



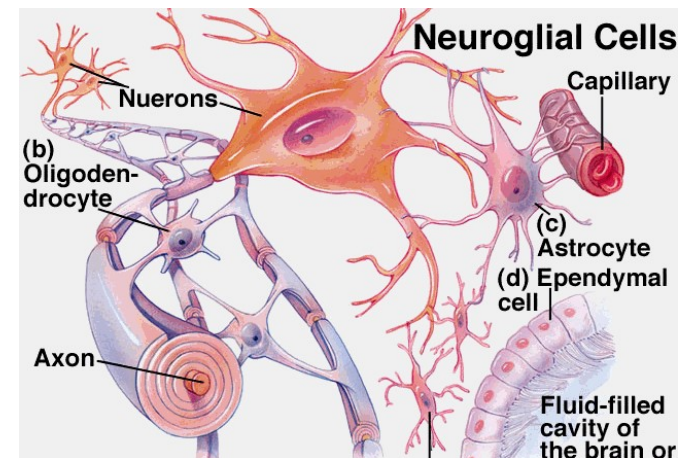
# **Role of Chemotherapy in Pediatric Brain Tumor**

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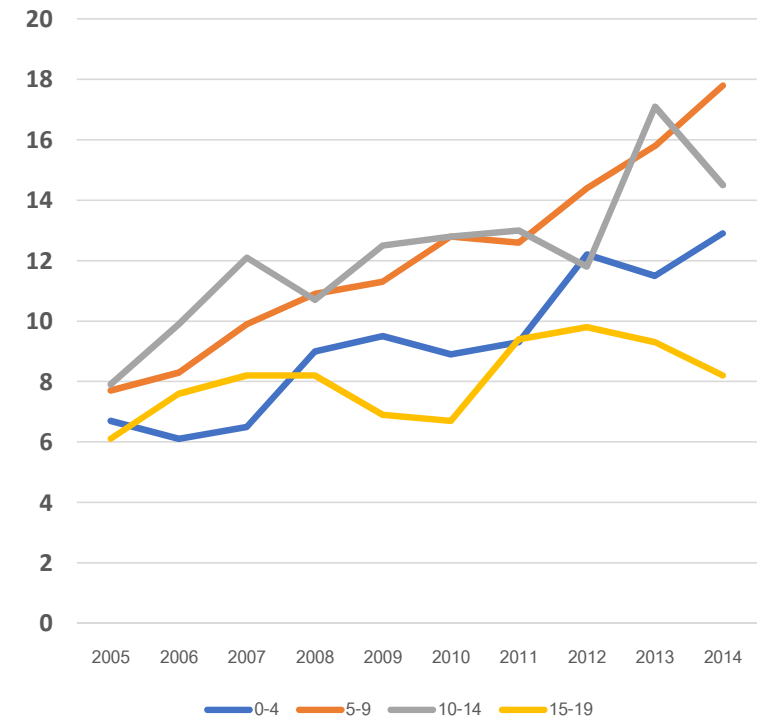
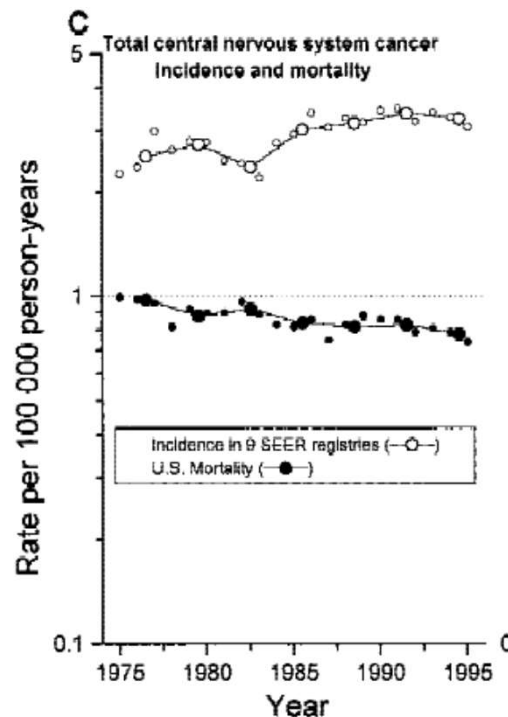
# Outlines

