H-MRSI AND PEDIATRIC LOW GRADE ASTROCYTOMA

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PEDIATRIC BRAIN TUMORS

- The most common solid cancer of childhood, occurs almost as often as ALL (2.4 vs 2.9/100.000)
- The most common form of PBT are low grade astrocytomas (30%-35%)

BIOLOGY OF GLIOMAS

Low grade

- Labeling index 1%
- S-phase fraction 1%
- Growth fraction 2%-6%
- Protein synthesis ratio 1
- Ki-index 0%-4.5%

High grade

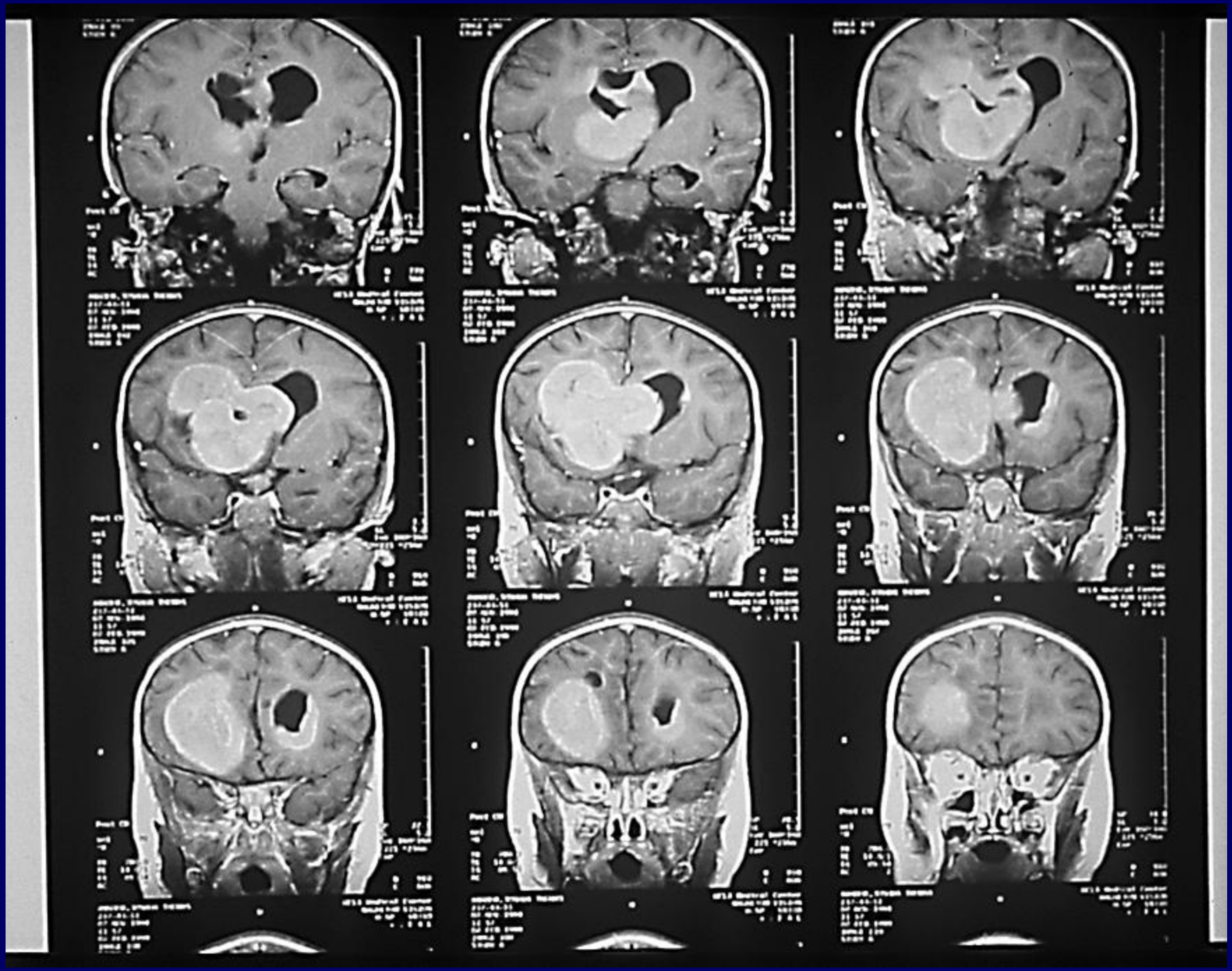
- Labeling index 5%-15%
- S-phase fraction 5%-20%
- Growth fraction 9%-47%
- Protein sinthesis ratio 2
- Ki-index 1.7%-32.2%

