INTRODUCTION

- Low-grade gliomas in young encompass a heterogeneous set of tumors of different histologies viz. astrocytic, oligodendroglial and mixed glial-neuronal.

- Most common are Cerebellar pilocytic astrocytomas followed by supratentorial fibrillary astrocytomas

- 30% to 50% of these CNS tumors occur in children.*

- Difficult to categorize

### Tumor Counts

<table>
<thead>
<tr>
<th>Tumor</th>
<th>INDIA</th>
<th>International</th>
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<tbody>
<tr>
<td>Astro Total</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>MB &amp; PNETs</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Cranioph</td>
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<td>7</td>
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<tr>
<td>Ependymal</td>
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<tr>
<td>Meningeal</td>
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<td>&lt;2</td>
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<tr>
<td>Nerve Sheath</td>
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<td>-</td>
</tr>
<tr>
<td>Neuronal Tm</td>
<td>3.5</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Choroid Plexus</td>
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<td>2</td>
</tr>
<tr>
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<td>2</td>
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<tr>
<td>Pineal Tm</td>
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<tr>
<td>Oligo</td>
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<tr>
<td>Lymphoma</td>
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</table>


### DIAGNOSIS

**Low-grade gliomas share similar characteristics on neuroimaging.**

*MRI*: T1W Hypo and Hyperintense on T2W images and varying degrees of enhancement on postgadolinium sequences.

**Pilocytic astrocytomas** usually appear as well-circumscribed tumors, often with a large cystic component and an enhancing mural nodule.

**Diffuse fibrillary astrocytomas** are less circumscribed and typically do not enhance to a large extent.

![Pilocytic astrocytomas](image1.png) ![Fibrillary astrocytomas](image2.png)
Aggressive Surgery Is Best for Children With Brain Tumors, Study Suggests

Nov. 22, 2010 — A new Mayo Clinic study found that children with low-grade brain tumors (gliomas) who undergo aggressive surgery to completely remove the tumor have an increased chance of overall survival. If complete removal is not possible, adding radiation therapy to a less complete surgery provides patients with the same outcomes as a complete removal. This study was presented at the Society for NeuroOncology Annual Scientific Meeting and Education Day in Montreal on Nov. 2.

“This study further reinforces Mayo Clinic’s practice of aggressive surgical resection,” says Nadia Laack, M.D., a Mayo Clinic radiation oncologist and the study’s lead author. "We found that when compared to previous studies, more children are now able to have complete removals, most likely due to the fact that we have better neurosurgical techniques and better imaging techniques that help guide the surgeons.”

As part of an ongoing study, Dr. Laack and a team of Mayo Clinic researchers identified 127 consecutive pediatric patients with World Health Organization Grade I and Grade II low-grade gliomas treated at Mayo Clinic between 1990 and 2005. Of those, 90 patients had complete removal of their tumor and 20 patients had subtotal resections with added radiation therapy. Results showed that greater than 89 percent of the patients are surviving more than 10 years later. When combined with results from a previous Mayo Clinic study, this is the largest group of patients reported and was conducted through long-term follow-up by the Mayo Clinic team.

“This is great news for families because it shows that even if a complete surgery isn’t possible, adding radiation to a less than complete surgery reduces their chances of tumor progression to yield the same outcome as if there was a complete removal,” says Dr. Laack.

Other members of the research team included Shariq Khwaja, Nicholas Wetjen, M.D., and Paul D. Brown. The number one predictor of how a child will do in an operation is not based on where the tumor is or how big it is. The number one predictor is how experienced the neurosurgeon is in doing that operation in children.

Mark Kieran, MD, PhD, director of the Pediatric Brain Tumors Program

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**Prognostic Factors and Survival Patterns in Pediatric Low-grade Gliomas Over 4 Decades.**

Ryan S. Youland, Shariq S Khwaja, David A Schomas, Gesina F Kesting, Nicholas M Wetjen, Nadia N Laack

Departments of Radiation Oncology & Child and Adolescent Neurology | Neurosurgery, Mayo Clinic, Rochester, MN | Department of Radiation Oncology, Saint Luke’s Cancer Institute, Kansas City, MO.

Journal of Pediatric Hematology/Oncology | Impact Factor: 0.971, 29/2012

Prognosis and survival in LGGs

The Mayo Clinic team reviewed the records of 351 pediatric patients who had a diagnosis of LGG at Mayo Clinic in Rochester, Minn., and divided them into two groups:

- Those with the initial diagnosis from 1970 to 1989 (group I)
- Those with the initial diagnosis from 1990 to 2009 (group II)

Prognostic factors were recorded and analyzed statistically to determine their association with overall survival and progression-free survival. The results showed some improvement in both overall and progression-free survival rates.

