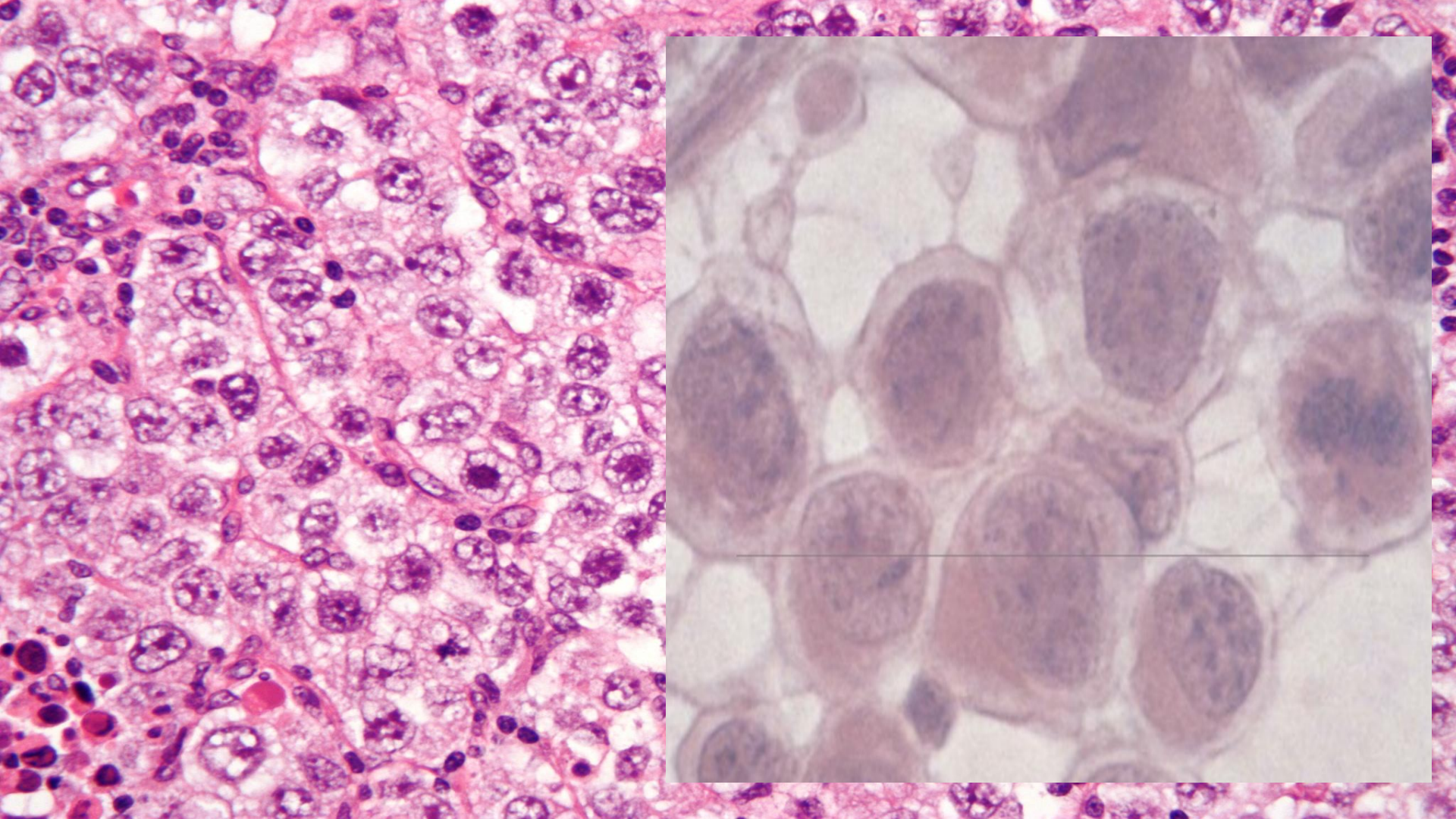


CNS Germ Cell Tumors & Rare Paediatric Brain Tumors

Dr Arpitha.S
Professor Radiation Oncology
Vydehi Institute of Medical Sciences and Research Centre.

INTRACRANIAL GCT

- Intracranial germ cell tumors (IGCT) represent a histologically heterogeneous pediatric group of primary, predominantly midline tumors of the CNS, most commonly seen in the pineal and the suprasellar region classically divided into two main groups:

- Germinomas – the most common (2/3rds)

  Non-germinomatous GCT, which carry a less favorable prognosis .
- Germinomas are highly sensitive to both chemotherapy and radiotherapy (RT), and curable by RT alone.

Demographics:

Median age of diagnosis 10-12 years old,

Male > female (2-3:1)

3-5% pediatric CNS tumors (in the west).

More common in Asia (15- 18%) of all CNS pediatric tumors

Asians and those of Asian descent have 2-3× higher incidence of GCT.

Risk factors: No major risk factors known.

Genetics: Aberrations in KIT/RAS and/or AKT/mTOR pathways in majority of intracranial GCTs

Pathophysiology

- Extragonadal GCT occurs intracranially, as well as in the sacrococcygeal region and the retroperitoneum, among other sites.
- Extragonadal GCT may arise from **primordial germ cells** that exhibit aberrant or incomplete migration during embryonic development.

- **Location**: Primary locations of intracranial GCT are the pineal gland and suprasellar region, pineal gland more common than suprasellar (2:1).
- Rare to occur at other intracranial sites. 5-10% of cases have both pineal and suprasellar tumors, which are known as **“bifocal”** GCT.
- 1/4 th are Mixed .

WHO Classification of Intracranial GCTs

1. Pure Germinoma

2.NGGCT types include:

a. –Endodermal sinus tumor (Yolk sac tumor)
b. –Choriocarcinoma
c. –Embryonal carcinoma
d. –Mixed malignant germ cell
e. –Teratoma (immature, mature,malignant transformation)

Presentation of Intracranial GCTs

Symptoms depend on location of tumor.

- Pineal location
  - Acute onset of symptoms
  - Symptoms of increased ICP due to obstructive hydrocephalus (40%)
  - Parinaud's syndrome (40-50%): Upward gaze and convergence palsy, sluggish pupillary reflex as well as convergence nystagmus thought to be due to compression of superior colliculus.

Presentation of Intracranial GCTs

Symptoms depend on location of tumor.

-Suprasellar location:

- *Indolent onset of symptom*
- *Endocrinopathies*
- *Visual field deficits (i.e. bitemporal hemianopsia)*

Diabetes insipidus can present due to tumor involvement of either location.

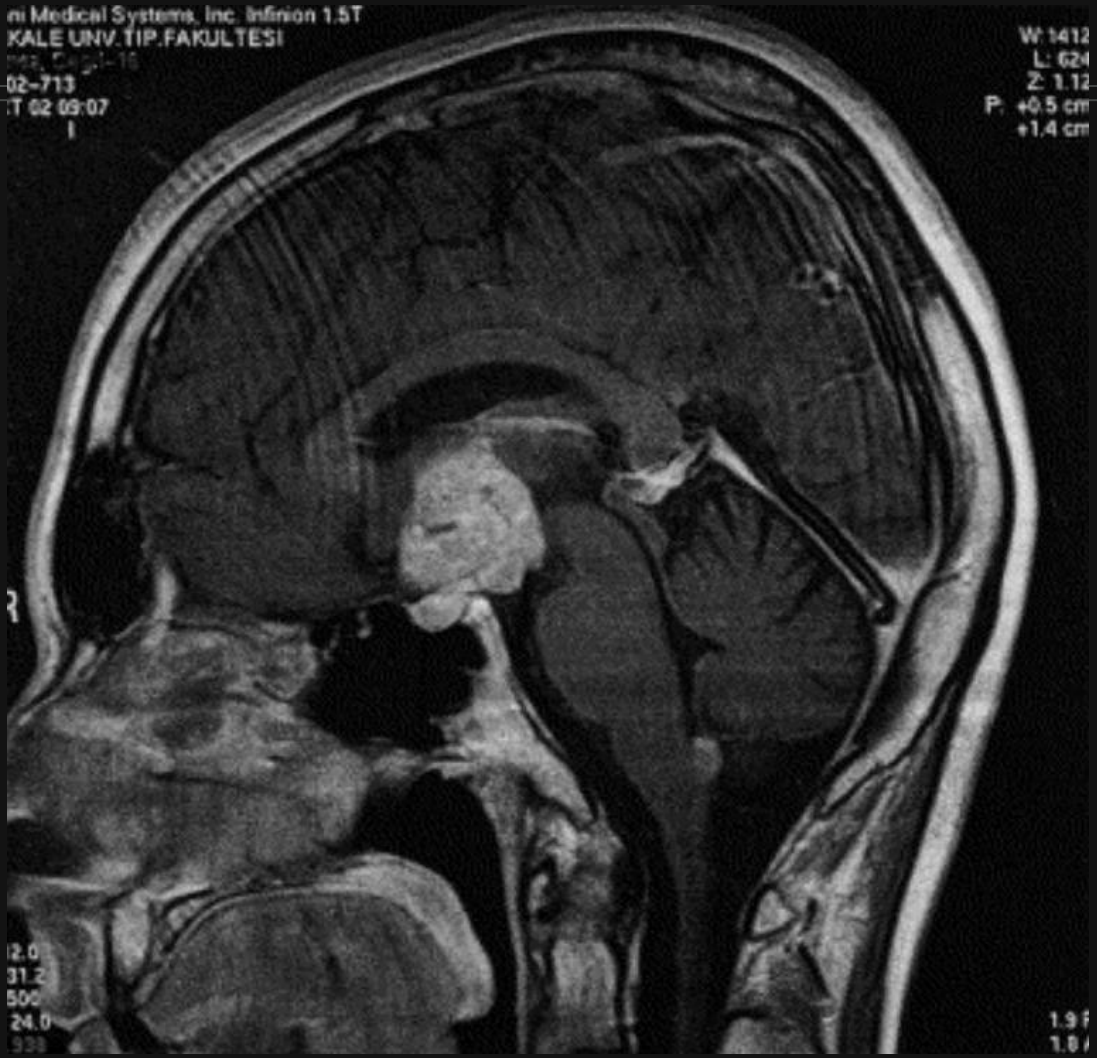
Imaging Characteristics

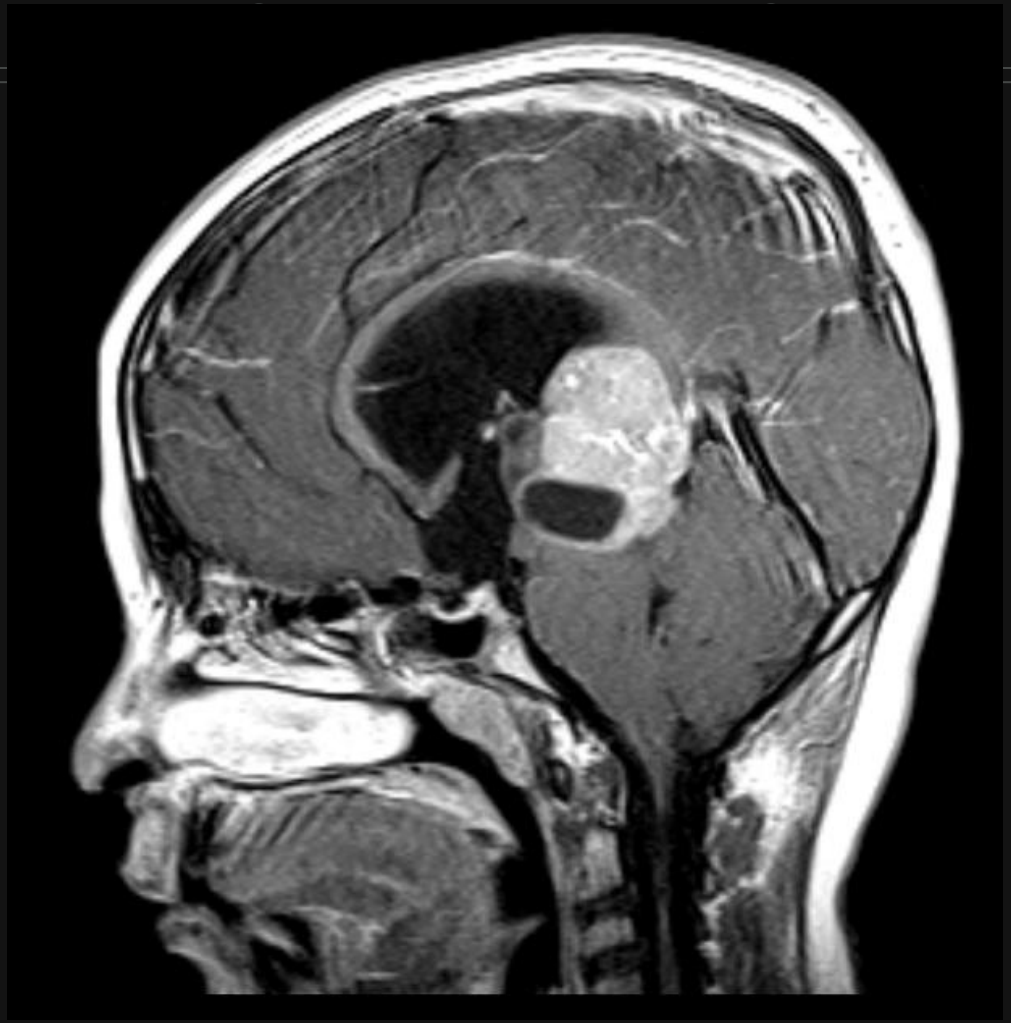
1. *Imaging cannot distinguish the type of GCTs*