PEDIATRIC LOW GRADE ASTROCYTOMA

- Cerebral hemispheres
- Optic tracts/ hypothalamus
- Thalamus
- Intraventricular
- Brain Stem
- Cerebellum

For many low grade astrocytomas the best treatment is surgery alone

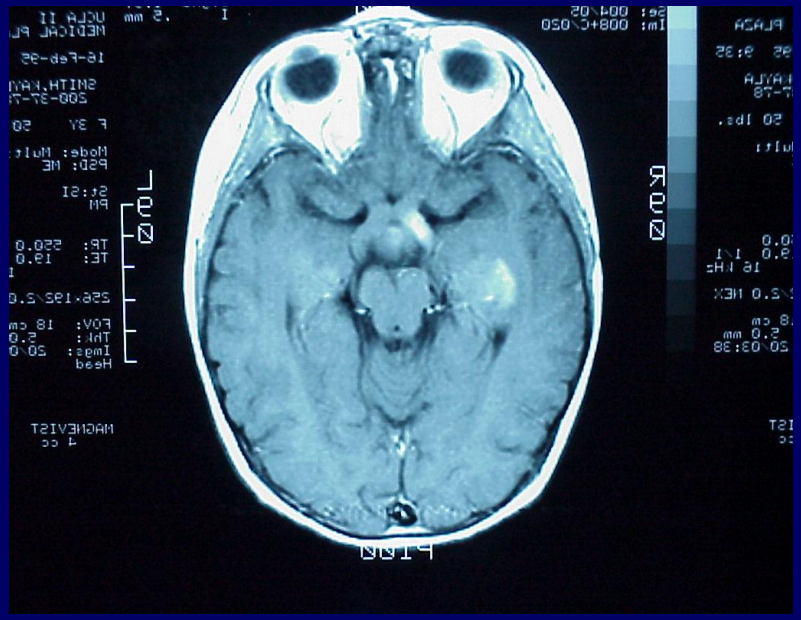
The next slides clearly show that it is possible to completely remove hemispheric tumors



But in some ocassions the tumor can dissapear without any treatment.
Those are rare cases, but raise the question about what to do when surgery is not possible, as in the next case

Pilocytic astrocytoma of the optic tract. Surgery will cause severe damage to the child.

3 months after the previous picture, and without treatment the tumor has almost dissapeared. The child did not have fibromatosis

