Post-Operative Imaging Trends in Juvenile Pilocytic Astrocytoma: A Detail Oriented Analysis at a Small North American Center

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Introduction

Juvenile pilocytic astrocytoma (JPA) is the most frequently diagnosed histologic subtype of all pediatric brain tumors with an annual incidence of 0.8 per 100,000 according to the Central Brain Tumor Registry of the United States. The current lack of consensus on post-operative imaging in juvenile pilocytic astrocytoma (JPA) patients poses a unique dilemma for small-to-medium sized academic neurosurgical centers. These centers tend to have less in-house data and experience to support the use of costly imaging protocols. To establish better-informed imaging guidelines at our hospital, we conducted a retrospective study of post-operative MRI features in a cohort of children who underwent craniotomy for JPA resection.

Methods

The medical records of children who underwent craniotomy for resection of JPA from 2000 to 2012 were reviewed. Preoperative imaging characteristics were recorded for comparison to postoperative imaging findings. Tumor recurrence, growth, and regression were analyzed and recorded. Frequency of imaging studies for individual patients was also recorded.

Results

Patient Characteristics

Patient No.	Age/Gender	Follow up length	Time to recurrence	Treatment
1	13/M	9.5 years*	3 years**	Surgery, SRS
2	16/F	10 years	3 years**	Surgery
3	14/M	9 years	No recurrence	Surgery, SRS
4	13/F	4 months	Unknown	Surgery
5	18/F	7 years	No recurrence	Surgery
6	3/F	2.5 years	No recurrence	Surgery
7	2/M	10 months	No recurrence	Surgery
8	7/M	2 years	No recurrence	Surgery
9	14/F	3 months	No recurrence	Surgery
10	13/M	8.5 years	No recurrence	Surgery
11	10/F	8.5 years	No recurrence	Surgery
12	3/M	10 years	No recurrence	Surgery

Table I: Patient ages reported as age at time of craniotomy during study period (SRS = stereotactic radiosurgery). *Two craniotomies performed in 2000. **Although craniotomy was performed during study period, recurrence took place in 1999 prior to the study period.

Twelve patients underwent JPA resection between 2000 and 2012. All tumors irrespective of extent of resection or use of adjuvant stereotactic radiosurgery (SRS), either failed to recur, were stable in their size, or regressed over the study period. Post-operative imaging frequency and timing varied greatly between patients.

Tumor Characteristics

Patient No.	Initial Tumor Size (cm)	Location	Extent of Resection
1	5.9 x 4.0 x 4.5	Pretectal/Third Ventricle	PR
2	4.9 x 4.9 x 4.1	Cerebellar hemisphere	GTR
3	4.9 x 5.2 x 3.9	Fourth Ventricle	STR
4	4.7 x 5.7 x 3.9	Vermis	GTR
5	3.9 x 3.7 x 3.0	Vermis	GTR
6	5.5 x 4.5 x 4.3	Vermis	GTR
7	4.4 x 3.0 x 3.0	Cerebellar hemisphere	STR
8	2.7 x 3.7 x 3.7	Vermis	GTR
9	4.5 x 5.7 x 6.0	Pretectal/Third ventricle	GTR
10	3.6 x 3.1 x 4.0	Hypothalamus/Third ventricle	STR
11	Unavailable	Vermis	GTR
12	3.0 x 3.0 x 4.0	Supracellar	STR

Table II: Abbreviations: GTR = gross total resection; PR = partial resection; STR = subtotal resection.

Interval MRI Findings in 2 Representative Patients

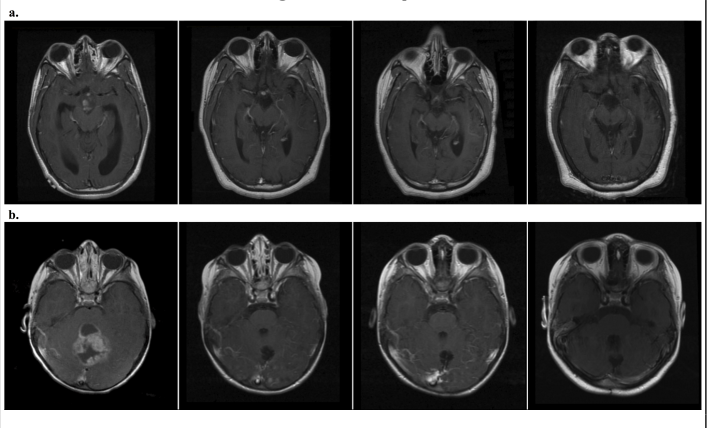

Figure 1: a. Consecutive long-term follow up of hypothalamic juvenile pilocytic astrocytoma resected subtotally as seen on contrasted MRI preoperatively, at 12 months, 48 months and 96 months from left-to-right (Patient 10); b. Consecutive short-term follow up of vermian juvenile pilocytic astrocytoma resected gross totally as seen on contrasted MRI preoperatively, at 3 months, 9 months and 30 months from left-to-right (Patient 6).

Change in Tumor Size Post-Operatively

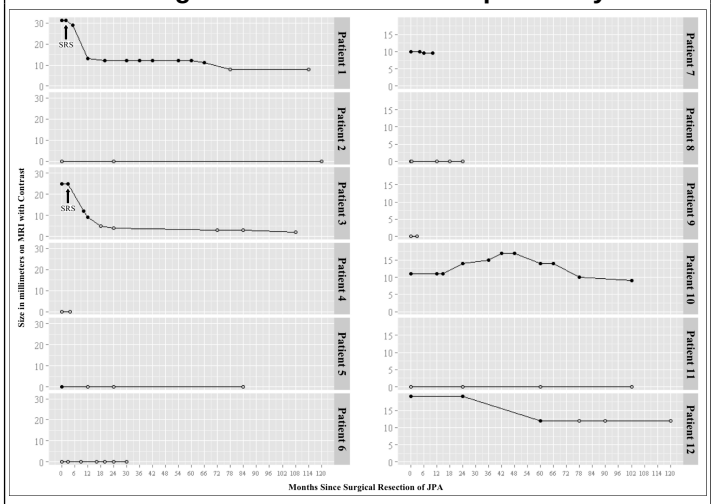

Figure 2: Change in maximal diameter on magnetic resonance imaging (MRI) with contrast after most recent surgical resection in months. Time 0 months is the immediate post-operative MRI. Data points are shaded black if tumor/operative site was enhancing or shaded grey if non-enhancing. SRS = stereotactic radiosurgery.

Conclusions

Our results suggest that post-operative imaging frequency in pediatric patients with JPA can be greatly relaxed independently of factors such as extent of resection or use of SRS. Larger studies are needed to define optimal post-operative imaging frequency protocols that can balance clinical utility and cost-effectiveness.

References

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