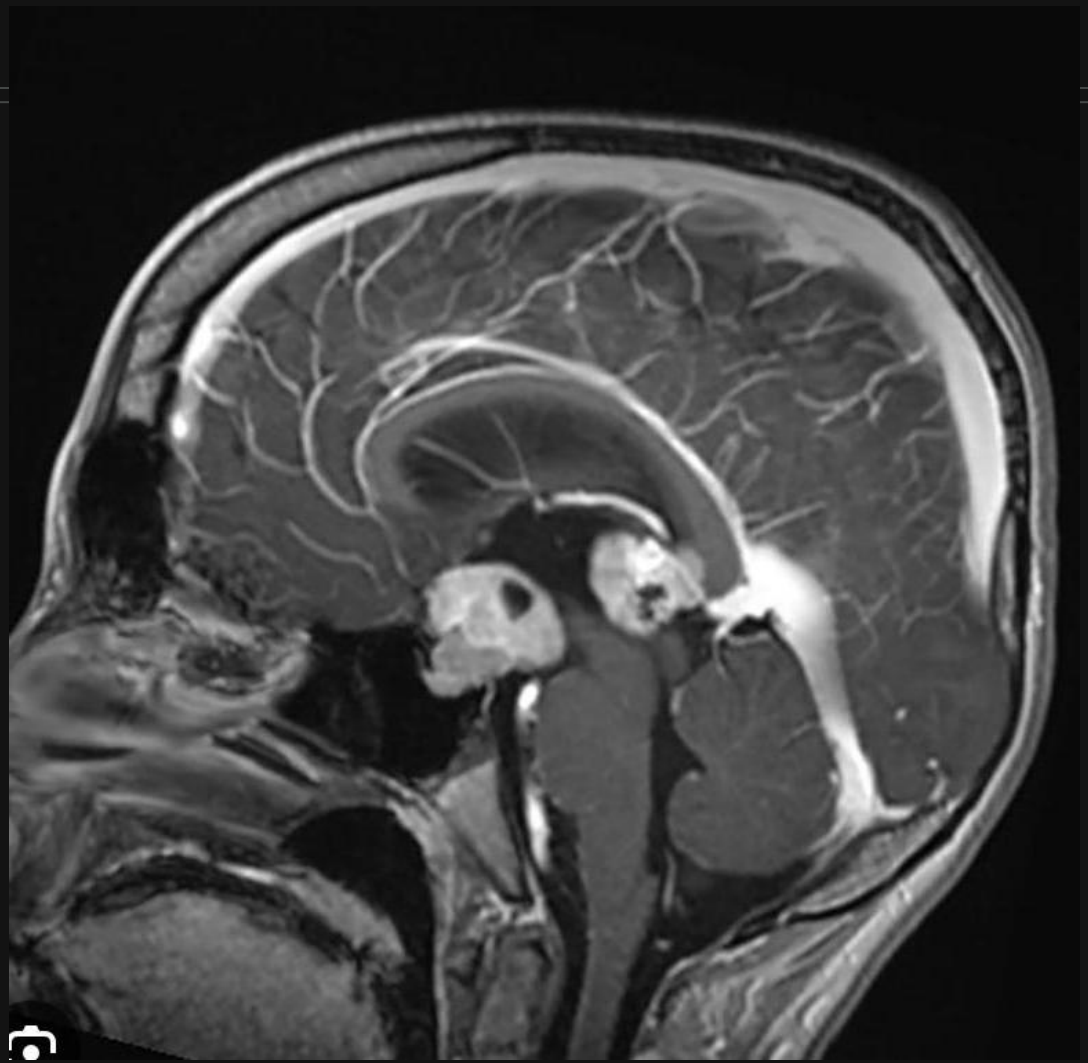
2. *NGGCTs have a more heterogeneous imaging characteristics*

   CT : hyperdense,contrast enhancement,calcifications

   MRI; T1- isointense, T2 - isointense to hyperintense


ni Medical Systems, Inc. Infinion 1.5T
KALE UNV.TIP.FAKULTESI
02-713
T 02 09:07
W: 1412
L: 624
Z: 1.12
P: +0.5 cm
+1.4 cm
R





Differential diagnosis

Pineal tumor differential diagnosis includes

1. *GCT (germinoma/NGGCT),*
2. *glioma,*
3. *pineoblastoma, pineocytoma,*
4. *PNET,*
5. *ependymoma,*
6. *pineal parenchymal tumor of intermediate differentiation (PPTID),*
7. *papillary tumor of the pineal region,*
8. *meningioma,*
9. *lymphoma,*
10. *hamartoma.*

Suprasellar tumor differential diagnosis includes

1. *Craniopharyngioma,*
2. *Langerhans cell histiocytosis,*
3. *Glioma,*
4. *GCT (germinoma/NGGCT),*
5. *Pituitary adenoma,*
6. *Meningioma,*
7. *aneurysm.*

Additional work up

1. *Basic labs*
2. *MRI total spine*
3. *Serum tumor markers (B HCG,AFP)*
4. *LP and CSF cytology and tumor markers*
5. *Biopsy*

Biopsy is required when serum and CSF tumor markers are not elevated. (>25ng/ml AFP and > 50IU/ml B-HCG)

Patients will often require surgical intervention due to hydrocephalus and there is a possible role of maximal safe resection in NGGCT whereas as biopsy is sufficient in Germinomas.

Germ cell tumour	Beta - HCG	Alpha - fetoprotein	IHC tumor marker
Germinoma	**+/-**	**-**	**PLAP,c-kit and OCT3/4**
Germinoma (syncytiotrophoblastic)	**+**	**-**	
Teratoma	**-**	**-**	
Embryonal carcinomas	**+/-**	**+/-**	**CD30, CK AE1/3**
Choriocarcinoma	**++**	**-**	**HCG**
Yolk sac tumor	**+/-**	**++**	**SALL4,AFP**

Staging

No formal staging system

Modified Chang system

(from medulloblastoma) has been used to characterize M-stage

-M0: No neuro-axial or extra-CNS metastases
-M1: + CSF cytology
-M2: Nodular intracranial seeding
-M3: Nodular spinal seeding
-M4: Extra-neural spread

Pragmatically, disease extent is categorized as M0 (localized) or M+ (disseminated)-10-15% will have leptomeningeal dissemination at time of diagnosis

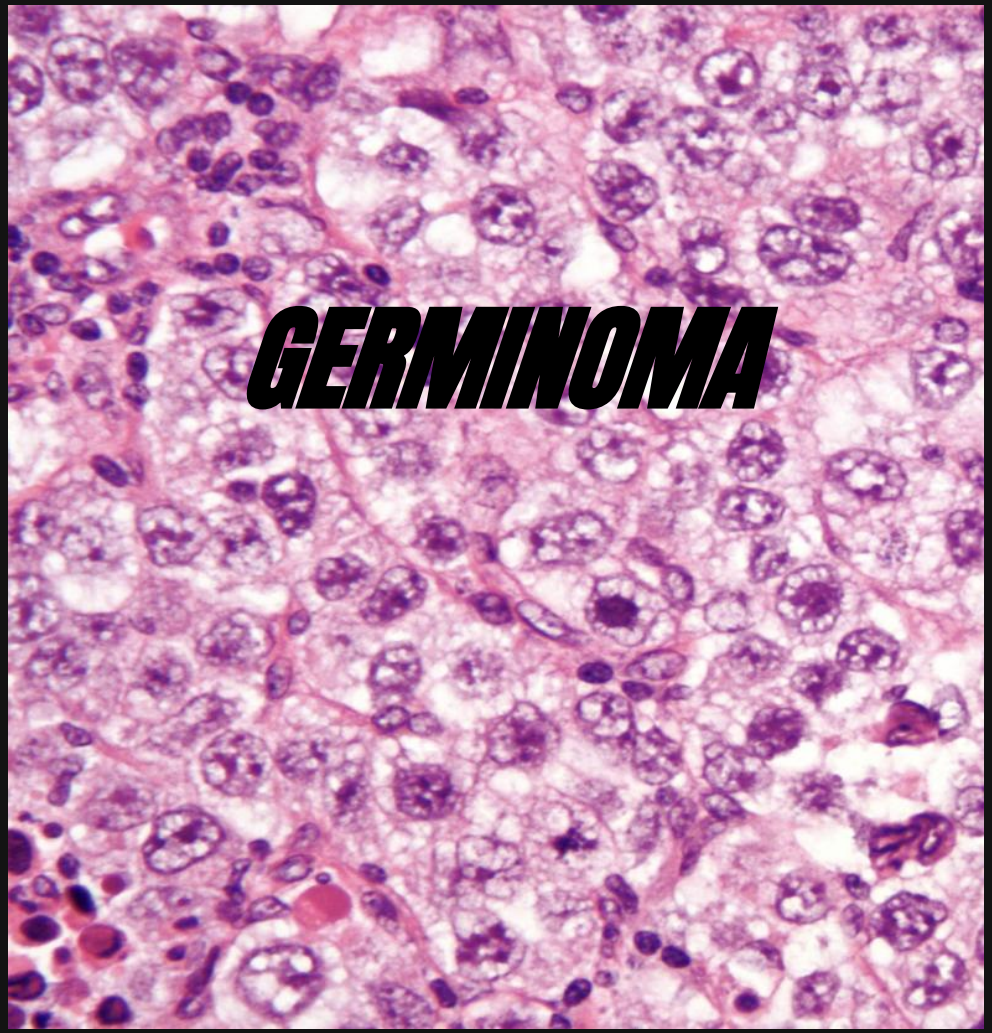
Treatment Overview

- Histology (germinoma versus NGGCT) is most important prognostic factor

- Histology and M-stage are major determinants of treatment approach.

GERMINOMA
5-year PFS > 90%
5-year OS > 90%

NGGCT
5-year PFS- 40-70%
5-year OS- 60-70%



Pathology

Microscopy:

Large uniform tumor cells with:

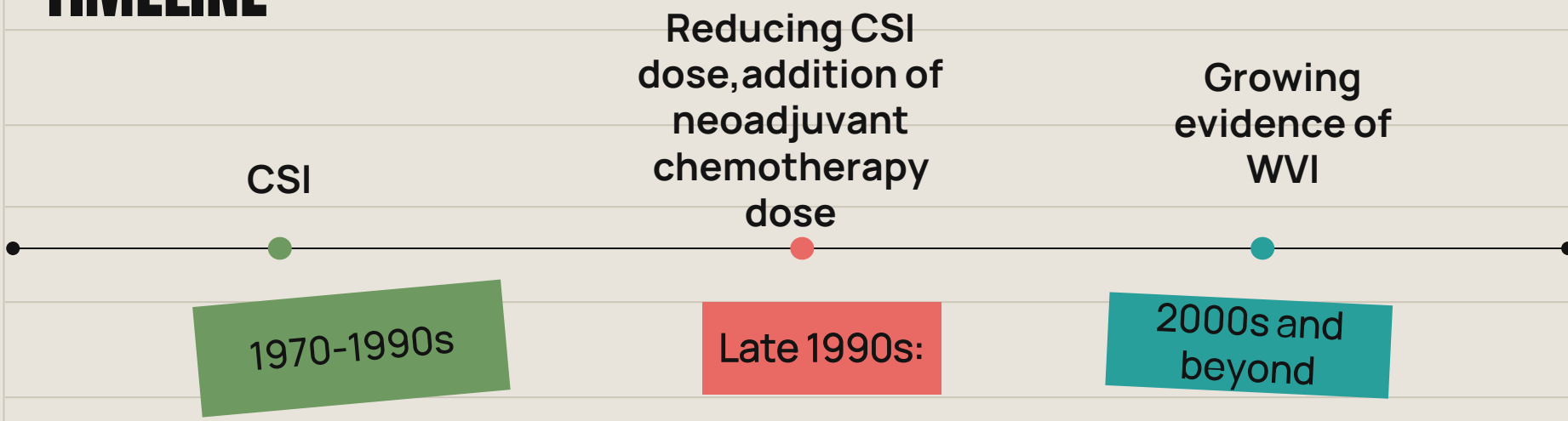
- *Round nuclei, prominent nucleoli.*
- *Clear, glycogen-rich cytoplasm ("fried-egg" appearance).*
- *Fibrous septa infiltrated by lymphocytes, sometimes plasma cells.*
- *Granulomatous reaction with epithelioid histiocytes/giant cells may be seen.*
- *Rare syncytiotrophoblastic giant cells → secrete β-hCG.*

Treatment for Germinomas

- Historical standard treatment for GCTs was single modality radiotherapy with 36 Gy craniospinal irradiation (CSI) + primary boost to 50-54 Gy.

- Given the overall excellent prognosis (particularly for germinomas) and recognition of late effects of radiation (endocrine, neurocognitive, secondary malignancy, musculoskeletal, auditory/visual), practice has evolved towards combined-modality treatment (CMT) with chemotherapy, lower RT doses, and smaller RT volumes.

TIMELINE



Evolution: Transition from CSI to WVI

Reducing dose

Clinical Trial > J Clin Oncol. 1999 Aug;17(8):2585-92. doi: 10.1200/JCO.1999.17.8.2585.

Radiation therapy for intracranial germinoma: results of the German cooperative prospective trials MAKEI 83/86/89

M Bamberg [1], R D Kortmann, G Calaminus, G Becker, C Meisner, D Harms, U Göbel

Affiliations + expand

PMID: 10561326 DOI: 10.1200/JCO.1999.17.8.2585

Reducing Dose: MAKEI 83/86/89

- Series of German prospective, nonrandomized trials enrolling from 1983 to 1993
- Assessing dose reduction in CNS germinomas
- MAKEI 83/86 (pilot studies)
  - 11 patients
  - 36 Gy CSI + 14 Gy boost (1.8-2.0 Gy fx)
  - No relapses
- MAKEI 89
  - 49 patients
  - 30 Gy CSI + 15 Gy boost (1.5 Gy fx)
  - 5 relapses (4 outside of CNS)
- Conclusion: CSI dose can be reduced to 30 Gy in germinomas

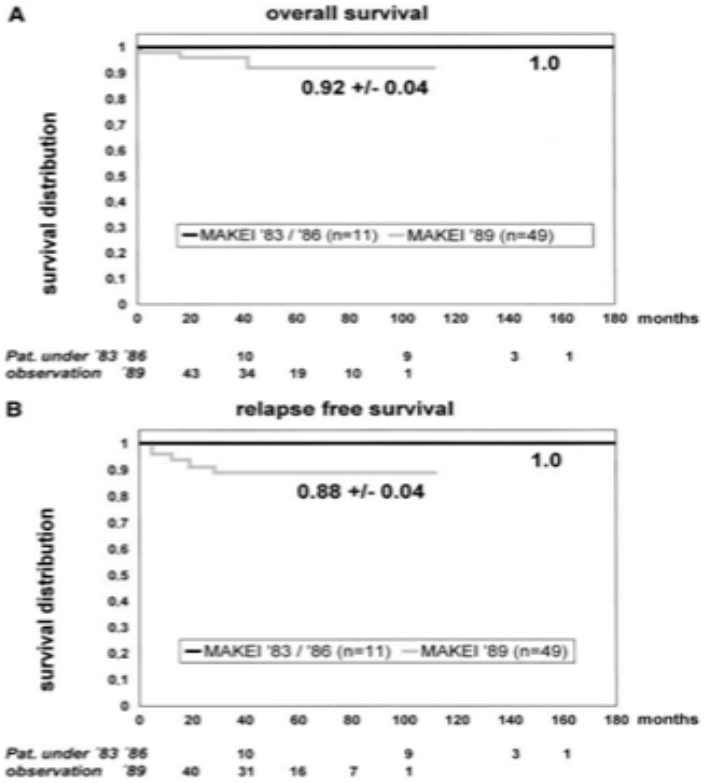


Fig 1. Actuarial (A) overall and (B) relapse-free survival rates after treatment with radiotherapy alone in patients (Pat.) with intracranial germinoma (MAKEI 83/86/89) (Kaplan-Meier survival distribution function).

Bamberg *et al.* JCO. 1999.

In 1990, the French Society of Paediatric Oncology(SFOP) initiated a trial using chemotherapy and local field radiotherapy in localized germinomas with favorable results.

In 1998, Matsutani et al (Japanese Pediatric trail group)reported excellent survival for germinomas treated with surgery, followed by chemotherapy and local radiotherapy. Patients who received chemotherapy before reduced radiotherapy (24Gy) were all alive at a median follow-up of 4.3 years.

Aoyama et al (2002)presented promising excellent results (5y OS 93%)in a Japanese series including 16 germinomas treated with surgery, followed by chemotherapy and low-dose involved-field radiotherapy(24GY).