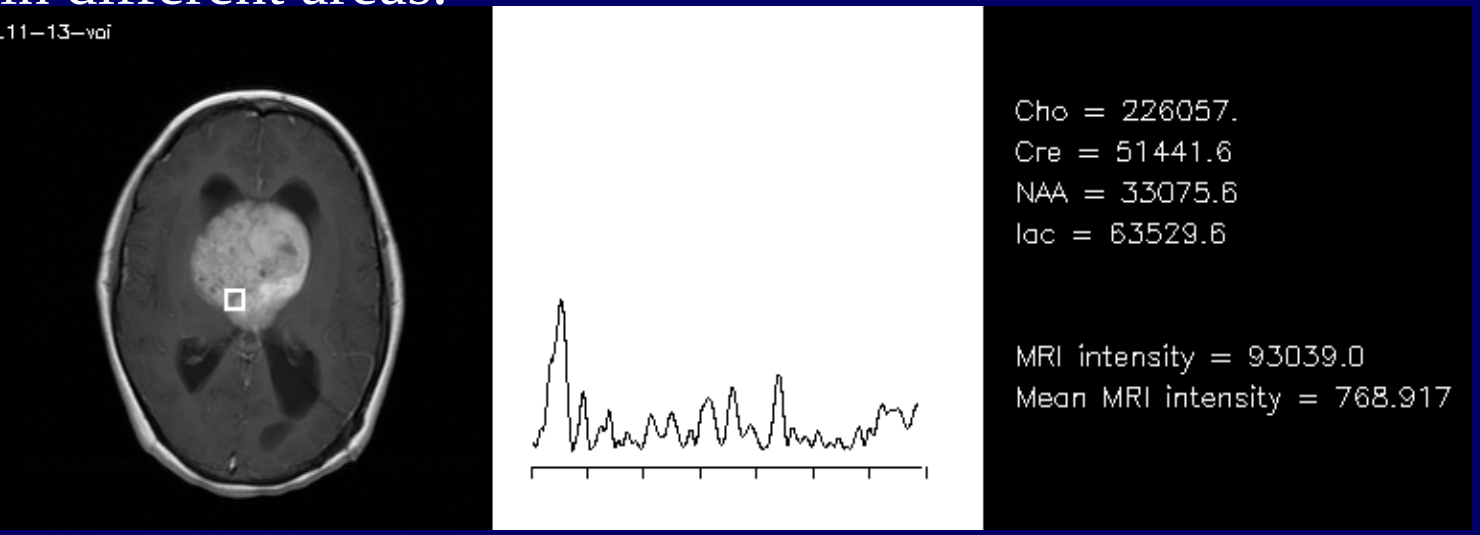


So when we offer treatment we actually might not be offering any valid alternative as in the cartoon bellow.

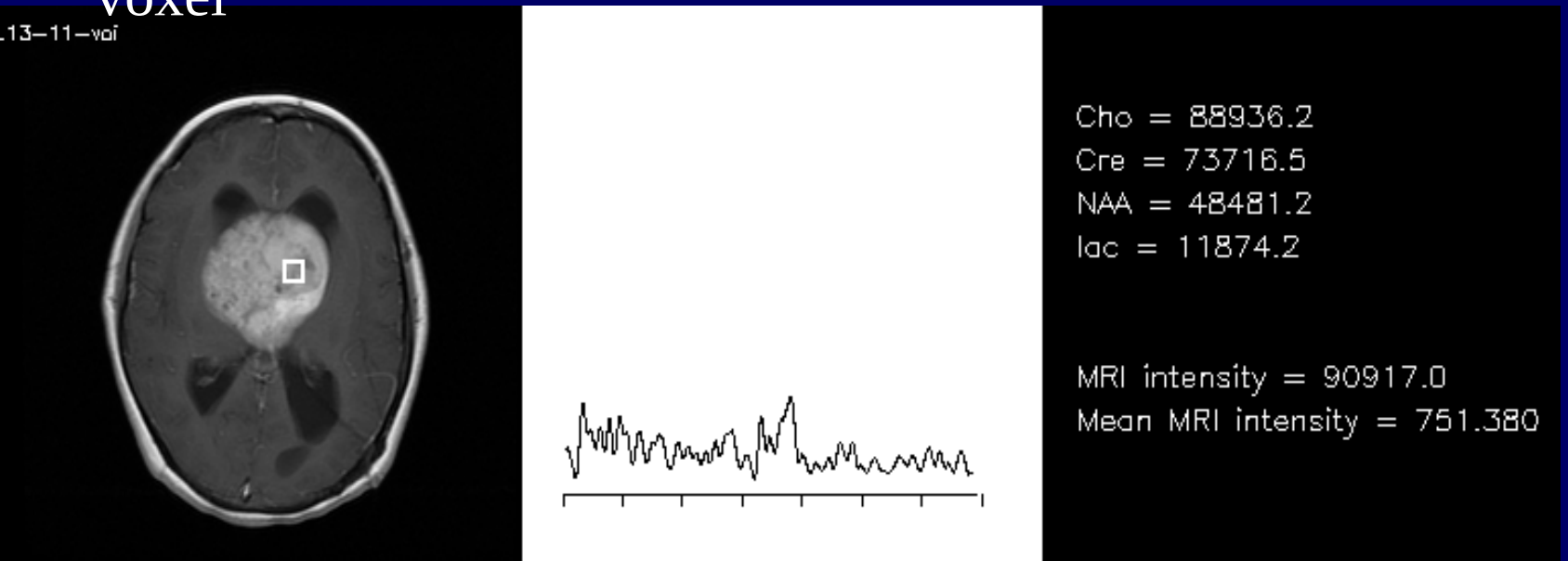
So, how can we know when to be aggressive with a low grade astrocytoma that can not be surgically removed

For that we use spectroscopy. Multivoxel analysis of tumor metabolism.