- Ten-year survival rates for groups I and II were 86.9 percent and 94.4 percent, respectively.
- Ten-year progression-free survival rates for groups I and II were 57.4 percent and 67.7 percent, respectively.

In both groups, the most important factor associated with improved survival was gross total resection, with an overall progression-free survival rate at 10 years of 71.3 percent. Gross total resection was achieved more often in group II than in group I.

**Overall,**

*GTR associated with improved OS and PFS.
*GTR was achieved in more cases after 1991.
Low-grade gliomas of the cerebral hemispheres in children: an analysis of 71 cases.

Patrick F. Gasior, D. al-Subhi, D. Janerick, E. Continetti

Author information

Abstract

Low-grade gliomas constitute the largest group of cerebral hemispheric tumors in the pediatric population. Although complete tumor resection is generally the goal in the management of these lesions, this can prove difficult to achieve because tumor margins may blend into the surrounding brain. This raises several important questions on the long-term behavior of the residual tumor and the role of adjuvant therapy in the management of these lesions. To examine these issues, the authors reviewed their experience in 71 children with low-grade cerebral hemispheric gliomas who were treated at their institution between 1986 and 1991 and assessed the relationship between clinical, radiographic, pathological, and treatment-related factors and outcome. Only seven patients in the series died, from perioperative complications, late from progressive disease, and one (a child with neurofibromatosis) from a second neoplasm. For the 70 patients who survived the perioperative period, overall actuarial survivals at 5, 10, and 20 years were 93%, 93%, and 65%, respectively; progression-free status was maintained in 88%, 79%, and 75%, respectively. On univariate analysis, the factor that was most strongly associated with both overall and progression-free survival was the extent of tumor resection (p = 0.013 and p = 0.015, respectively). A relationship between extent of resection and progression-free survival was present both in patients with pilocytic astrocytomas (p = 0.041) and those with nonpilocytic tumors (p = 0.027). Histopathological diagnosis was also associated with overall survival on univariate analysis; poorer results were seen in the patients with nonpilocytic astrocytoma compared to those with other low-grade gliomas, such as pilocytic astrocytoma, mixed glioma, and oligodendroglioma (p = 0.027). The use of radiotherapy was not associated with a significant improvement in overall survival (p = 0.8). All three patients who ultimately developed histologically confirmed anaplastic changes in the vicinity of the original tumor had received prior radiotherapy, 20, 45, and 137 months, respectively, before the detection of malignant progression. In addition, children who received radiotherapy had a significantly higher incidence of late cognitive and endocrine dysfunction than the nonirradiated patients (p < 0.01 and 0.05, respectively). The authors conclude that children with low-grade gliomas of the cerebral hemispheres have an excellent overall prognosis. Complete tumor resection provides the best opportunity for long-term progression-free survival. However, even with incomplete tumor excision, long-term progression-free survival is common. (ABSTRACT TRUNCATED AT 400 WORDS)
A study of 637 children under 16 having treatment for low grade glioma (CNS 9702)

After 5 years follow up,

- over 94 out of 100 children (94.6%) were still alive and in over 64 out of every 100 (64.9%) their tumour had not come back.

- Factors determining if the tumour was more likely to start growing again, the 2 most important factors were age (tumours were more likely to come back if the child was diagnosed up to and including the age of 5) and having a tumour that could not be completely removed with surgery.

Factors related to outcome for children with low-grade gliomas treated with surgery followed by observation were identified in a Children’s Oncology Group study that included 518 evaluable patients.[14]

- Overall outcome for the entire group was 78% PFS at 8 years and 96% overall survival (OS) at 8 years.
Pediatric LGG

The following factors were related to prognosis:[14]

- **Age:**
  Younger children (age <5 years) showed higher rates of tumor progression but there was no significant age effect for OS in multivariate analysis.

- **Tumor location:**
  Cerebellar and cerebral tumors showed higher PFS at 8 years compared with patients with midline and chiasmatic tumors (84% ± 1.9% versus 51% ± 5.9%).

- **Histology:**
  Approximately three-fourths of patients had pilocytic astrocytoma, and PFS and OS for these patients was superior to that of children with nonpilocytic tumors.