Approaches using chemotherapy alone have not been promising.Chemotherapy-only approaches for germinomas have yielded inferior outcomes, with >50% rates of relapse, even after CR from chemotherapy (Balmaceda et al. JCO 1996)

Reducing Volume and adding chemo

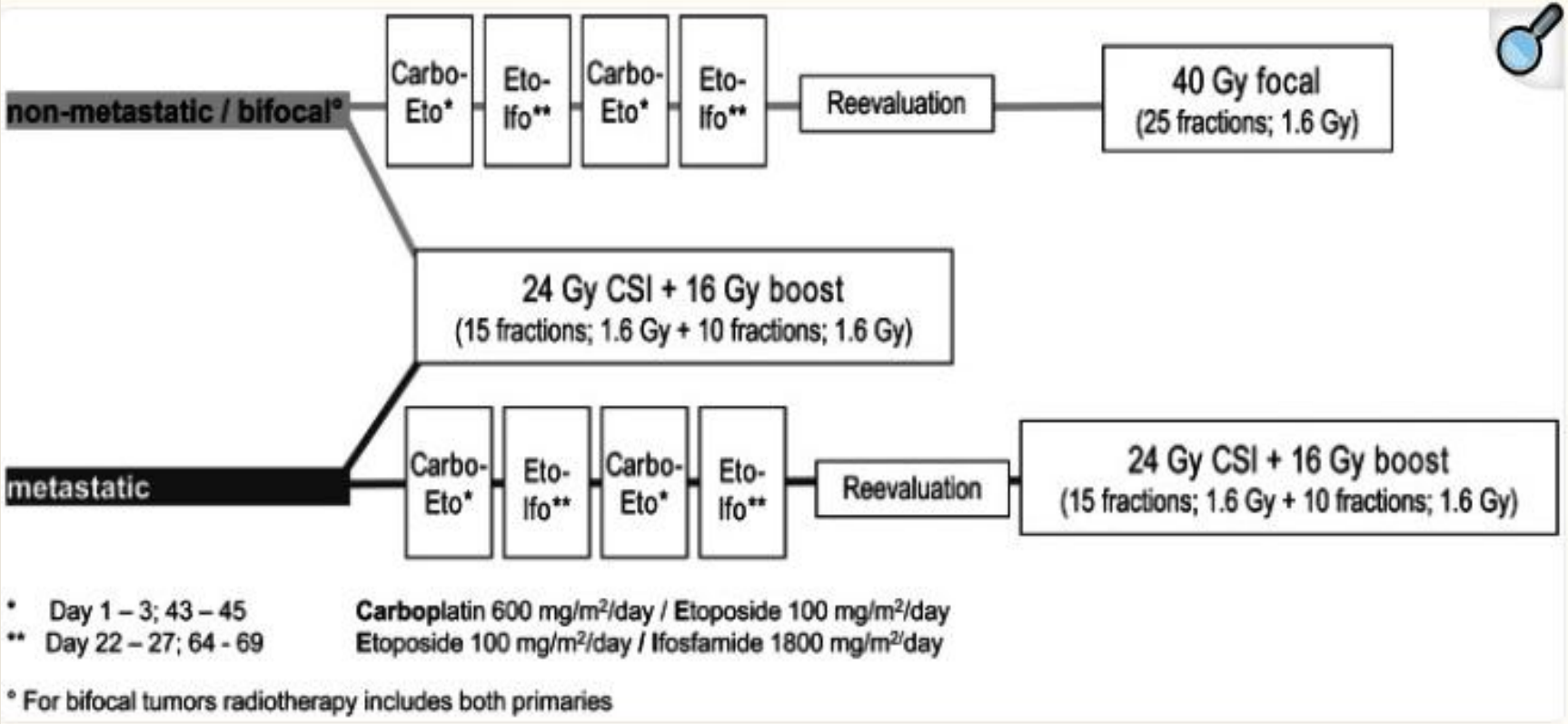
Neuro-Oncology 15(6):788–796, 2013.
doi:10.1093/neuonc/not019
Advance Access publication March 3, 2013

NEURO-ONCOLOGY

SIOP CNS GCT 96: final report of outcome of a prospective, multinational nonrandomized trial for children and adults with intracranial germinoma, comparing craniospinal irradiation alone with chemotherapy followed by focal primary site irradiation for patients with localized disease

Gabriele Calaminus, Rolf Kortmann, Jennifer Worch, James C. Nicholson, Claire Alapetite, Maria Luisa Garrè, Catherine Patte, Umberto Ricardi, Frank Saran, and Didier Frappaz

Fig. 1.


non-metastatic / bifocal°
Carbo-Eto*
Eto-Ifo**
Carbo-Eto*
Eto-Ifo**
Reevaluation
40 Gy focal
(25 fractions; 1.6 Gy)
24 Gy CSI + 16 Gy boost
(15 fractions; 1.6 Gy + 10 fractions; 1.6 Gy)
metastatic
Carbo-Eto*
Eto-Ifo**
Carbo-Eto*
Eto-Ifo**
Reevaluation
24 Gy CSI + 16 Gy boost
(15 fractions; 1.6 Gy + 10 fractions; 1.6 Gy)
* Day 1 – 3; 43 – 45
** Day 22 – 27; 64 - 69
Carboplatin 600 mg/m²/day / Etoposide 100 mg/m²/day
Etoposide 100 mg/m²/day / Ifosfamide 1800 mg/m²/day
° For bifocal tumors radiotherapy includes both primaries

Patients with localized germinoma (n 190) received either CSI alone (n 125) or combined therapy (n 65), demonstrating no differences in 5-year event-free or overall survival, but a difference in progression-free survival (0.97+0.02 vs 0.88+0.04; P .04).

Seven of 65 patients receiving combined treatment experienced relapse (6 with ventricular recurrence outside the primary radiotherapy field), and only 4 of 125 patients treated with CSI alone experienced relapse (all at the primary tumor site).

Metastatic patients (n 45) had 0.98+0.023 event-free and overall survival.

Study shows that patients with localized germinoma can be treated effectively with 2 treatment options:

Radiotherapy alone at reduced doses of 24 Gy CSI and additional boost to the primary and metastatic sites of 16 Gy or a combined treatment approach using carboplatin-based chemotherapy followed by local radiotherapy (40 Gy).

The primary rationale for limiting the extent of radiation in young patients is to minimize potential adverse effect

ELSEVIER

The Lancet Oncology

Volume 6, Issue 7, July 2005, Pages 509-519

Review

Radiotherapy of localised intracranial germinoma: time to sever historical ties?

SJ Rogers FRCR [a], MA Mosleh-Shirazi PhD [b], Dr FH Saran FRCR [a]

A comprehensive review of patterns of relapse for 788 patients with localized pure germinoma treated with definitive radiation alone using varying radiation volumes published in 2005 revealed that the treatment of the full neuroaxis may have been excessive.

CSI reducing spinal failures merely 2%.

In contrast, focal irradiation alone yielded an unacceptably high rate of relapse at 23% after a median follow-up of 6.4 years . In effect, the data buttressed support for volume reduction from CSI to WVRT but stopped short of focal irradiation alone, at least in the absence of chemotherapy

The natural spread in intracranial germinoma is believed to be laminar, along the subependymal lining of the walls of the third and fourth ventricles, leading to multifocal disease and regional intraventricular relapse before spinal dissemination.

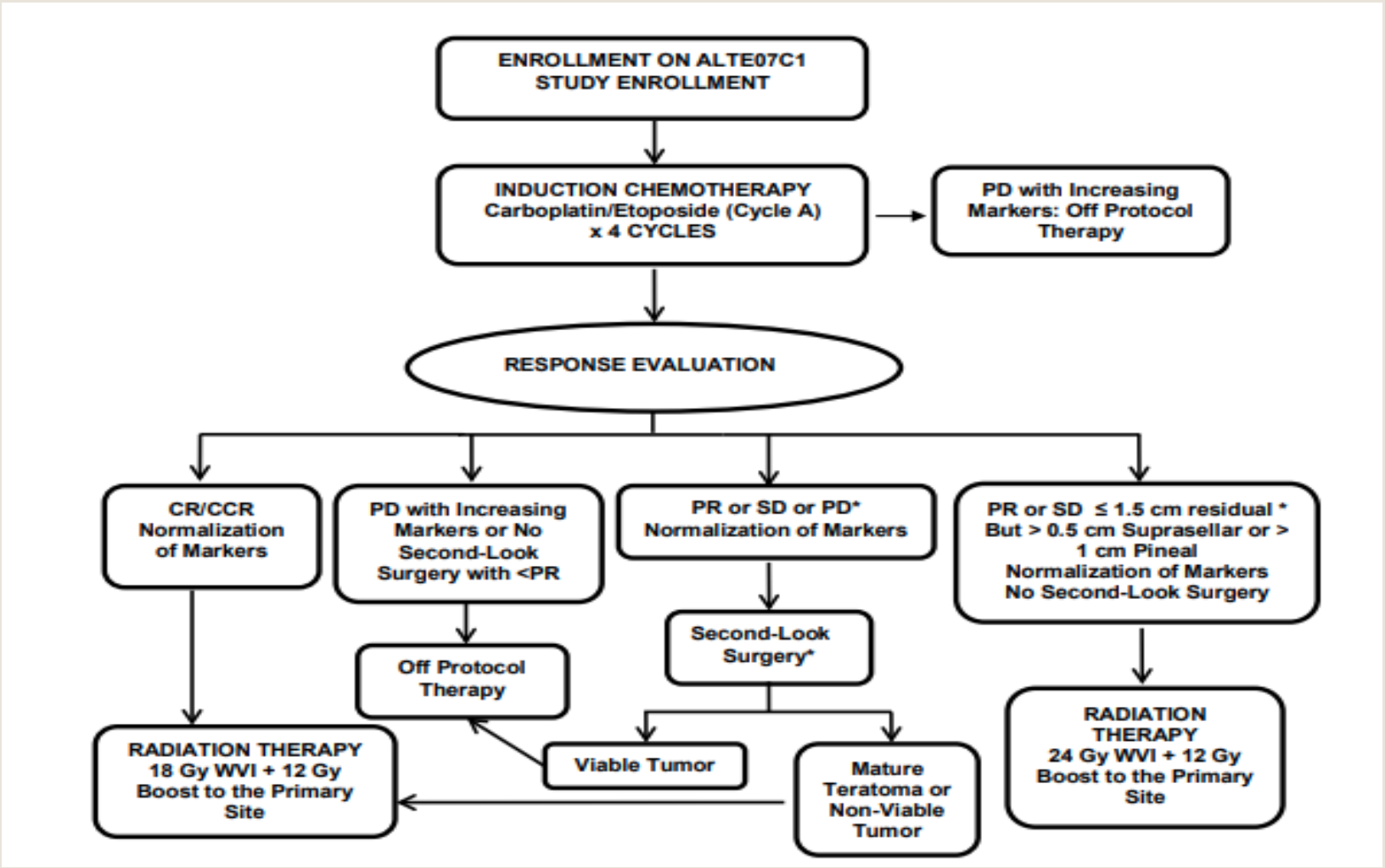
The predominant pattern of relapse in localised intracranial germinomas treated by the combined-modality approach is ventricular.

Detailed analysis of the SIOP and Societé Française d'Oncologie Pédiatrique (SFOP) groups, lends support to the use of ventricular radiotherapy as part of the primary treatment strategy.

ACNS 1123

Phase II trial of response-based radiation therapy for patients with localized germinoma: a Children's Oncology Group study

Ute Bartels [1,✉], Arzu Onar-Thomas [2], Sunita K Patel [3], Dennis Shaw [4], Jason Fangusaro [5], Girish Dhall [6], Mark Souweidane [7], Aashim Bhatia [8], Leanne Embry [9], Christine L Trask [10], Erin S Murphy [11], Shannon MacDonald [12], Shengjie Wu [13], James M Boyett [14,2], Sarah Leary [15], Maryam Fouladi [16], Amar Gajjar [17], Soumen Khatua [18]


ENROLLMENT ON ALTE07C1
STUDY ENROLLMENT
INDUCTION CHEMOTHERAPY
Carboplatin/Etoposide (Cycle A)
x 4 CYCLES
PD with Increasing Markers: Off Protocol Therapy
RESPONSE EVALUATION
CR/CCR Normalization of Markers
PD with Increasing Markers or No Second-Look Surgery with <PR
PR or SD or PD* Normalization of Markers
PR or SD ≤ 1.5 cm residual * But > 0.5 cm Suprasellar or > 1 cm Pineal Normalization of Markers No Second-Look Surgery
Off Protocol Therapy
Second-Look Surgery*
RADIATION THERAPY
18 Gy WVI + 12 Gy
Boost to the Primary Site
Viable Tumor
Mature Teratoma or Non-Viable Tumor
RADIATION THERAPY
24 Gy WVI + 12 Gy
Boost to the Primary Site

This is the first and largest prospective study of a dose reduction strategy in localized germinoma, a rare disease in North America and Europe.

It is a multicentre study through the COG consortium, on 137 eligible patients across USA, Canada, and Australia.

This trial demonstrated a 3-year PFS of 94.5 ± 2.7% with reduced dose of whole ventricular irradiation (WVI of 18 Gy) in patients aged 3–21 years.

Non Inferiority trial failed to meet primary endpoint due to study design but suggests equivalent outcomes and improved neurocognitive function with 18Gy whole ventricular and 30 Gy total dose to primary site for complete responders. 2-drug chemotherapy regimen resulted in high response rates.

Radiation Dose

Dose:

Generally, treat at 1.5 Gy/# for germinoma.

Localized germinoma: If RT alone,

whole-ventricle RT (WVRT) to 24 Gy → boost gross disease to 40-45 Gy .

Localized germinoma: If RT after chemotherapy,

then treat per COG ACNS1123 RT dose

depending on tumor response on repeat imaging after chemotherapy.

ACNS1123: If PR/SD after chemotherapy: 24 Gy WVRT → 12 Gy boost to primary site

ACNS1123: If CR after chemotherapy: 18 Gy WVRT → 12 Gy boost to primary site

Radiation Dose

Bifocal germinoma: Treat as above for localized germinoma but boost both primaries (suprasellar and pineal).

Cannot have other tumors beyond these two sites to be classified as Bifocal Disseminated.