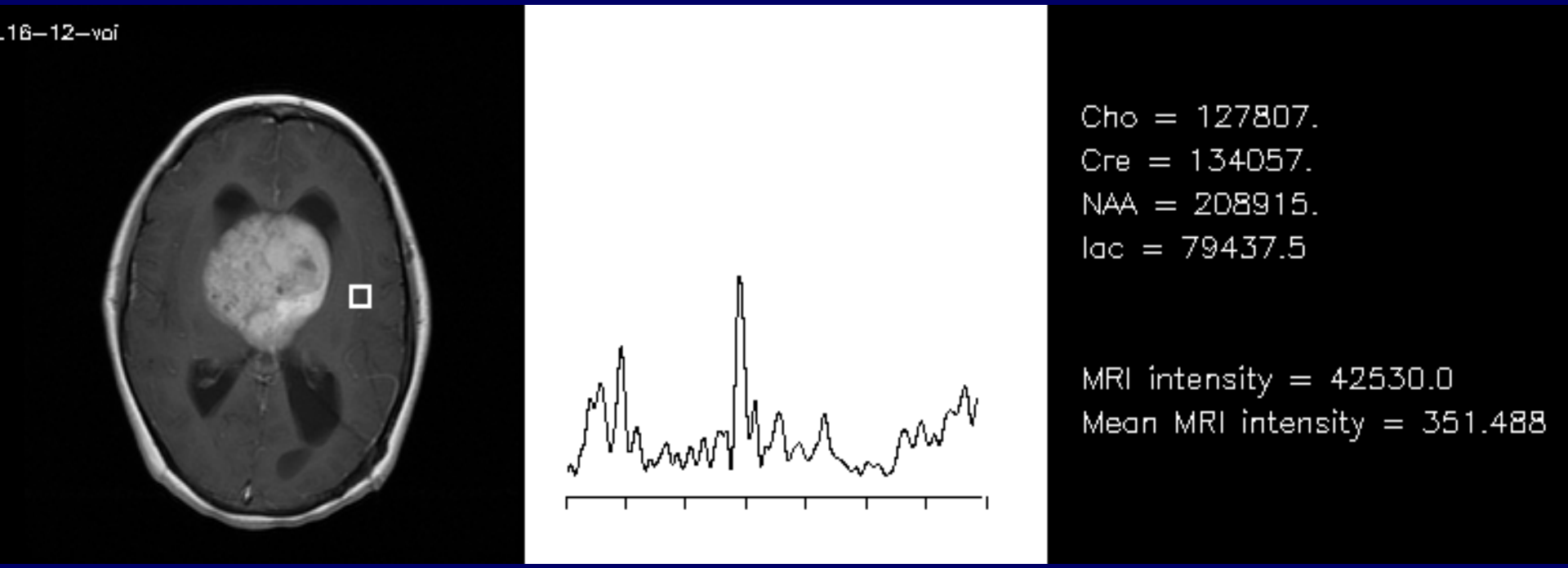
Here we see that the same tumor has different Choline signal intensity in different areas.