- **Developmental treatment in brain tumor**
- **Outcomes of Pediatric brain tumor: Past until present**
- **Chemotherapy role in brain tumor**
- **Supportive care in Pediatric brain tumor**



# Childhood CNS Tumor: How Important?

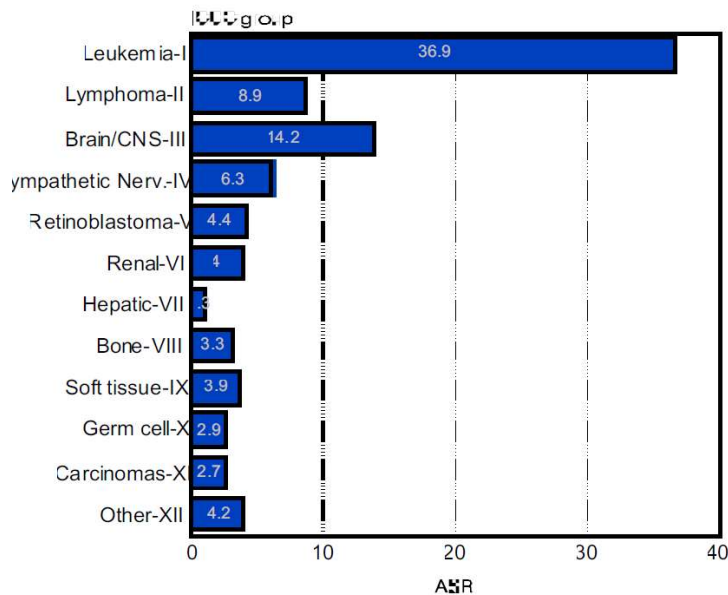
- 2<sup>nd</sup> most common cancer in children
- 16.6% of all malignancy in children with increasing trend
- Prevalence (2014) 13.2/100,000
- Male > Female



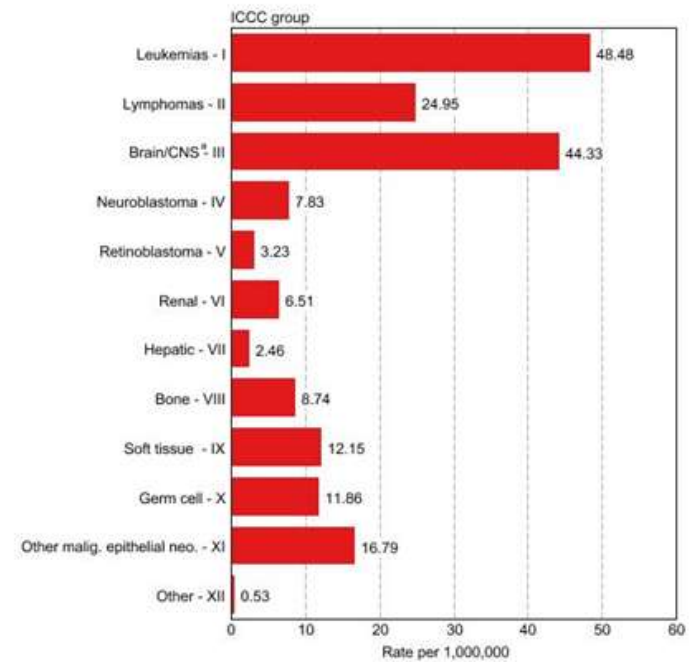
**Prevalence per million of CNS tumor reported by NHSO**