(M+) germinoma:

CSI to 23.4-30 Gy → boost to primary to total dose ~40- 45 Gy

BASAL ganglia Germinoma: WBRT(18Gy)+ boost(12.6Gy)

JOURNAL ARTICLE

GCT-11. 24 Gy whole ventricular radiotherapy alone is sufficient for disease control in localised germinoma in CR after initial chemotherapy – final of the SIOP CNS GCT II study

Gabriele Calaminus, Brigitte Bison, Cecile Faure Conter, Didier Frappaz, Andreas Peyrl, Nicolas U Gerber, Jans-Enno Müller, Thankamma Ajithkumar, Giovanni Morana, Justin Cross ... Show more

Neuro-Oncology, Volume 24, Issue Supplement_1, June 2022, Page i56,

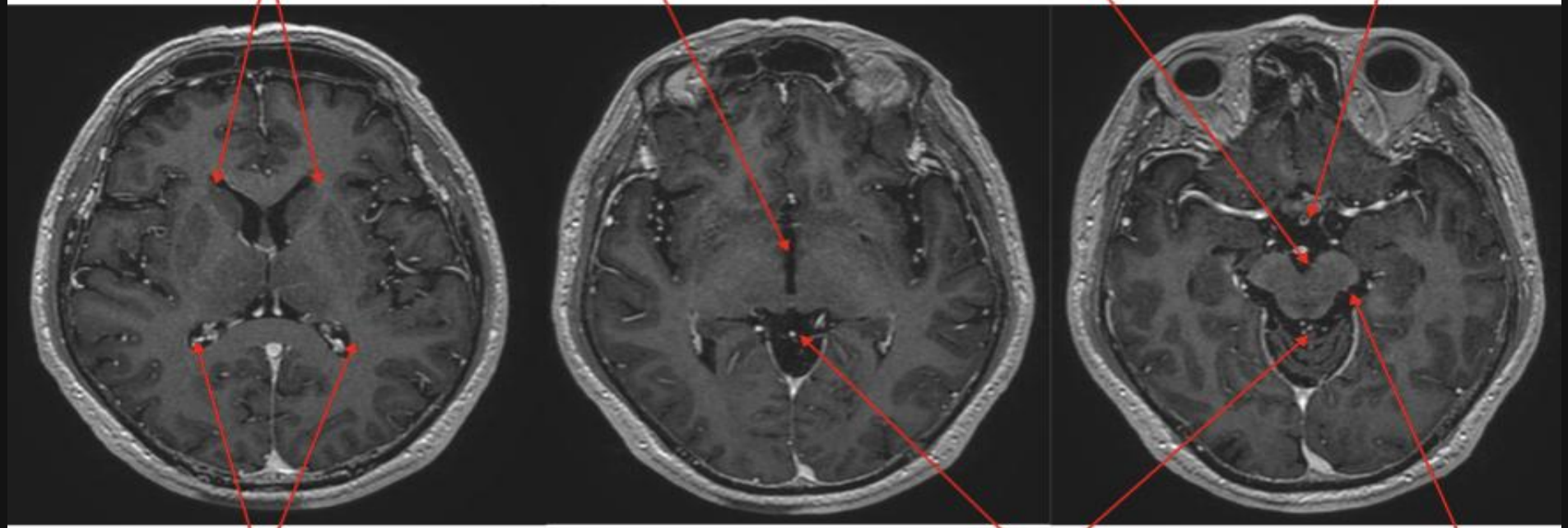
Chemotherapy

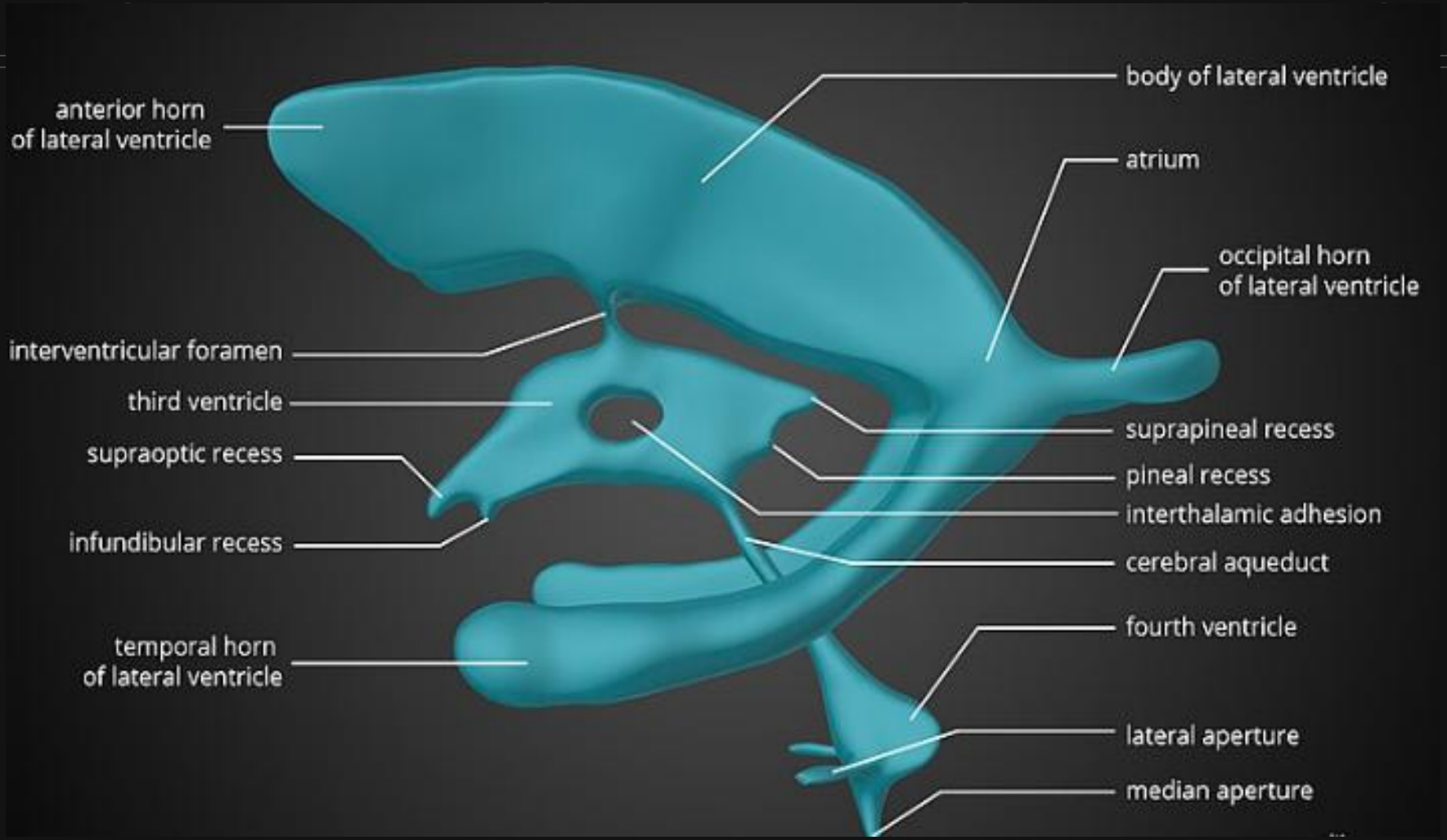
The chemosensitivity of iGCT is well recognized. Cisplatin or carboplatin have become the backbone protocols, which have also included etoposide plus either cyclophosphamide or ifosfamide in most regimens.

There is no clear demonstration of survival benefit of cisplatin compared to carboplatin in iGCT.
Rather, there is some evidence that cisplatin and other agents such as ifosfamide that require hyper-hydration are associated with a higher risk of toxicity (renal and/or neurological) among patients with DI, High-dose, marrow-ablative chemotherapy (HDC) regimens are used for poor responders or patients with recurrence.

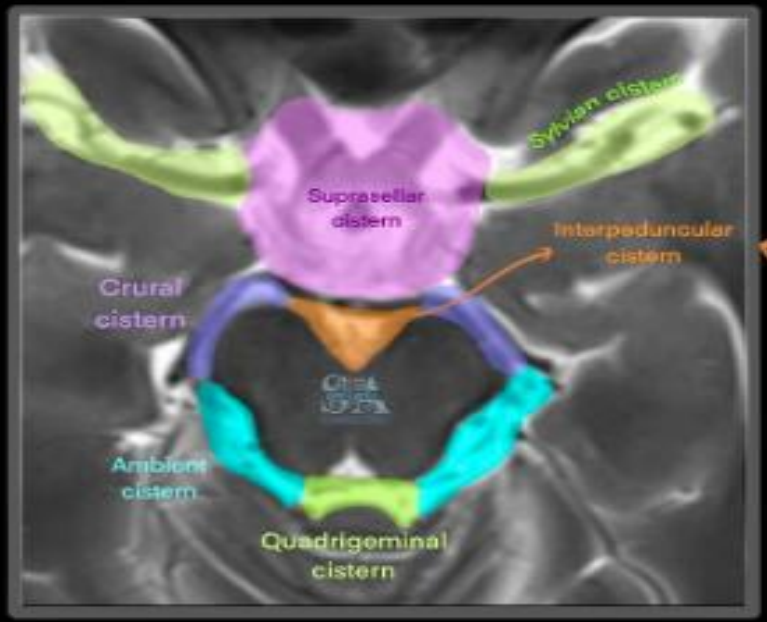
Most high-dose regimens include high-dose thiotepa combined with etoposide and/or carboplatin.

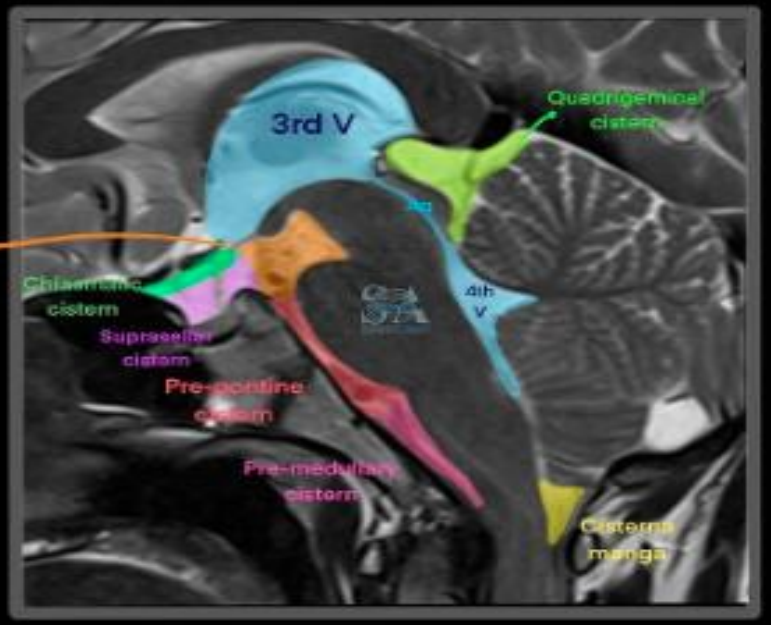
Anatomy


Frontal horn of lateral ventricle
3rd ventricle
Interpeduncular cistern
Suprasellar cistern
Occipital horn of lateral ventricle
Quadrigeminal cistern
Ambient cistern


anterior horn
of lateral ventricle
body of lateral ventricle
atrium
occipital horn
of lateral ventricle
interventricular foramen
third ventricle
supraoptic recess
infundibular recess
suprapineal recess
pineal recess
interthalamic adhesion
cerebral aqueduct
fourth ventricle
temporal horn
of lateral ventricle
lateral aperture
median aperture

CSF CISTERNS



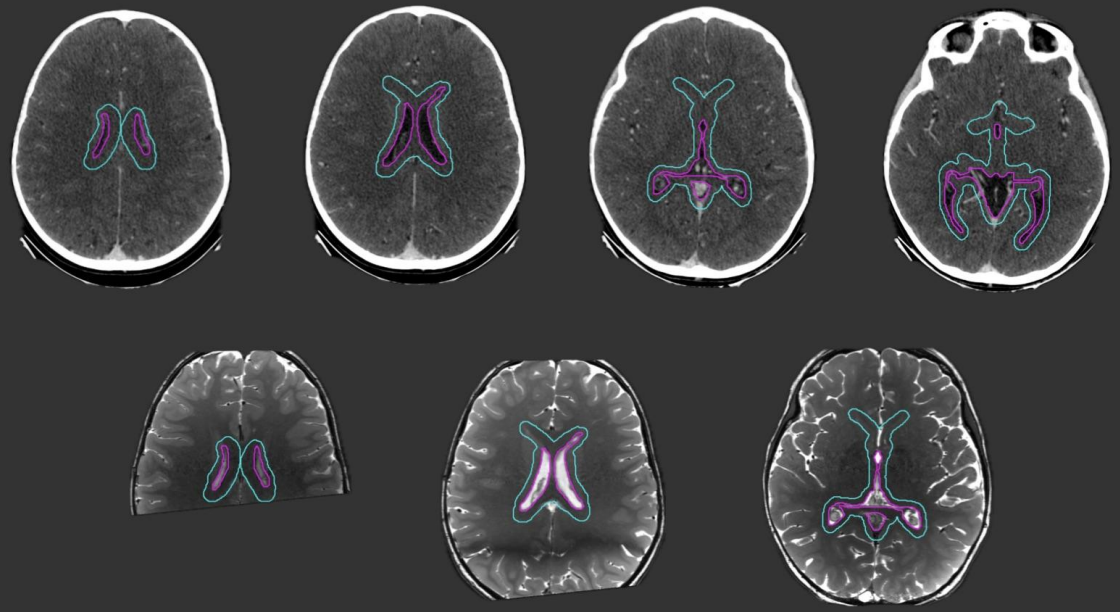


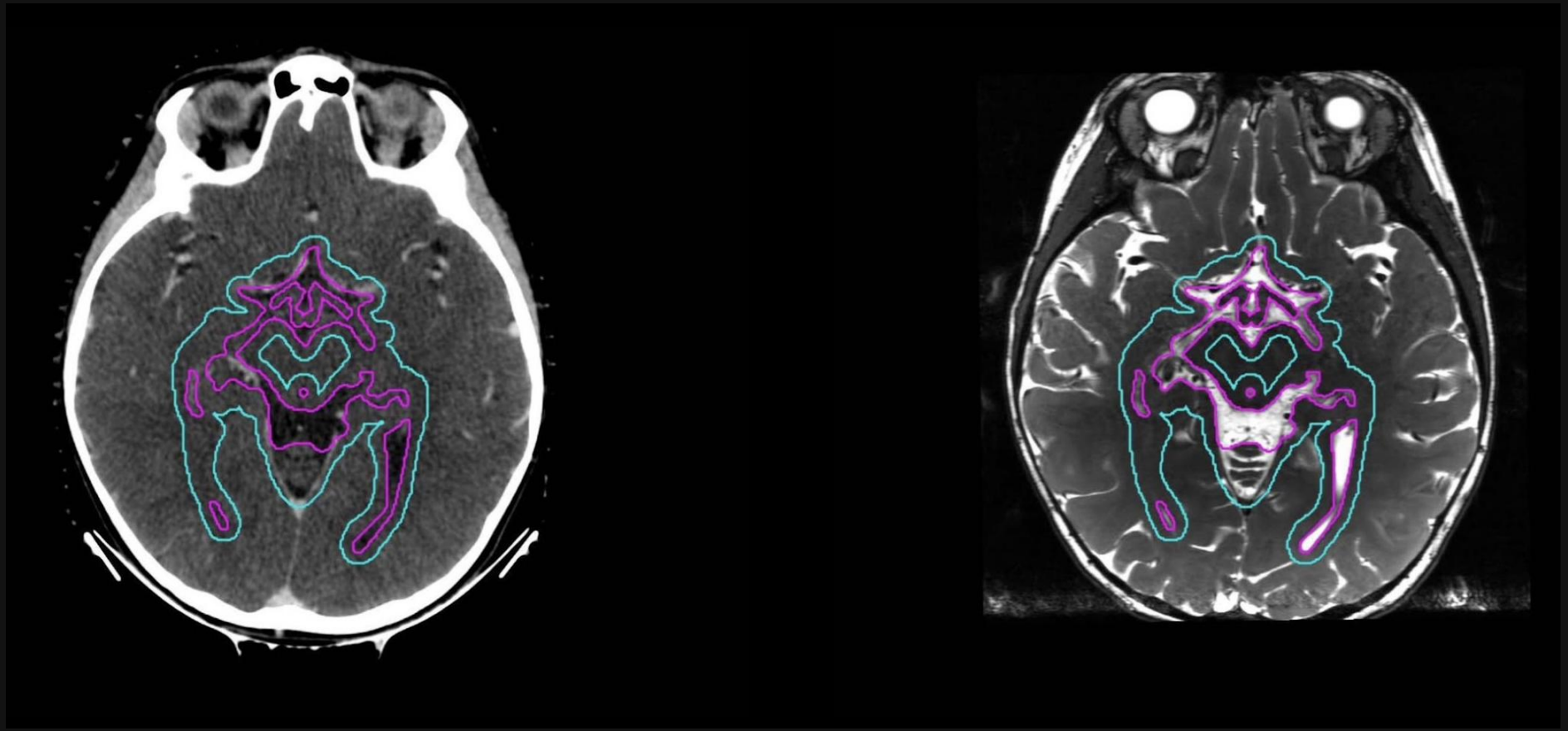
Whole ventricle Target Volume Atlas for Germ cell tumors