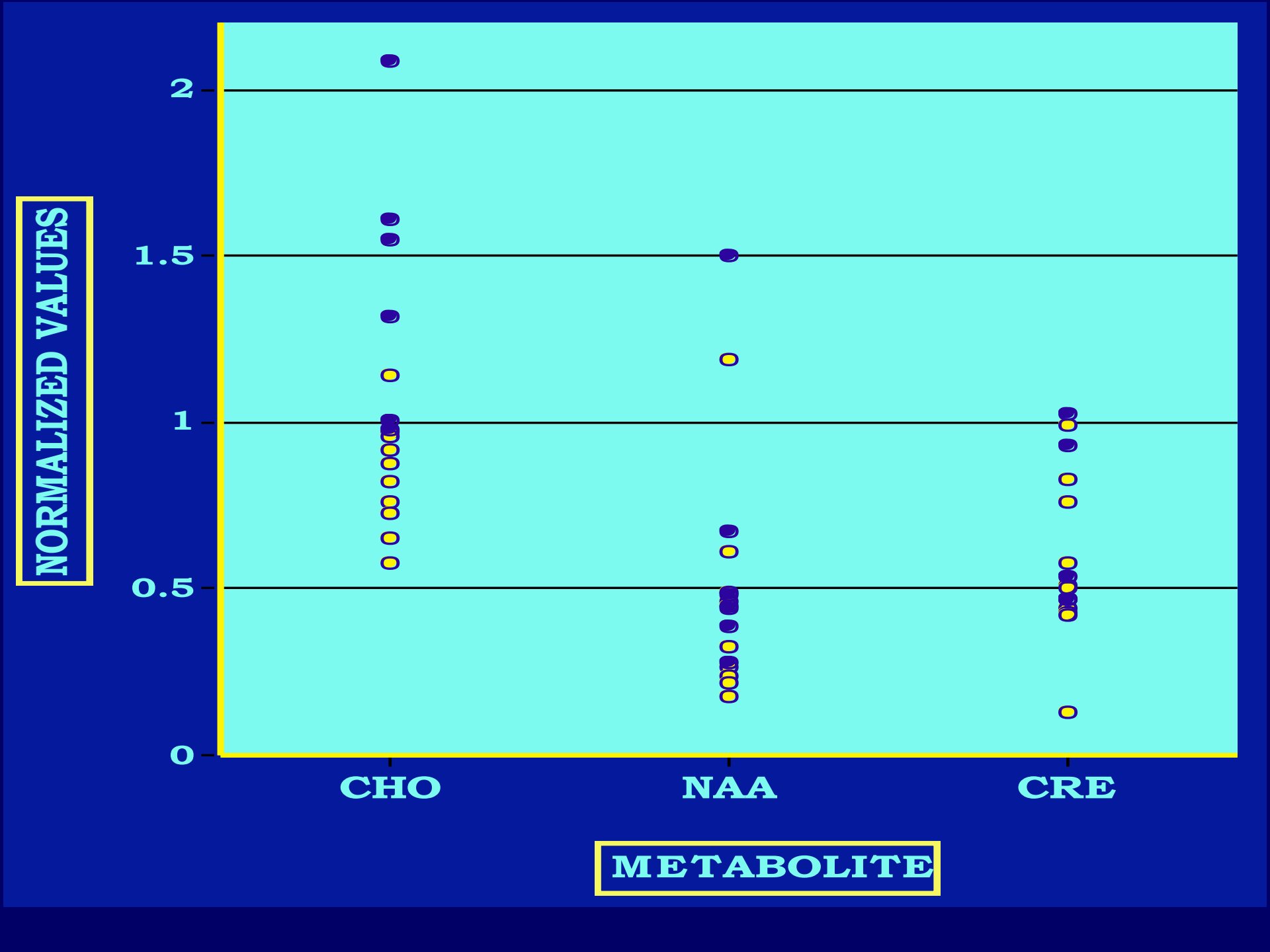
The Choline peak is the first at the left. Note how high is in the above voxel



Then we compare the tumor value with the value of the normal brain, and we construct a Normalized Choline value; when it is above 1 it means that there is more choline in the tumor than in the normal brain



