongata

Surgical approaches

• for posterior medullary tumors: a suboccipital craniotomy and subtonsillar approach is appropriate

• for anterolateral medullary lesions: a far-lateral suboccipital approach might be necessary

20 % of BS tumors

Kellogg JX et al, 1997
Mussi AC et al, 2000,
Jean WC et al, 2003
Kyoshima et al, 2004
Morota N et al, 2006
Parker F et al, 2009
• For tumors of medulla oblongata, we performed microsurgery that offers simultaneously diagnostic confirmation and posterior fossa decompression.

• The subtonsillar approach provides an ample surgical view to the foramen of Luschka laterally and up to the middle cerebellar peduncle.

• Tumors of the medulla oblongata produce “per se” a mild elevation of the tonsils making the access easier.
Illustrative Case 4

- 41-year-old woman. KPS 90
- 6-month history of: headaches, vertigo, unsteadiness and persistent cough.
Subtonsillar approach was performed
Pathology: subependymoma
• A 29-year-old man.

• KPS 70

• 2 months history of:
  rt hemiparesis,
  rt hypoacusia,
  rt facial palsy,
  dysphagia,
  dysphonia.
Pathology:
Inflammatory demyelinating disease (IDD)

Long term follow-up:
the patient developed a CNS demyelinating disease (MS)
Illustrative Case 6

- 30-year-old man
- KPS 60

- 2-month history of: headaches, vomiting, gait ataxia, dysphonia, dysphagia, urinary incontinence.
There was no complications. Post operatively, he received chemotherapy and radiotherapy.
In conclusion

- Awareness of the histopathology of BS tumors is crucial to define:
  - the course of treatment
  - the prognosis
  - and could avoid the disastrous consequences of empiric treatments
However, we need to know more...

- Although we are encouraged to approach BS tumors in adults,

- we recognize that well evidence-based studies will be conducted in order to define the surgical outcome in large series of patients.
Greetings from Argentina!
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