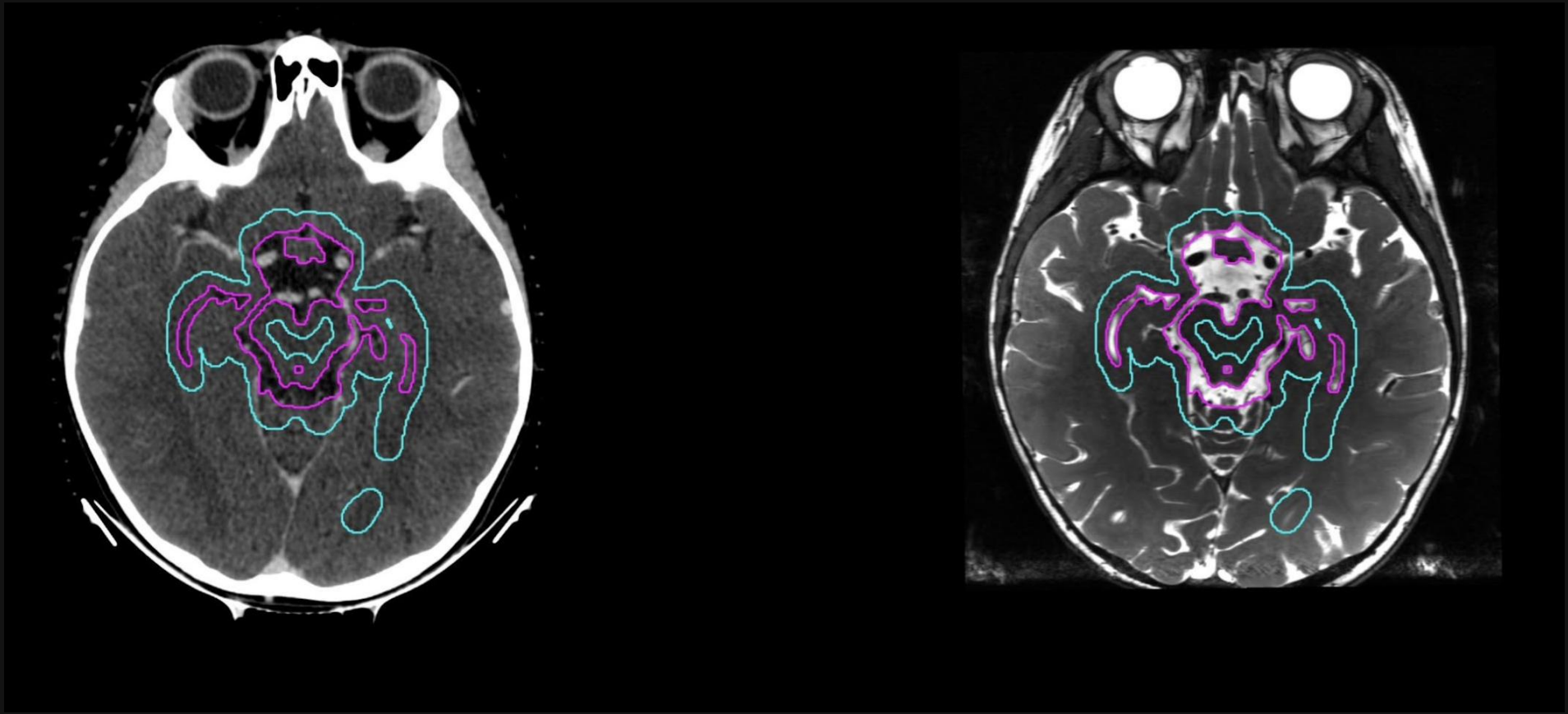
Childrens Oncology Group
ACNS1123

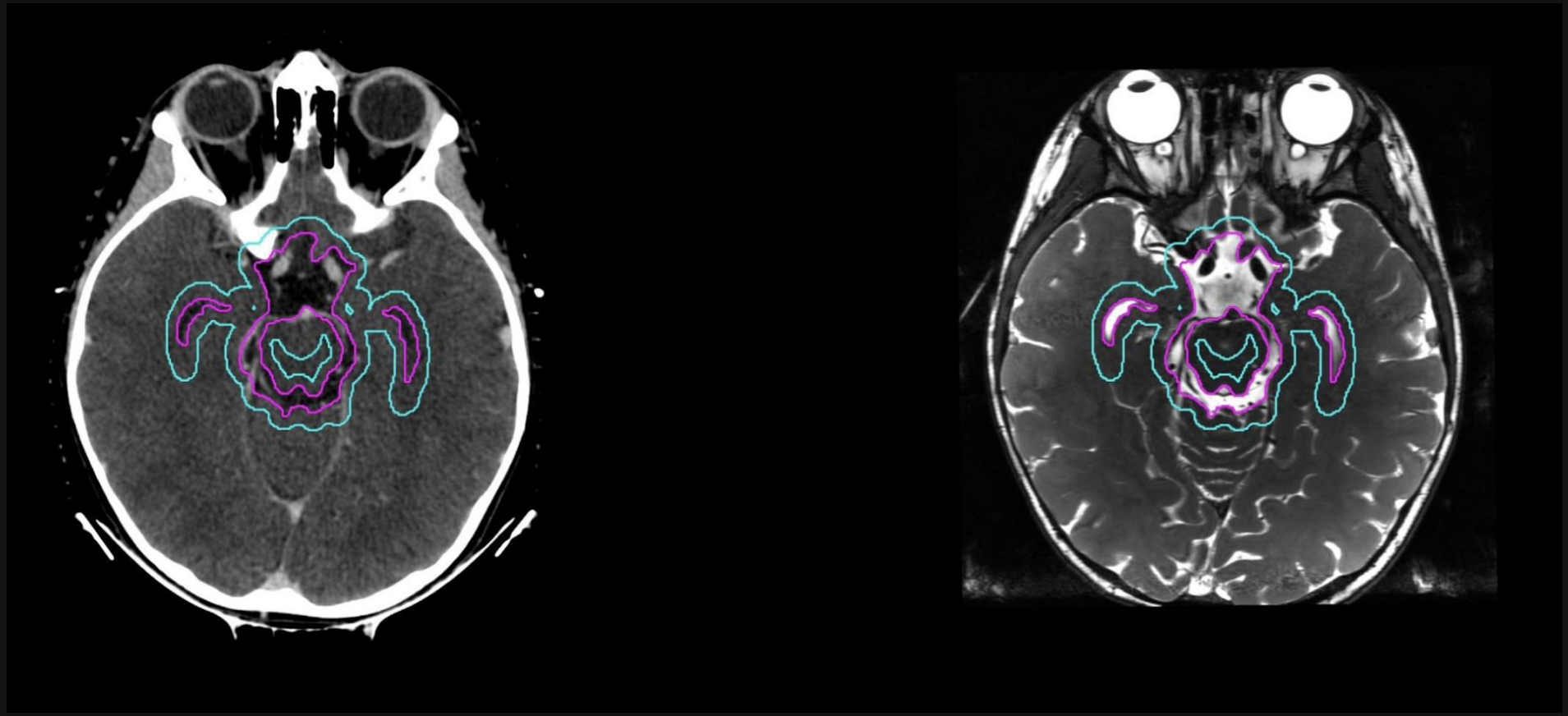
General Guidelines

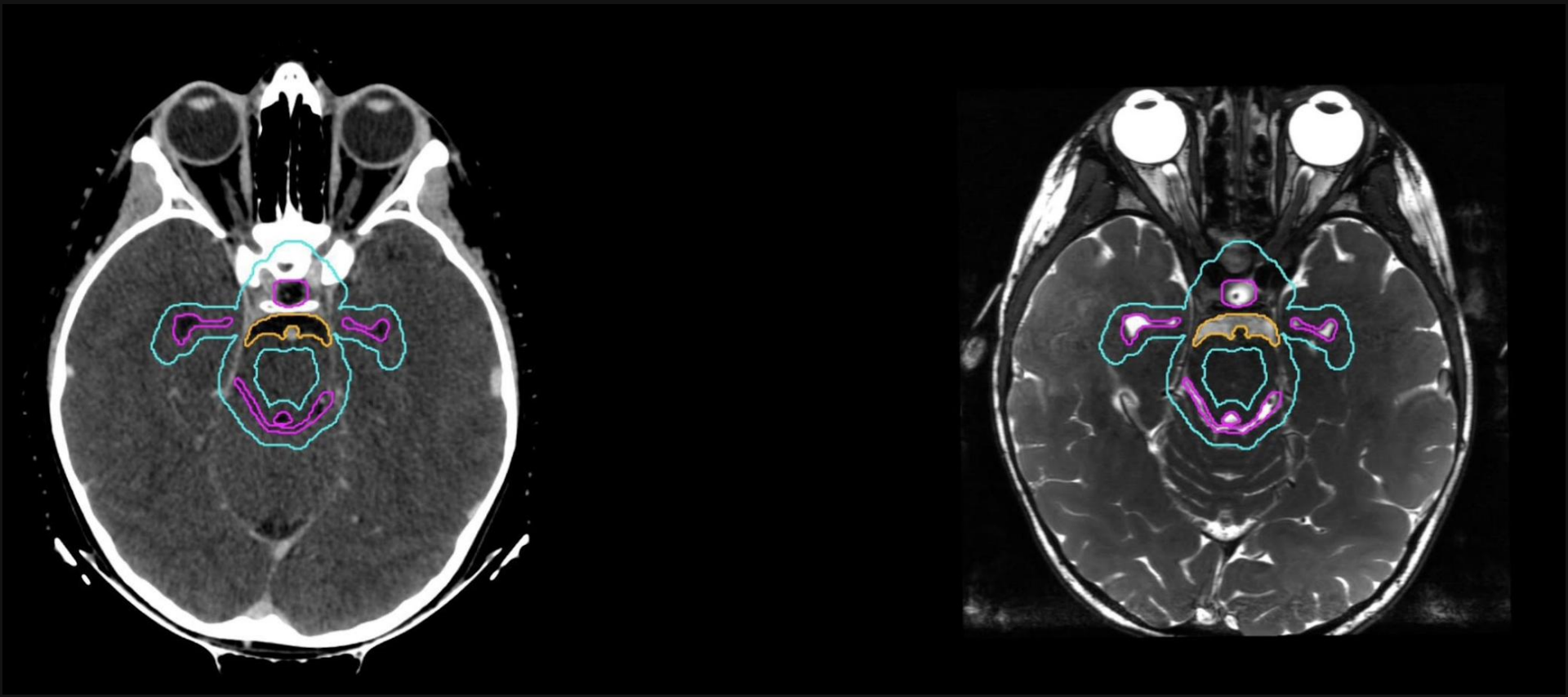
- Planning CT to be fused with the most recent T2 MRI sequence
- WVV is considered the CTV
- The involved field CTV should be delineated first and encompasses in WVV volume