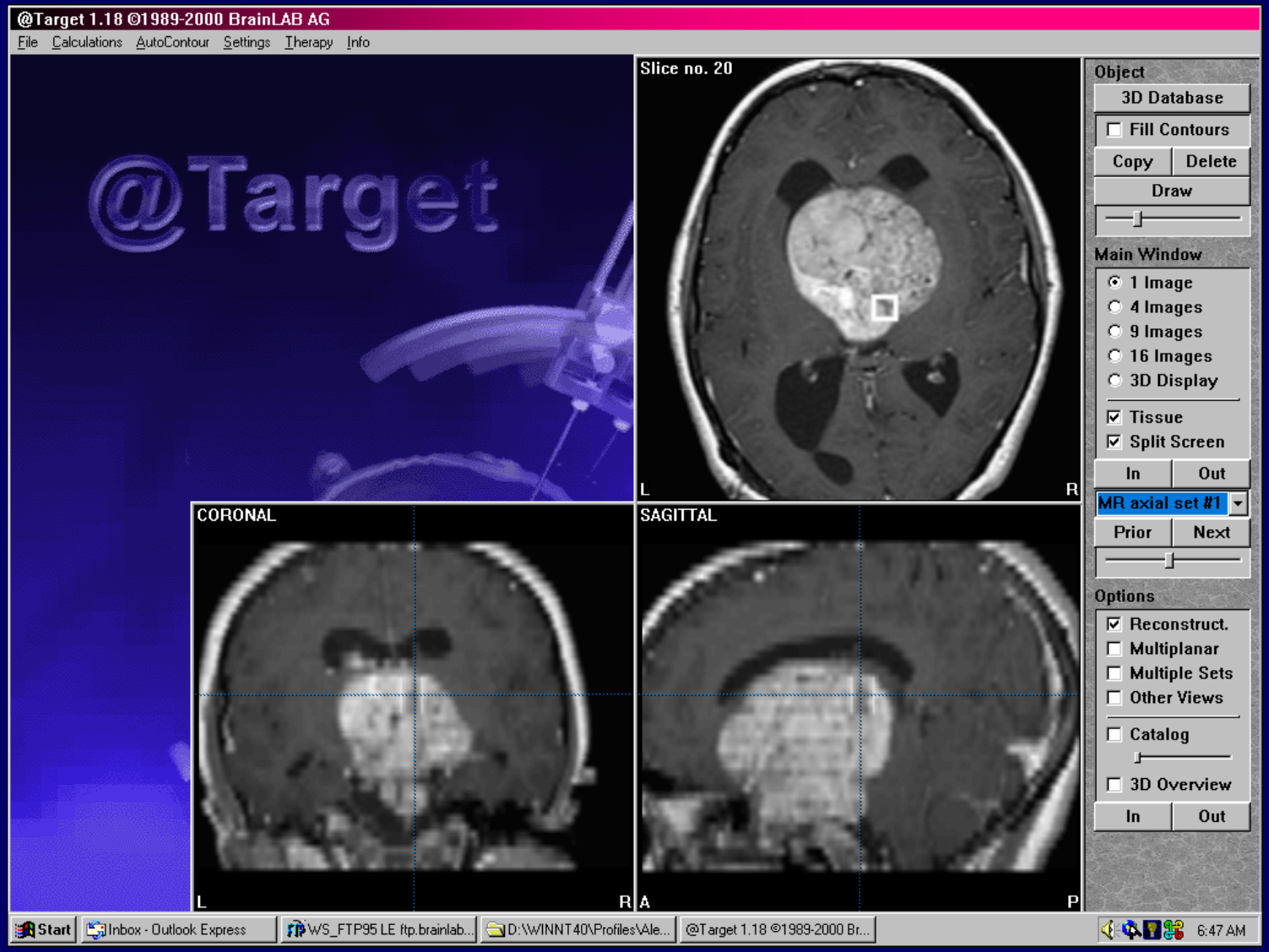
The next slide shows that those tumors that have a normalized choline above 1 usually progress


NORMALIZED VALUES
2
1.5
1
0.5
0
CHO
NAA
CRE
METABOLITE

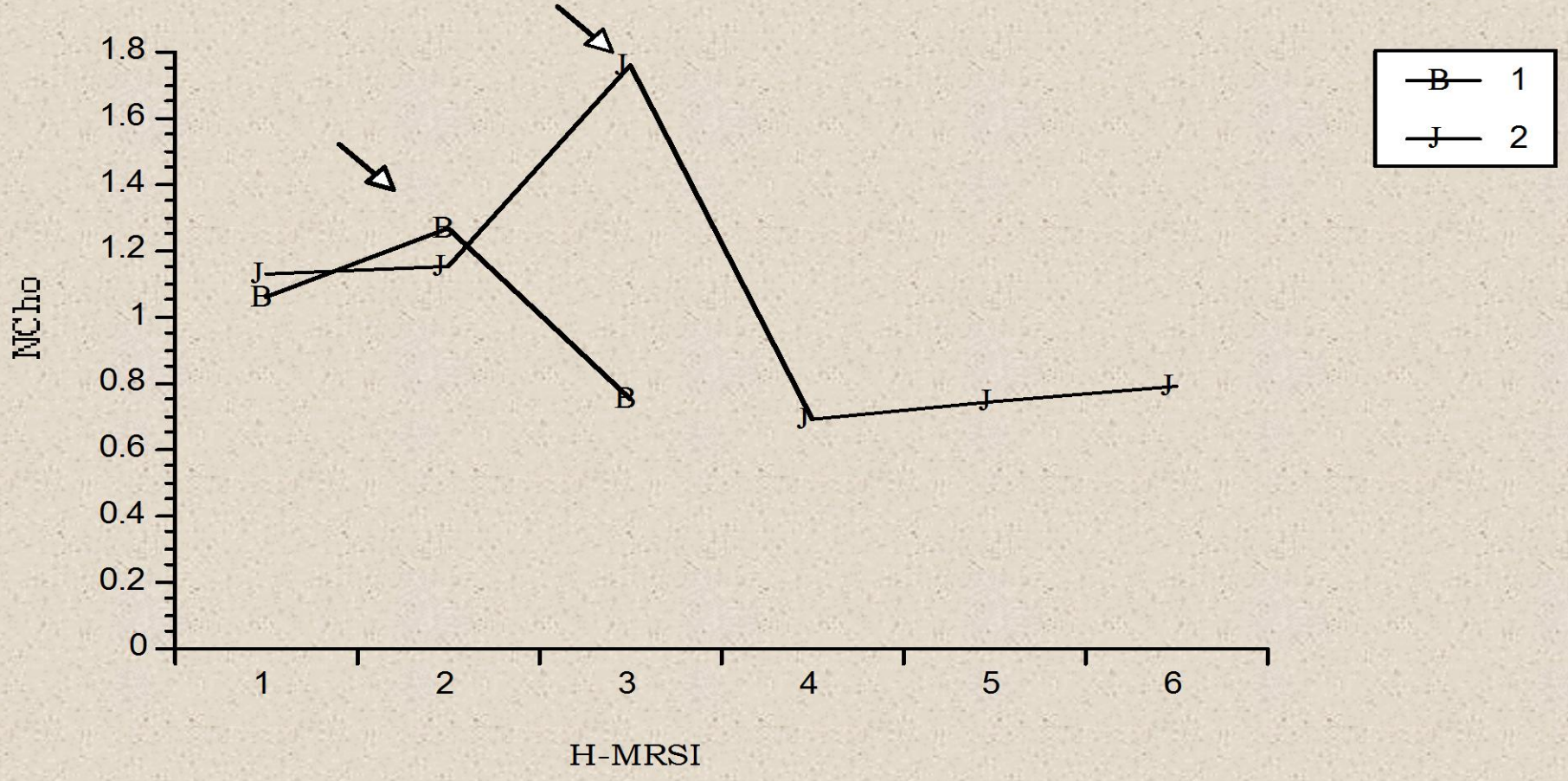
So by calculating the Choline index whe can determine when to be aggressive with chemo and or radiation