- **Extent of resection:** Patients with gross total resection had 8-year PFS exceeding 90% and OS of 99%.

  By comparison, approximately one-half of patients with any degree of residual tumor (as assessed by operative report and by postoperative imaging) showed disease progression by 8 years, although OS exceeded 90%.
CEREBELLAR PILOCYTIC ASTROCYTOMA

- 16 year old female
- Headache
- Gait ataxia
- Blurring of vision
- Recurrent Vomiting
- Worsening of symptoms

- Bilateral papilloedema
- Cerebellar signs present
  - Nystagmus
  - Dysdiadochokinesia
  - Impaired tandem gait

MIDLINE SUBOCCIPITAL CRANIOTOMY AND GROSS TOTAL EXCISION

PILOID CELLS

ROSENTHAL FIBRES

- Seizure characteristics and control following resection in 332 patients with low-grade gliomas. [J Neurosurg. 2008]
- Review Surgical management of pediatric tumor-associated epilepsy. [J Child Neurol. ]
LGG with Epilepsy

LGG with calcification with epilepsy
LEFT TEMPORAL Low Grade tumor with Epilepsy
Increase in frequency seizures
Affecting scholastic performance
Was being followed up for 5 yrs
PRAVEEN GHODE

IMMEDIATE POST OP CT

HPR : GG

Natural history and surgical management of incidentally discovered low-grade gliomas

Clinical article

MATTHEW B. POTTS, M.D., JUSTIN S. SMITH, M.D., PH.D., ANNETTE M. MOLINARO, PH.D., AND MITCHEL S. BERGER, M.D.
Department of Neurological Surgery, Brain Tumor Research Center, University of California, San Francisco, California

J Neurosurg / October 14, 2011
Natural history and surgical management of incidentally discovered low-grade gliomas

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Department of Neurological Surgery, Brain Tumor Research Center, University of California,
San Francisco, California

Conclusions

The potential risks and benefits of resection must always be carefully considered, especially when a patient is asymptomatic. Here, we showed that surgical morbidity is actually lower in patients with incidental lesions, which is probably related to the higher preoperative functional status seen in patients with incidental lesions as well as the noneloquent location of the incidental LGGs. Overall, this study provides further data that the surgical management of incidental LGGs is safe and may be associated with better outcomes as compared with symptomatic LGGs. The data argue that resection, as opposed to a watch-and-wait strategy, should be offered to patients with incidental LGGs.
INTRAVENTRICULAR PILOCYTIC ASTROCYTOMA
MRI

INTRAVENTRICULAR GLIOMA

ENDOSCOPE ASSISTED MICROSURGICAL EXCISION
FOLLOW-UP SCAN
Nikhil Bhura

Presented with visual deterioration

TS with SEGA

Nikhil Bhura
Pilocytic astrocytoma arising from septum

LOW GRADE ASTROCYTOMA
Transcallosal Approach
LOW GRADE ASTROCYTOMA

PILOCYTIC ASTROCYTOMA
1 & ½ yr old child

ENDOSCOPIC BIOPSY
FOLLOWED BY RADICAL EXCISION

Pre op

Post op

Prthivijit Patil
Neurosurgical management of low-grade astrocytomas of the cerebral hemispheres
Edward R. Laws, Jr., M.D., William F. Taylor, Ph.D., Marvin B. Clifton, M.D., and Haruo Okazaki, M.D.
Departments of Neurologic Surgery, Medical Statistics, and Pathology, Mayo Medical School, Mayo Clinic, Rochester, Minnesota

• In 461 cases of supratentorial low-grade astrocytoma:
  Age of the patient at the time of surgery was by far the most important variable in predicting length of survival.

• Other variables correlating with increasing survival were:
  Gross total surgical removal,
  Lack of major preoperative neurological deficit,
  Long duration of symptoms prior to surgery,
  Seizures as a presenting symptom and
  Surgery performed in recent decades
MAXIMISING RESECTION REQUIRES

- THOROUGH UNDERSTANDING OF ANATOMY
  - SULCAL ANATOMY
- PREOPERATIVE NEUROIMAGING
- TRACTOGRAPHY
- AWAKE CRANIOTOMY
- INTRAOPERATIVE MONITORING
- NEURONAVIGATION
Awake craniotomy
KHUSHBOO