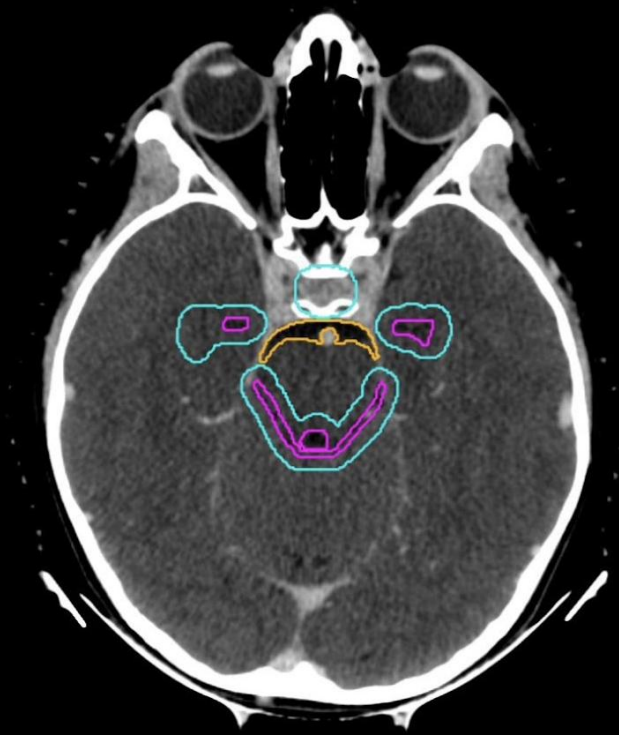

WVVCTV
WVVPTV
prepontine cistern

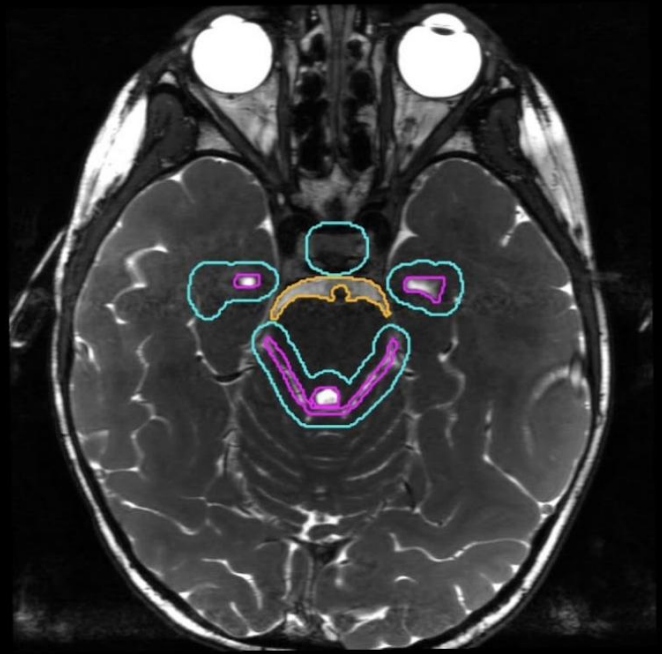


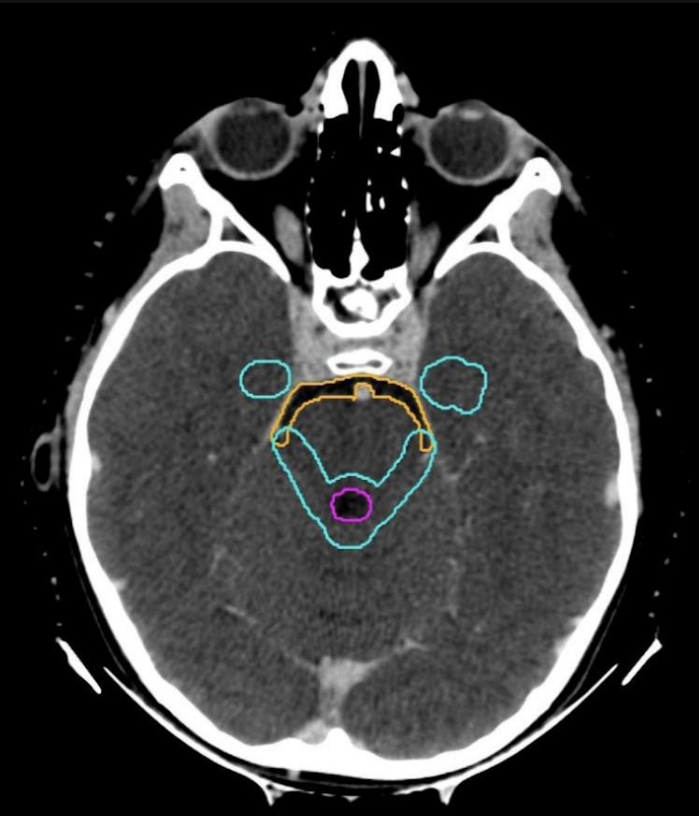


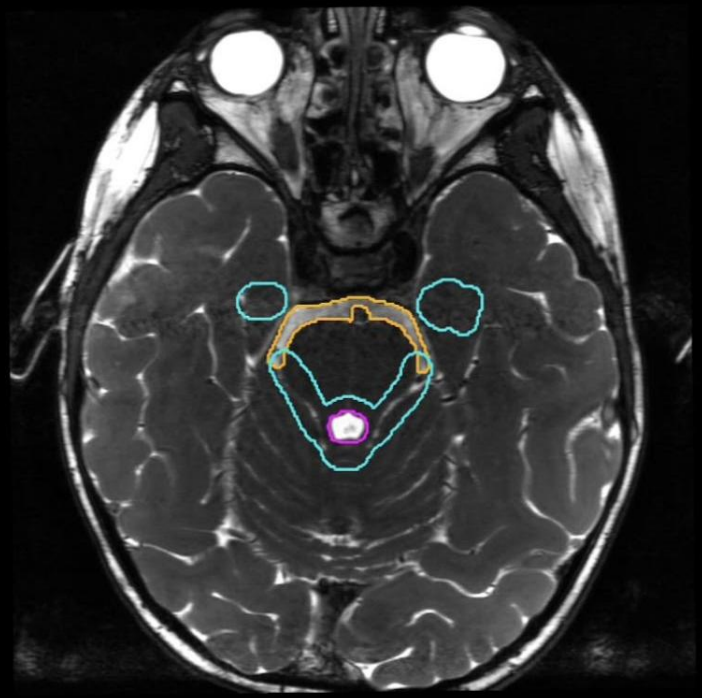


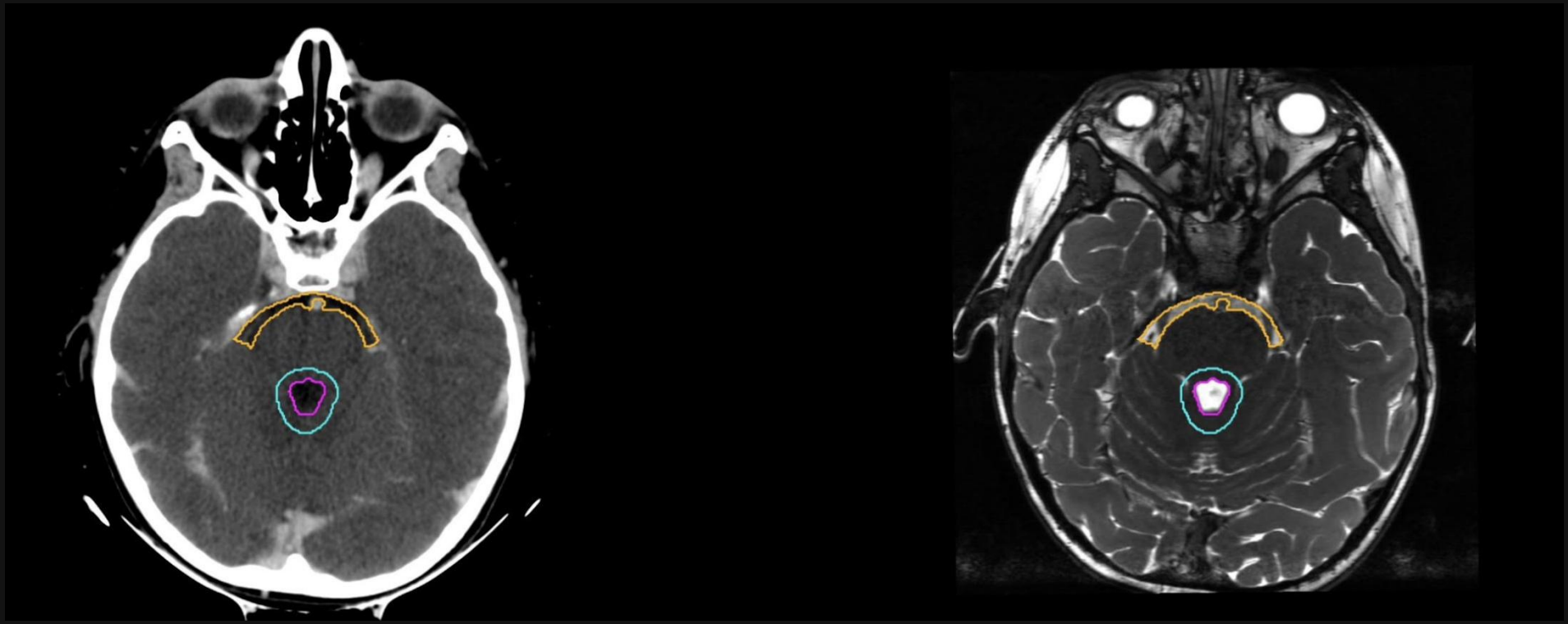


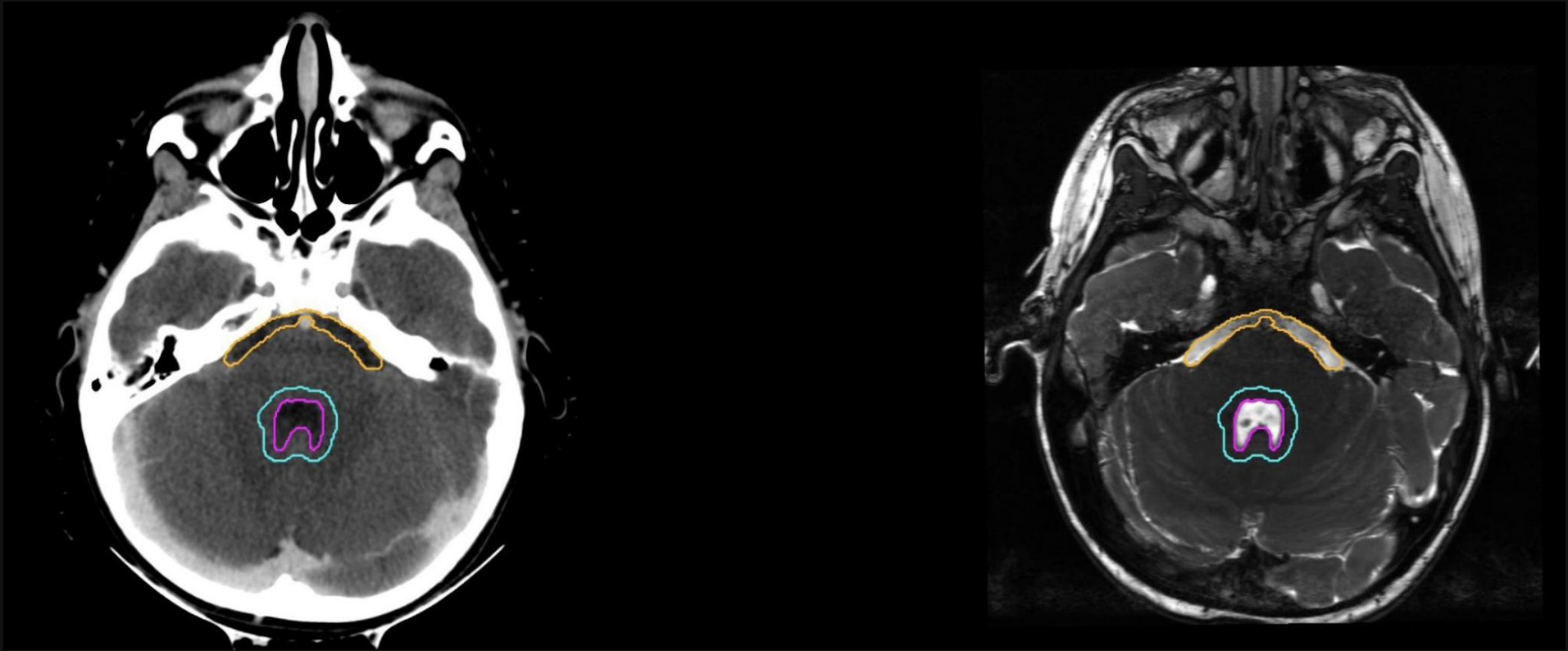


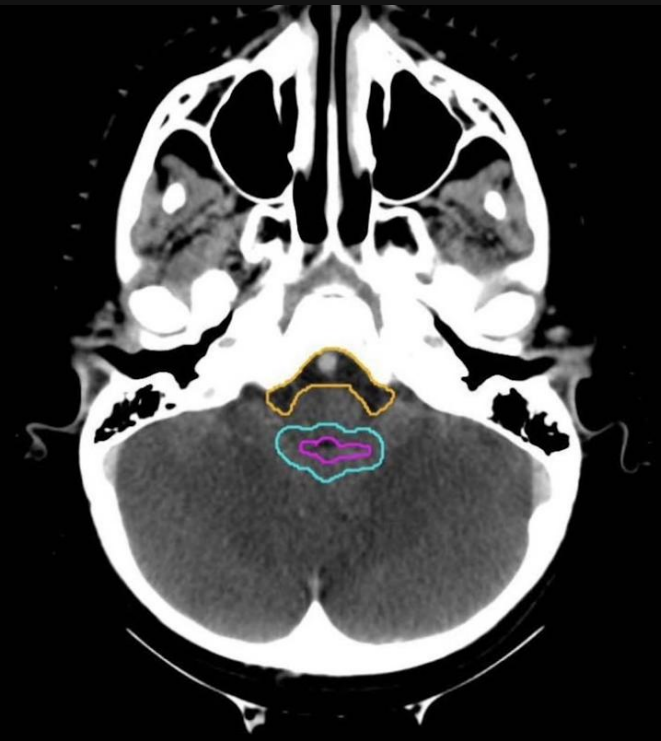


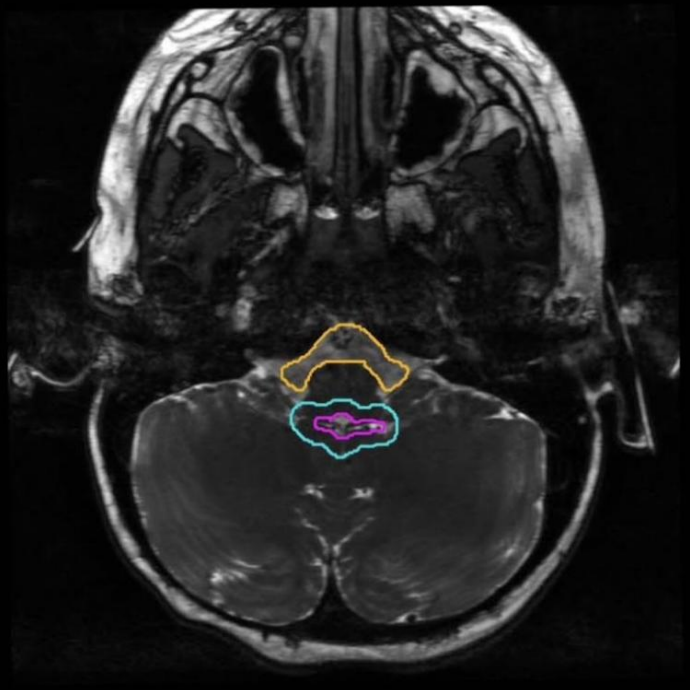


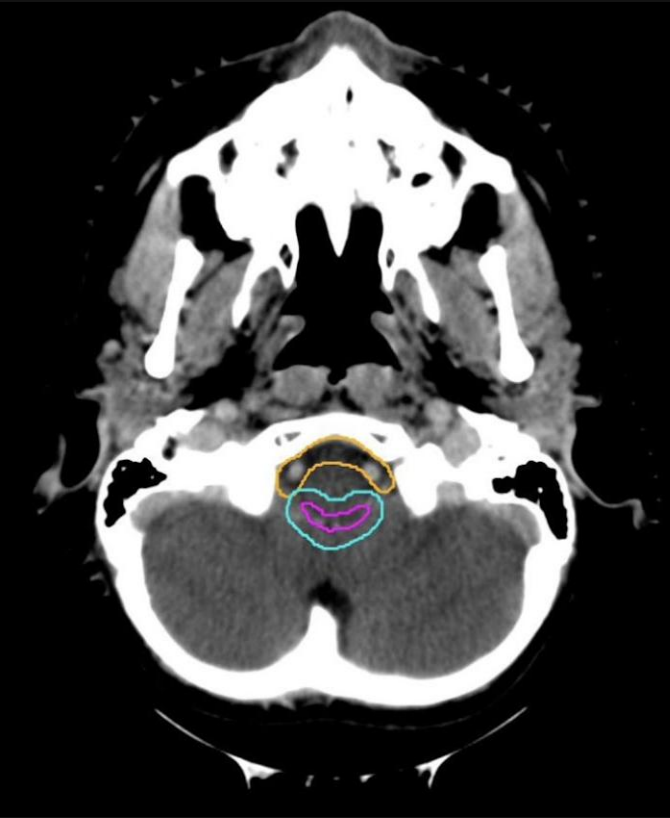


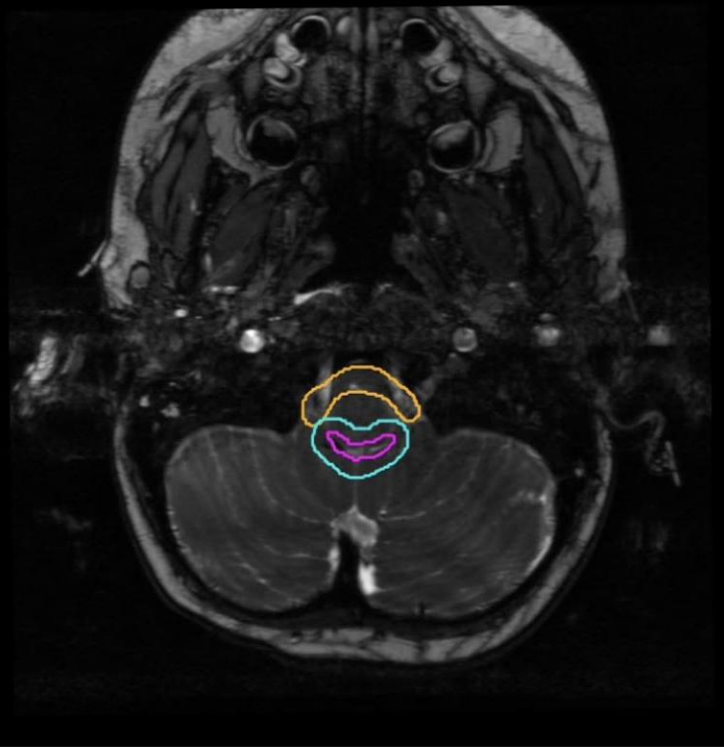


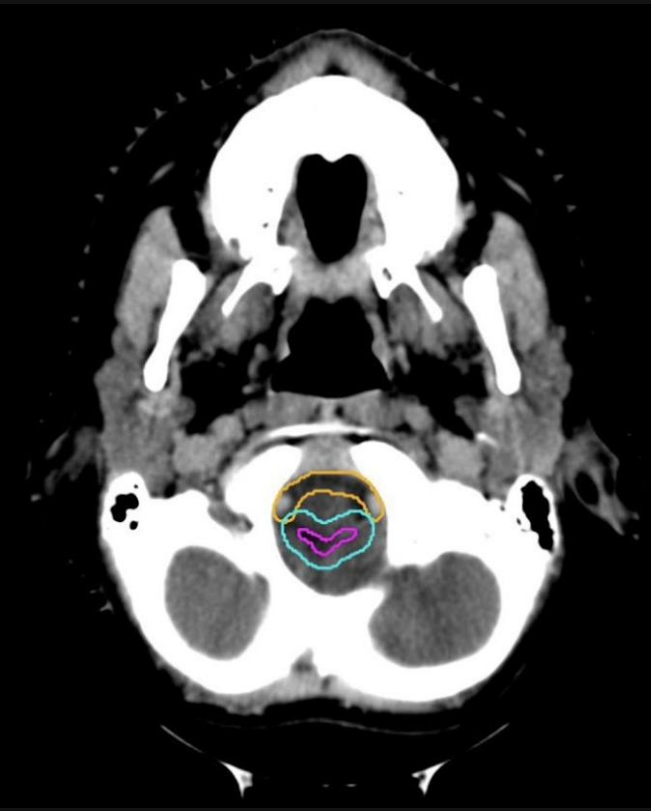


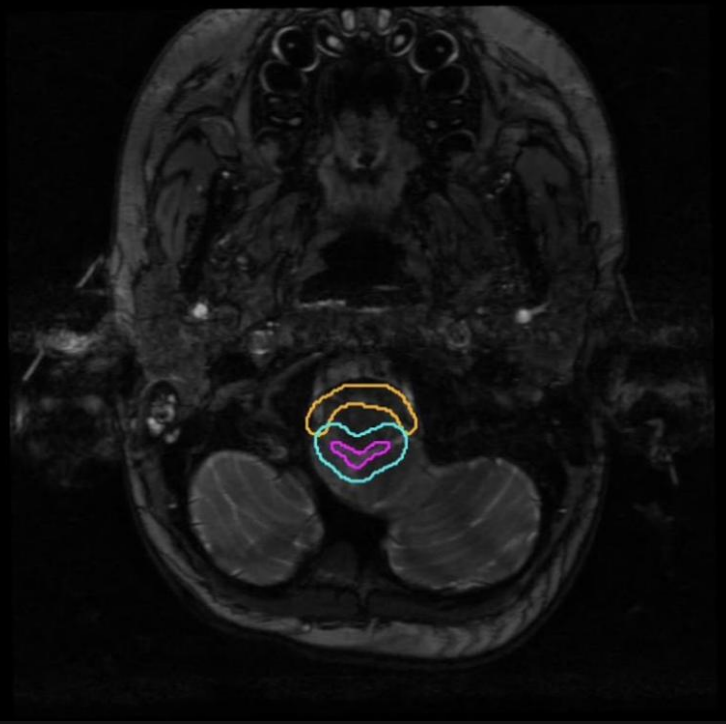


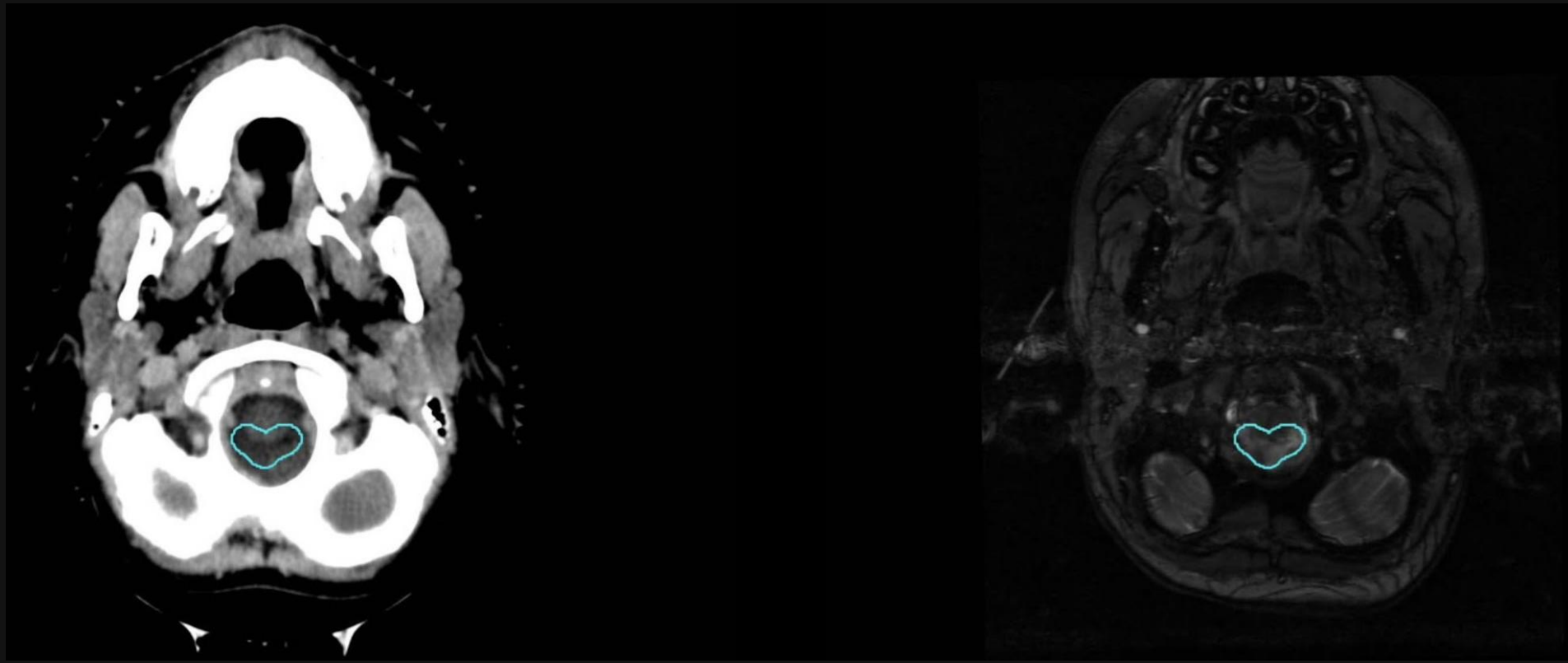


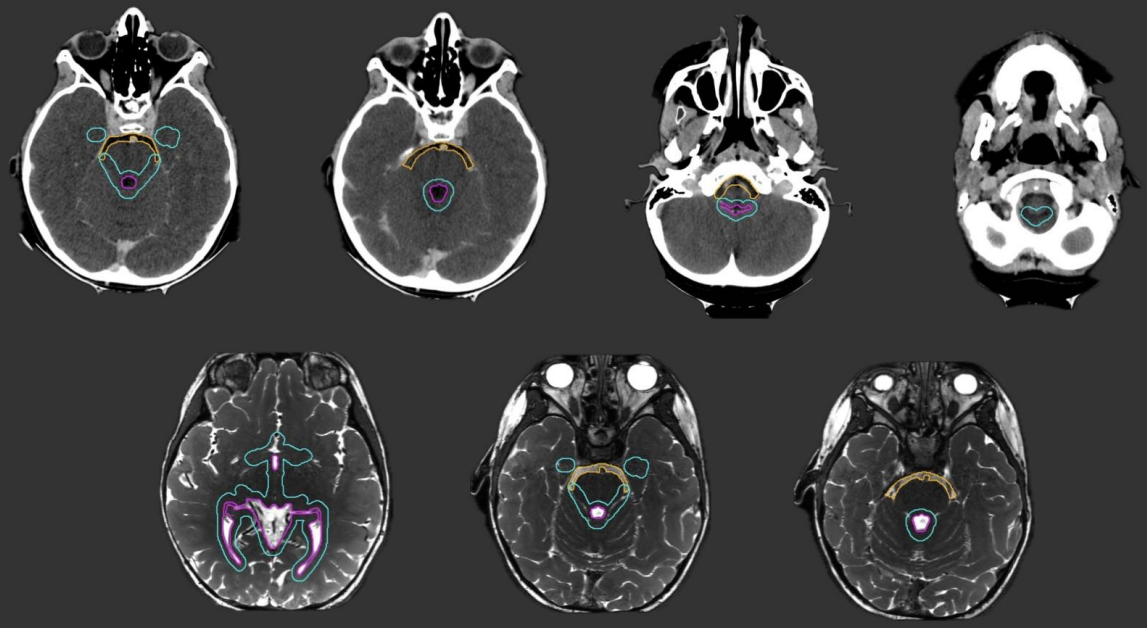










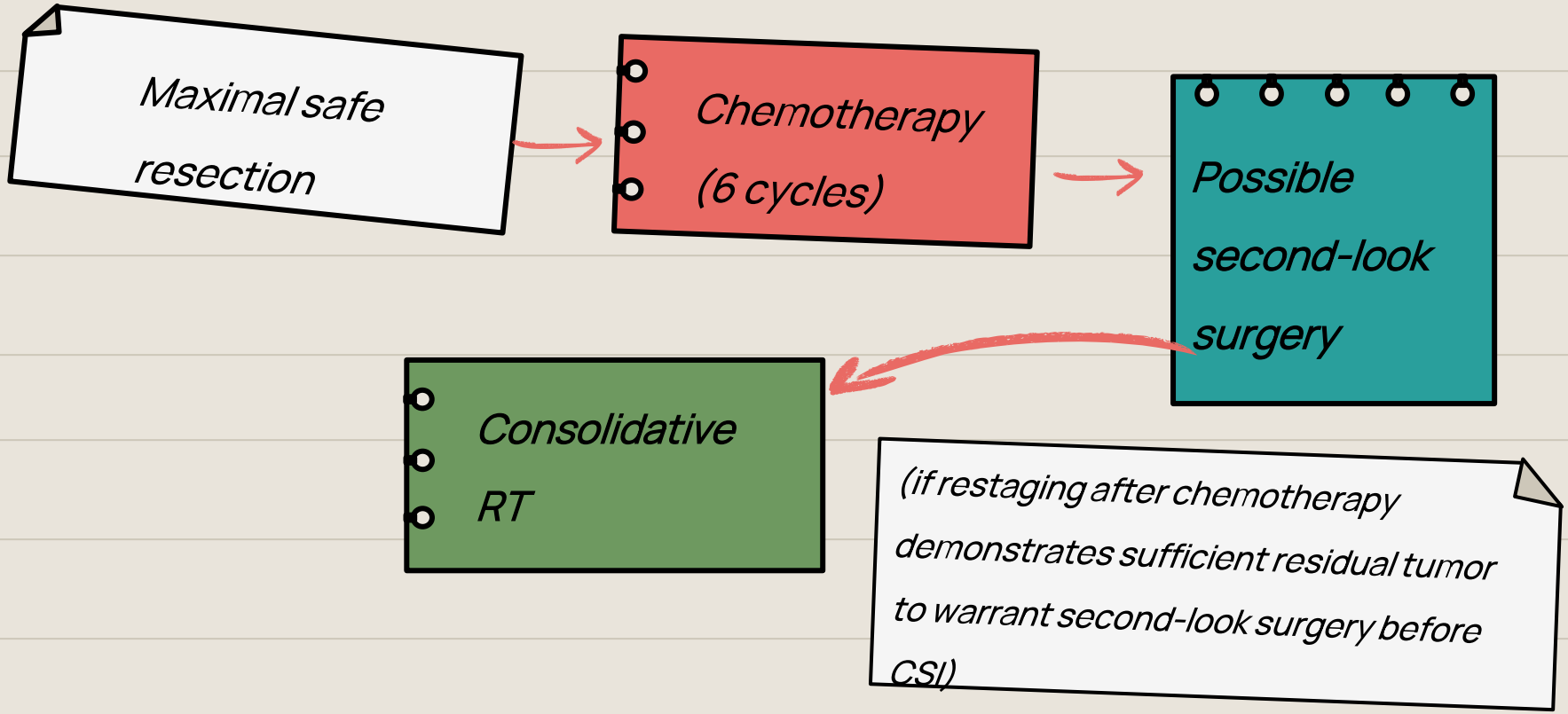

WVVCTV
WVVPTV
prepontine cistern

Tumor bed boost

- Contour tumor bed and gross residual disease if present.
- 1 cm expansion from tumor bed for CTV
- 3- 5 mm expansion for PTV

Treatment of NGGCTs

NGGCT: Several approaches, but in general,



NGGCTs

- The optimum goal is to obtain a CR before initiating radiotherapy.
- Four to six courses of multi-agent chemotherapy are usually administered.
- For patients not experiencing CR, additional radical surgery or HDC is considered followed by radiotherapy.

Trials

- COG ACNS 0122 (102 patients) utilized full-dose CSI (36Gy) along with 18Gy tumor bed boost following 6 alternating cycles of carboplatin and etoposide with ifosfamide and etoposide.
- The 3 year and 5-year OS was 98% and 93% ± 3%, respectively.
- In the successor COG study ACNS1123, only patients with localized NGGCT were included.
- The same induction chemotherapy regimen was used, but for patients with CR/PR, the dose was reduced to 30.6Gy WVI along with a boost to a total dose of 54 Gy to the tumor bed.
- Increased spine recurrences with WVRT compared to CSI from ACNS 0122. Hence,CSI remains standard of care.