Also tumor heterogeneitycan help us in the design of an experimental treatment.
If some areas of the tumor have more Choline than others,
then lets target those areas with a gamma knife or a linear accelerator.

Here you see how we targeted only the high choline areas of a large tumor that otherwise will not be a candidate for gamma knife



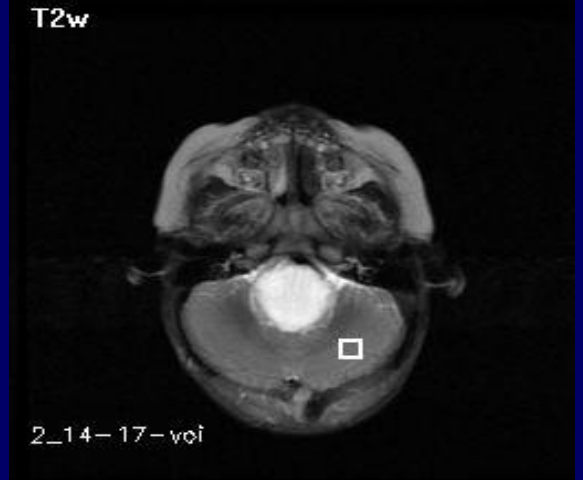
The choline value (on the y) shows that it was above 1 before treatment (arrow) and it later dropped to bellow 1 and the tumor stop progressing

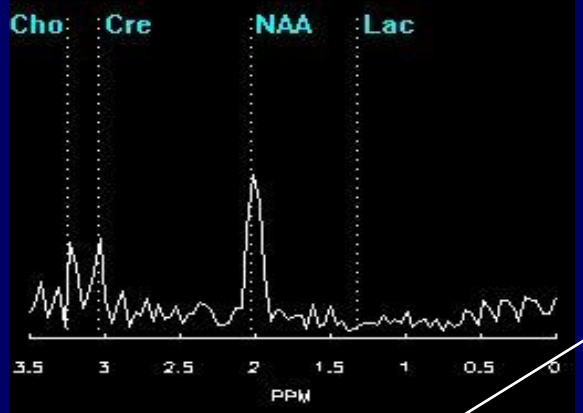


The following two slides show that a child with a brain stem tumor has a very low choline, we did not treat her at all and one year after-as predicted by the MRS-the tumor is shrinking.