*Wiangnon S et al Asian Pacific J Cancer Prev 2003;4:337-343*

# Type of Pediatric Cancer



**Childhood Cancer: Thai Cancer Registry**



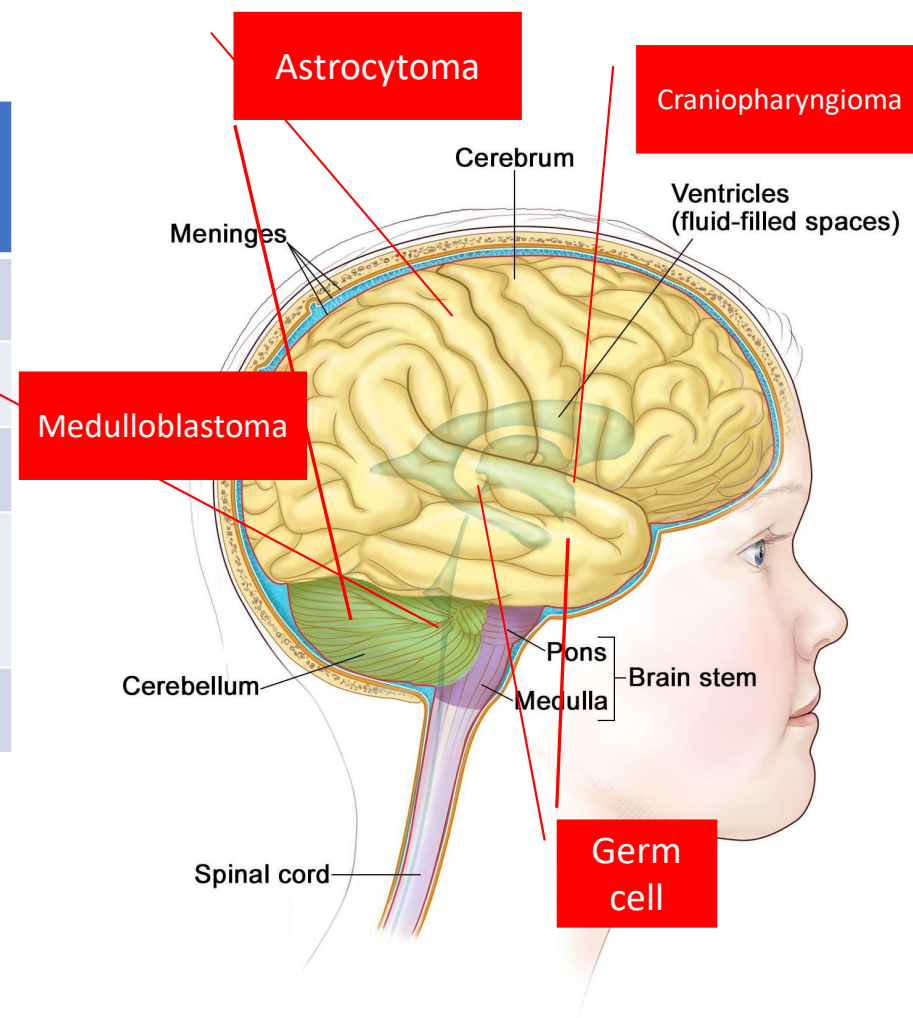
**Childhood Cancer: SEER Incidence Rates 2006-2010**

*Wiangnon S et al Asian Pacific J Cancer Prev 2003; 4: 337-343*

# Incidence of CNS Tumor According to the Type

Type of CNS tumor	Japan (%)	Thailand (%)	Germany (%)	SEER (%)
Astrocytoma	35.7	33.0	47	52
Germ cell tumor	14.3	17.7	2.5	1-2
Craniopharyngioma	10.5	ND	5.6	ND
Medulloblastoma	10.0	28.7 (+PNET)	16.3	21
Ependymoma	4.8	8.3	2.3	9

Miller BA Cancer Causes Control 2008;19:227-56  
 Thai Pediatric Oncology Group 2003-2005



# History of Brain tumor Treatment

1970 chemotherapy



1975-1980 radiation



1980 gamma knife



1999 temozolomide



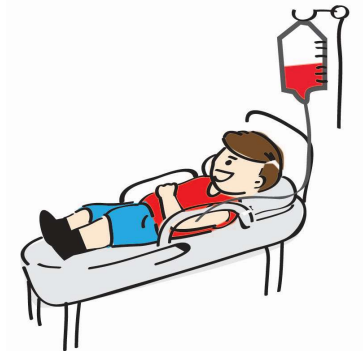
2005 genomic study



2008 targeted therapy (Bevacizumab)

## Chemotherapy role in brain tumor

- **Effectiveness:** Medulloblastoma, PNET, intracranial germ cell tumor
- **Prolonged survival:** High grade glioma
- **Control tumor:** Low grade glioma
- **Delayed radiation:** Children < 3 years