Trials

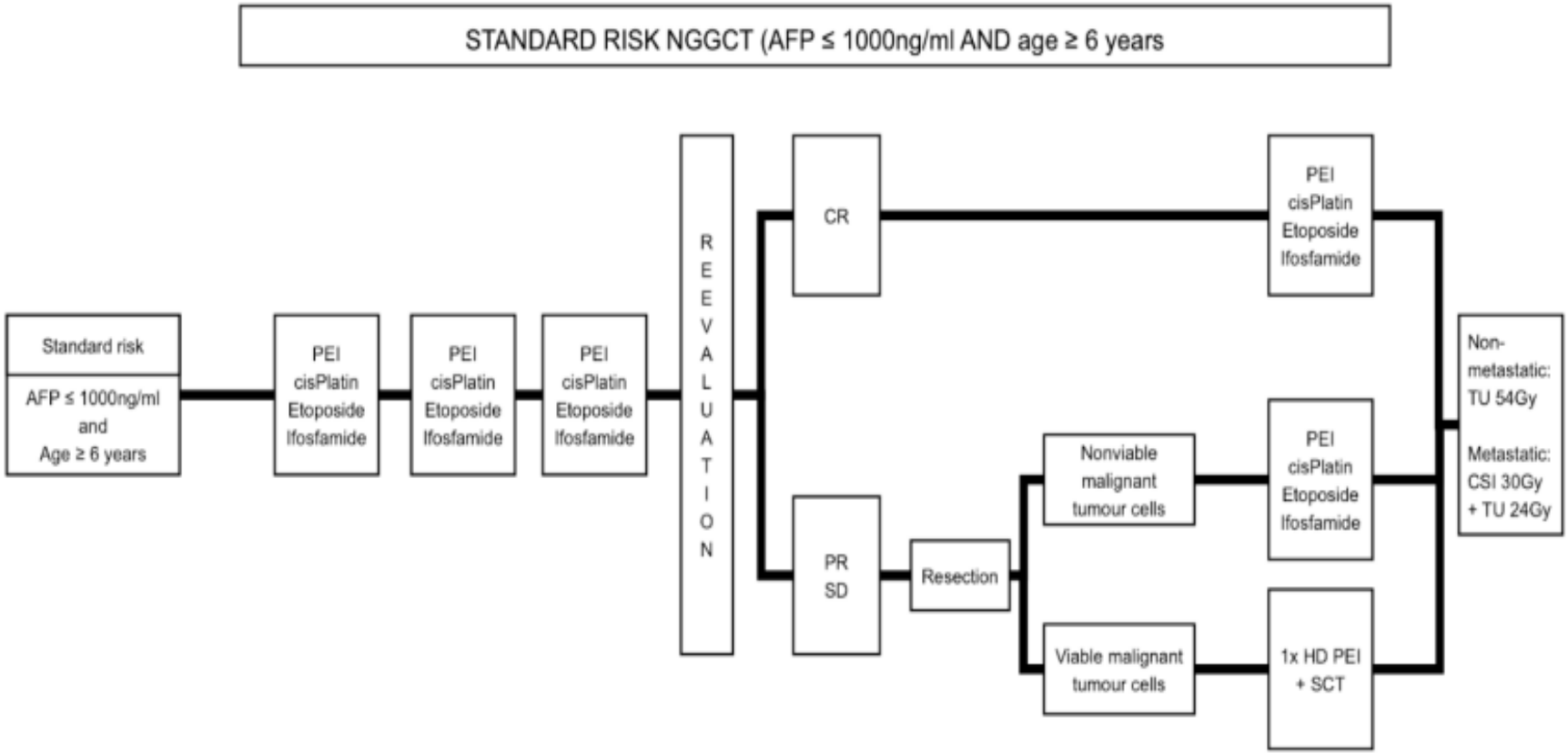
- COG study ACNS2021

- Based on the results of ACNS1123, COG recently launched a phase II trial of chemotherapy followed by WVI and spinal irradiation, with the aim of reducing the incidence of spinal relapses.

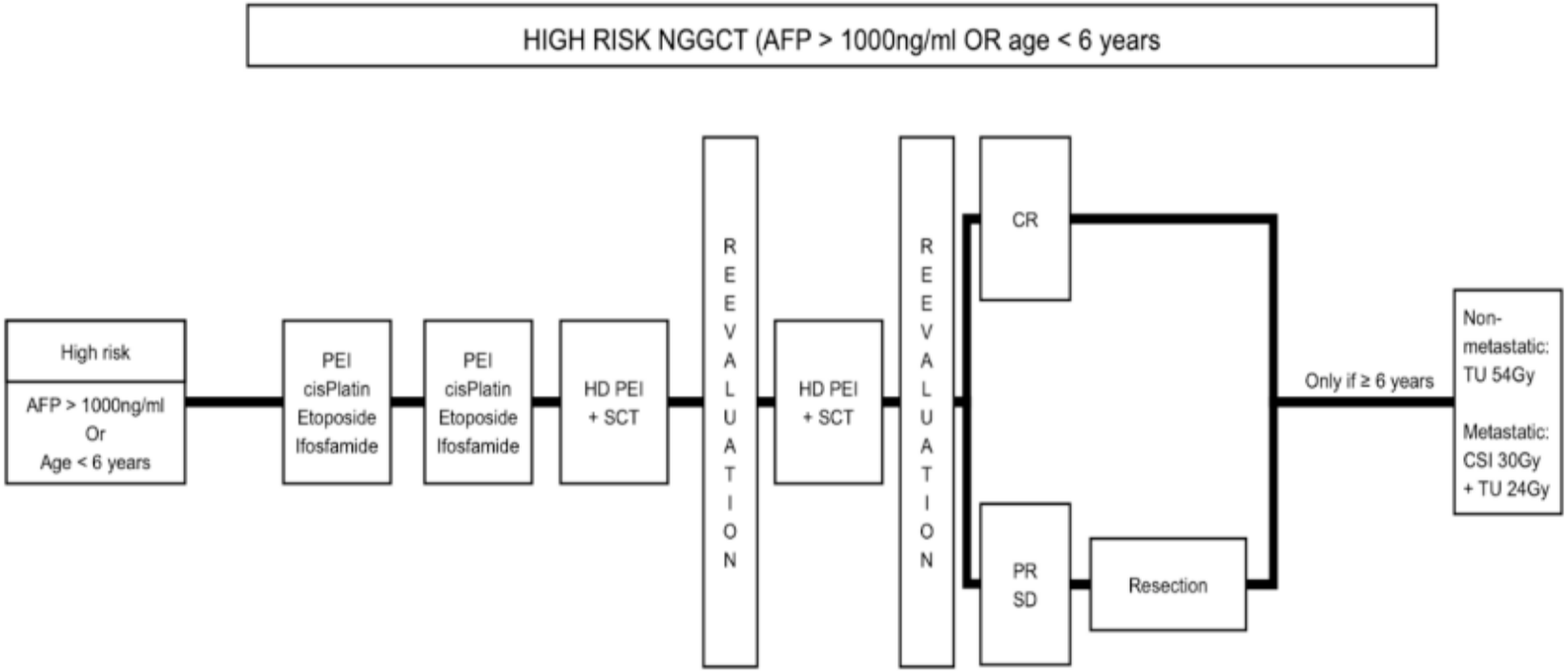
- **Preliminary, results for the SIOP CNS GCT II trial for malignant NGGCT patients show overall 3-year EFS and OS of 70% and 81%,respectively, similar to the SIOP CNS GCT 96 data.**

- **For NGGCT, patterns of relapse in SIOP CNS GCT II are not yet clear, and may require amalgamation with results from the previous SIOP CNS GCT 96 trial to help unravel the debate regarding the most appropriate radiotherapy fields.**

Standard-risk NGGCT first-line treatment



High-risk NGGCT first-line treatment



SIOP CNS GCT II trial protocol – <u>experimental treatment arm</u> for high-risk NGGCT

AFP: Alpha-fetoprotein, CR: Complete Remission, PR: Partial Remission, SD: Stable Disease, HD: High Dose Chemotherapy, SCT: Stem Cell Transplant, TU: Tumour bed, CSI: cranio-spinal irradiation, NGGCT: non-germinomatous germ cell tumour.

Relapses

Second-line treatments for relapse comprise chemotherapy, surgery, and re-irradiation.

A prominent role of HDC for chemosensitive tumors has been suggested with etoposide (with or without carboplatin) conditioning being the most commonly used regimen

Relapses

Pure teratomas require exclusive surgical treatment.

Other patients should be rechallenged with standard-dose chemotherapy (SDC) containing platinum-salt compounds, such as oxaliplatin, carboplatin, or cisplatin. In germinoma, HDC or re-irradiation are both valid options after SDC

Other rare pediatric CNS tumors

Rare Histologies Encountered in Pediatric CNS Tumors

Histologic Type
Embryonal
Atypical Teratoid /Rhabdoid Tumor
Embryonal Tumor Multilayered Rosettes
- Embryonal Tumor Abundant Neuropil True Rosettes
-Ependymoblastoma
- Medulloepithelioma
Medullomyoblastoma
Neuronal Tumors
Ganglioglioma
Gangliocytoma
Neurocytoma
Dysembryoplastic Neuroepithelial Tumor
Choroid Plexus Tumors
Choroid Plexus Papilloma
Anaplastic Choroid Plexus Tumor
Choroid Plexus Carcinoma
Pituitary Adenomas
Other
-Gliosarcoma
-Hemangiopericytoma
-Pilomyxoid astrocytoma
-Pleomorphic xanthoastrocytoma

Craniopharyngiomas

From remnants of the craniopharyngeal duct epithelium known as Rathke's pouch.

location - Sella turcica or above the sella turcica (suprasellar)

histological subtypes:

1. Adamantinomatous craniopharyngioma ;almost all the cases found in children (5 - 15 yrs of age); ACP has a bimodal age occurrence;

2. Papillary craniopharyngioma

Craniopharyngiomas

The imaging features of ACPs can be summarized using the so-called 90% rule, wherein ~90% of tumors are cystic, ~90% show typically prominent calcifications and ~90% take up contrast media in the cyst walls

Gross total resection using the extended trans-sphenoidal endoscopic endonasal approach

Subtotal resection - For patients with residual disease,

external beam radiotherapy with photons to a dose of 50.4- 55 Gy is given over a period of 6 weeks.

Craniopharyngiomas

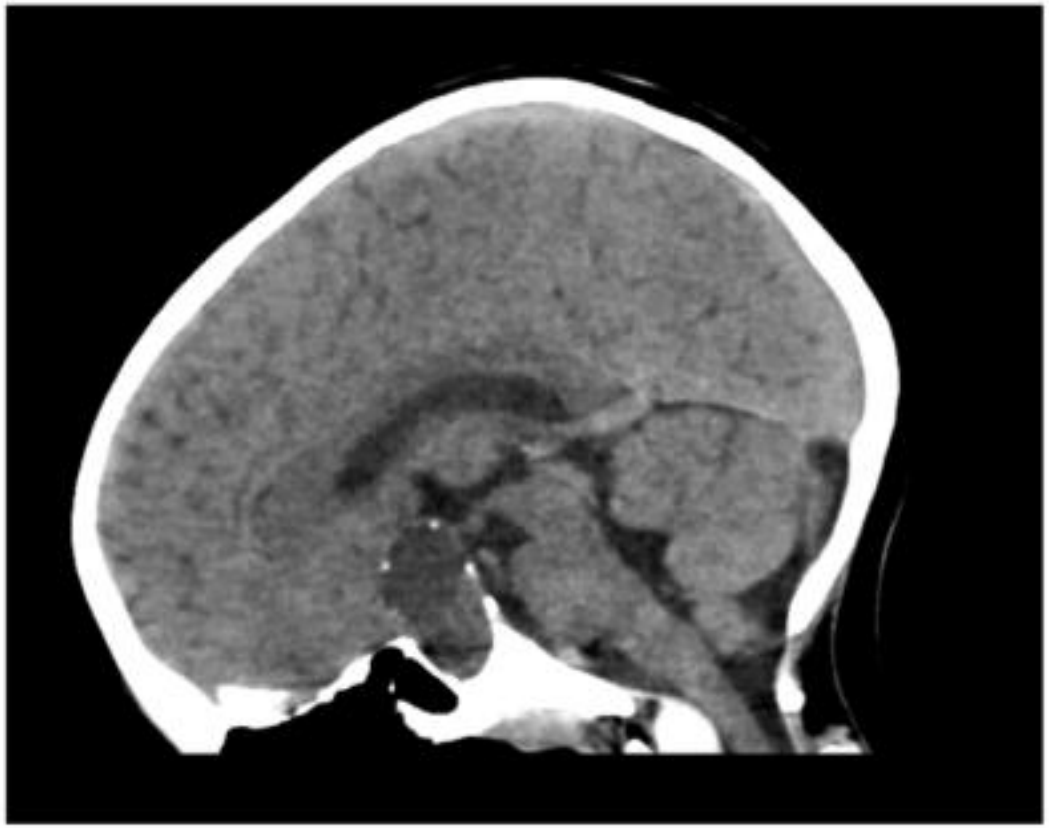


Fig. 1A. CT scan of adamantinomatous craniopharyngioma (ACP) showing large cyst with flecks of calcification around the cysts.

Childhood Central Nervous System (CNS) atypical teratoid/rhabdoid tumor

- AT/RT is extremely rare, clinically affecting children less than 3 years of age, which can also occur in older children and adults.

- AT/RT demonstrates biallelic inactivation of the SMARCB1 tumor suppressor gene on chromosome 22q11.2.

- About two-thirds of all malignant rhabdoid tumors arise in the CNS, with AT/RT bein the most common, generally arising in the posterior fossa

Childhood Central Nervous System (CNS) atypical teratoid/rhabdoid tumor

- Usually present with hydrocephalus
- 30% of patients with AT/RT have disseminated disease at presentation, primarily through leptomeningeal pathways, and therefore MRI of the brain, spine and CSF evaluation is a part of staging
- For confirmation of the diagnosis, surgery is indispensable to obtain tumor tissue in which immunohistochemical staining confirms loss of SMARCB1 protein expression

Childhood Central Nervous System (CNS) atypical teratoid/rhabdoid tumor

- 35% patients with germline mutations may have synchronous, multifocal tumors including rare patients with synchronous renal rhabdoid tumors
- Maximal safe resection with multi agent adjuvant therapy is the modality of treatment.
- RT fields tailored according to the age of the patient.
- Children aged <3 yrs age received focal RT (50.4 Gy) and children aged >3 yrs received CSI (36 Gy) with a boost to the tumor bed to 54 Gy, resulting in a two-year OS of 70%. For patients with M+ disease <3 yrs age CSI was 23.4 Gy

Embryonal tumor with multilayered rosettes/ Embryonal Tumor with Abundant Neuropil and True Rosettes (ETMR/ETANTR)

- A Variety of primitive neuroectodermal tumor combining pathologic features of neuroblastoma and ependymoblastoma

- Children less than 4 years of age with a clear predominance of females.

Choroid Plexus Tumors

WHO grading of CPT's

- Grade I- Choroid Plexus Papilloma (CPP)
- Grade II- Atypical choroid plexus papilloma (ACPP)
- Grade III- Choroid plexus carcinoma (CPC)
- The primary treatment is surgical removal.
- For the benign Papilloma type, complete surgical removal is often curative, leading to an excellent prognosis.
- The malignant Carcinoma type typically requires more aggressive treatment, including surgery followed by chemotherapy and sometimes radiation therapy

Summary

Germ cell Tumor (GCT)	RECOMMENDATION
Germinomas	4 cycles of platinum based chemo, usually including etoposide, ifosfamide, and either carboplatin or cisplatin. Followed by whole ventricular radiotherapy (18 - 24 Gy) and boost radiation(12-16 Gy) to Tumor bed. If CSF metastasis detected, then craniospinal irradiation also administered.
NGGCT	NGGCT: Several approaches, but in general, maximal safe resection → chemotherapy (6 cycles) → possible second-look surgery (if restaging after chemotherapy demonstrates sufficient residual tumor to warrant second-look surgery before CSI) → consolidative RT (including CSI)

THANK YOU!