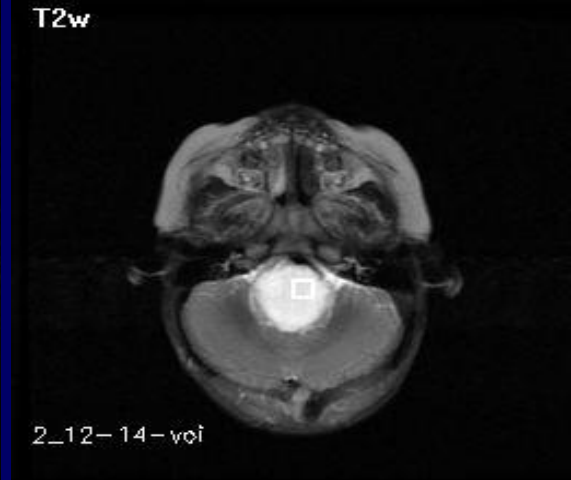
This is when the child arrived

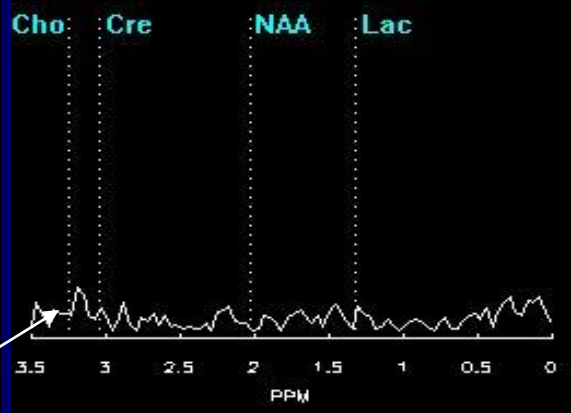
TUMOR





ZS991124 - 245-88-54
1.5 T
Cho = 122168.
Cre = 157930.
NAA = 311135.
LAC = 12273.2
PD = 1008.91
T2 = 393.661
PreC = 346.091
PostC = 372.818
ADC = 0.000000
Cho/NAA = 0.392654
Cho/Cre = 0.773562





ZS991124 - 245-88-54
1.5 T
Cho = 54529.4
Cre = 65871.6
NAA = 15882.3
LAC = 40528.0
PD = 1112.31
T2 = 842.653
PreC = 227.851
PostC = 407.884
ADC = 0.000000
Cho/NAA = 3.43334
Cho/Cre = 0.827813

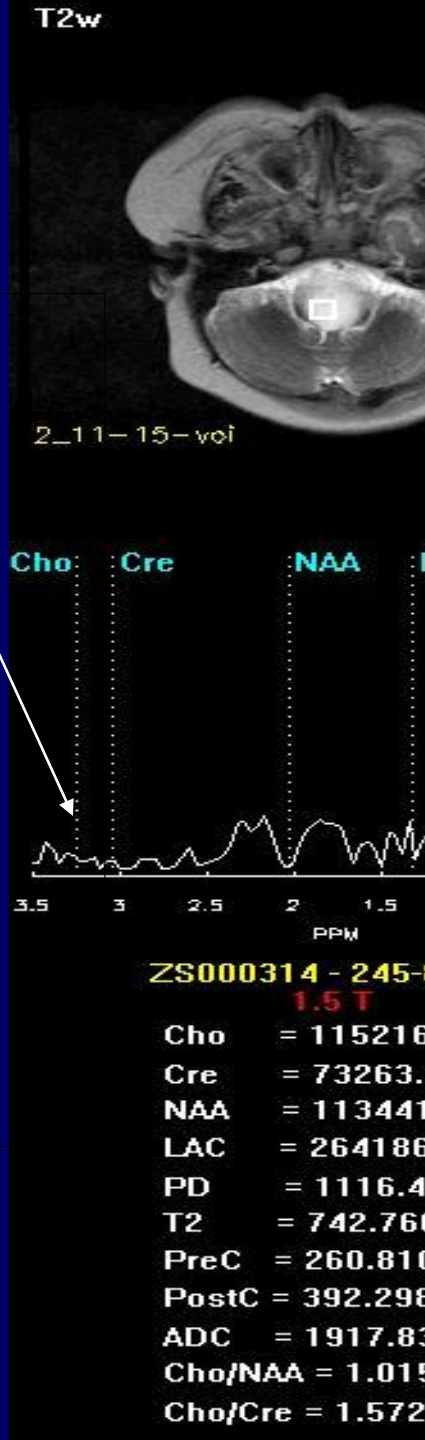
Very low choline

Most resent MRSI

When it arrived

TUMOR,
note the change
in size.

1 year after.



Merci!!!!!