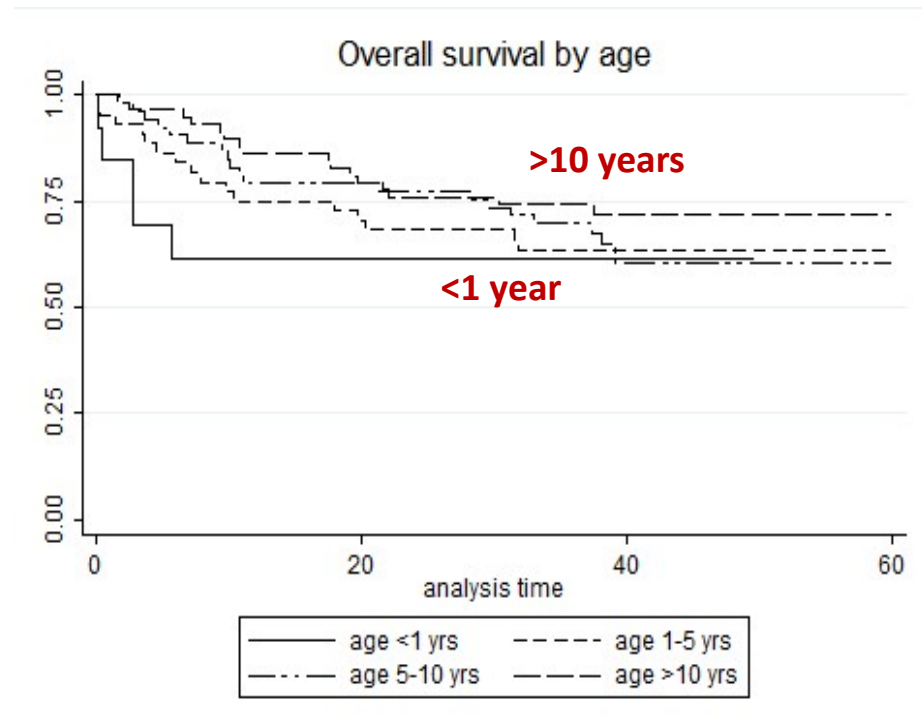
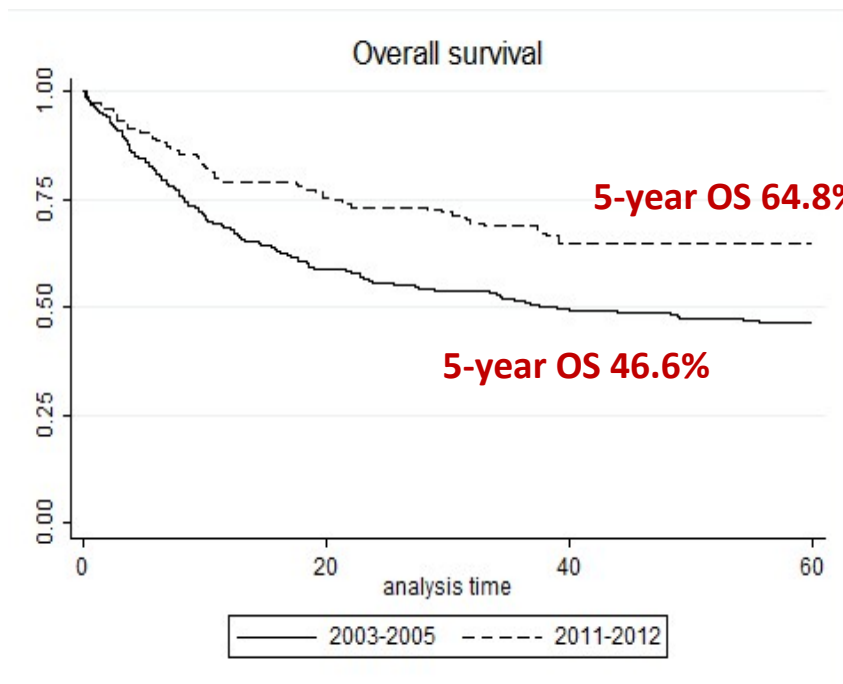
# Chemotherapeutic Agents

Drug	Route	Tumor type
<b>Alkylating agent</b>		
Melphalan	IV, SCR	High grade glioma
Thiotepa	IV, SCR	High grade glioma
CCNU, BCNU	PO, IV	High grade glioma, Oligodendroglioma
Cisplatin	IV	Ependymoma
Carboplatin	IV	Low grade glioma, Ependymoma
Procarbazine	PO	High grade, low grade glioma, Oligodendroglioma
Temozolomide	PO	High grade glioma
<b>Antimetabolite</b>		
Methotrexate	PO, IV	High grade glioma
<b>Plant alkaloids</b>		
Vincristine	IV	High grade, low grade glioma
Etoposide (VP16)	IV, PO	High grade, low grade glioma