NAVIGATION GUIDED AWAKE CRANIOTOMY

COMPLETE EXCISION

Md Wasim

Insular Glioma
First HPR: DNET
INTRAOPERATIVE ASSESSMENTS/S/O FEATURES OF HIGHER GRADE TUMOR
Second HPR: Anaplastic oligo
FIBRILLARY ASTROCYTOMA

HPR: Fibrillary Astrocytoma
INSULAR LOWGRADE ASTROCYTOMA
5 yr old boy with Episodic Abd. Pain & Vomiting

RIKRAKMA

THALAMIC LOW GRADE GLIOMA
NAVIGATION GUIDED CRANIOTOMY AND COMPLETE EXCISION

3 MONTHS POST OP MRI

HPR: PILOCYTIC ASTROCYTOMA
PEDUNCULAR PILOCYTIC ASTROCYTOMA

MID BRAIN PEDUNCULAR EXOPHYTIC GLIOMA

HEMANT

HEMANT
Thalamic Tumor with hydrocephalous
Shunted and Biopsy: Pilocytic astro
Transcallosal excision
Follow up six months

- Walking independently, power on Rt side grade IV
- Speech normal.

OPTICO-CHIASMAL GLIOMA

Pre-op

No Calcification
More strong view world wide in favouring aggressive resection

Increase in confidence level understanding of pathology

Intraoperative assistance
Deepanshi Tripathi

- 8 yr old female
- 6 months back c/o Visual disturbances
- Cranial nerves:
  - Visual acuity
    FC 3 ft (R) eyes & 6ft (L) eye
- Visual fields:
  - Bi temporal hemianopia
    R > L

- MRI Brain: A large lobulated suprasellar SOL
  ? Atypical craniopharyngioma. ? Optic chiasmatic neoplasm

Deepanshi Tripathi
POST OP CT

FOLLOW UP MRI

**HPR:** Pilocytic Astrocytoma (WHO grade – I)

PRE OP MRI

**OPTOCHIASMAL GLIOMA**

Sohal Datta
PRE OP MRI WITH GADO

UNDERWENT VP SHUNT (ELSEWHERE) WITH UNILATERAL VENTRICULOMEGALY
SEPTUM PELLUCIDOTOMY AND TUMOR BIOPSY

POST OP CT
ALOK MISHRA

MID BRAIN PILOCYTIC ASTROCYTOMA

Pre op Images 13.07.2009

Nirek

Pre op Images 13.07.2009
BRAIN STEM CYSTIC TUMOUR

COMPLETE MICROSURGICAL EXCISION FROM MEDULLA
NAVIGATION GUIDED EXCISION

HPR: Ganglioneuroma
Intraoperative monitoring
For cranial nerve nuclei and MEPs

POST OP CT
RESULTS OF A POLICY OF SURVEILLANCE ALONE AFTER SURGICAL MANAGEMENT OF PEDIATRIC LOW GRADE GLIOMAS.

Fisher BD, Leighton CC, Kajalovic O, MacDonald DR, Still LE

CONCLUSIONS: The extent of surgical resection was prognostically significant for progression-free survival but lost significance as a prognostic factor once the complete resection patients were excluded from the analysis. At a median survival of 7.3 years, 42% of the subtotally resected LGG patients who did not receive immediate postoperative RT had tumor progression. No statistically significant difference in survival was seen between the postoperative and deferred RT groups, even though the postoperative RT group was a group with poorer prognostic features (bulky residual tumor postoperatively, Karmofsky performance status <70, and nonhemispheric, noncerebellar tumors), indicating that RT may be beneficial for this particular subset of patients.
Surgery for subtotal excision elsewhere

Post op scan (3 months)

Increase in seizures
Recent scans: Recurrence

Neuropsychology: Left dominance
fMRI
Surgery forms the first therapeutic step

- Provides tissue for establishing diagnosis
- Reduce Tumor burden

Extent of resection is clearly associated with post-operative outcome

Exceptions are

- Unresectable infiltrating lesions on imaging
  - eg Diffuse brain stem glioma
- Deep seated Gliomas, biopsy is more suitable
GLIOMATOSIS CEREBRI

NEURONAVIGATION GUIDED BIOPSY

POST OP CT
Aggressive Surgery Should be Undertaken in LGG in the young? ✓

• Proper understanding of imaging
• The general medical and neurological status
• Counseling of patient and the family
• Discussion with oncology team
• Clear Understanding of the indication and purpose of the surgery
• Good anesthesia team (? Awake)
• Technical aids available in OR: Localization, Mapping and a competent neurosurgeon

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