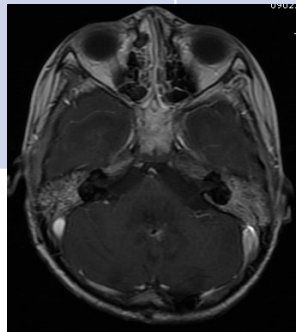
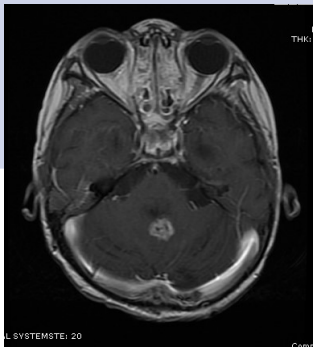
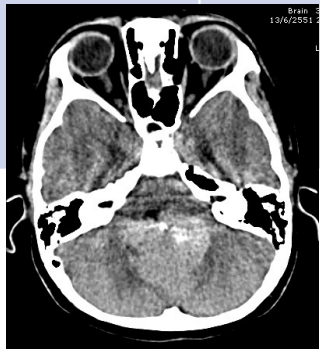
# Overall Survival of Thai Children with CNS Tumors





# Treatment of Medulloblastoma: Chemotherapy

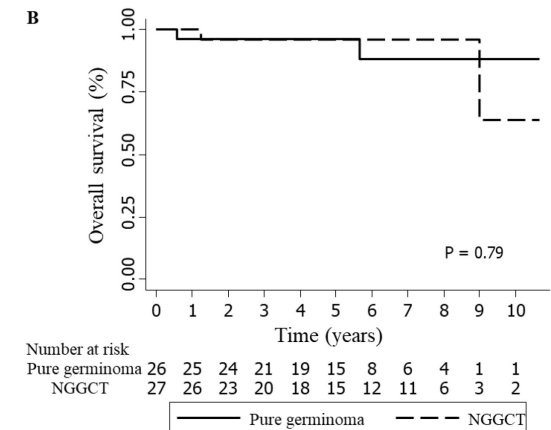
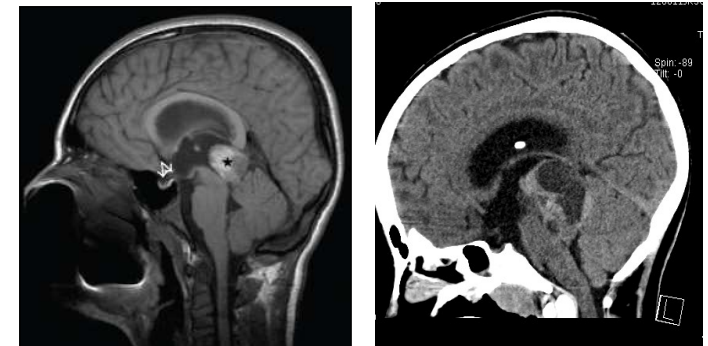
Year	Protocol	5-year OS (Standard risk)	5-year OS (High risk)	Note
1999-2007	VCR, cyclophosphamide, cisplatin and oral etoposide	70.4% <sup>1</sup> 84.4% <sup>2</sup>	47.6% <sup>1</sup> 42.8% <sup>2</sup>	Overall 60.6% <sup>1</sup> Overall 53.8% <sup>2</sup>
2008-2013	Cyclophosphamide, carboplatin, vincristine and etoposide		61.5%	-Reduced ototoxicity <sup>3</sup>
2014	Cyclophosphamide, vincristine, carboplatin and etoposide			-Increase total courses for high risk add vincristine during radiation -National protocol



*Sirachainan N et al J Clin Neurosci. 2011;18:515-9*  
*Nalita N et al J Pediatr Neurosci. 2018; 13: 150–157*  
*Sirachainan N et al J Clin Neurosci. 2018;56:139-142*

# Treatment of Germ Cell Tumor: Chemotherapy

Year	Protocol	Note
2006	RT alone 20Gy	Overall 83% <sup>2</sup>
2003	RT 36 Gy whole brain local 54 Gy	Overall 81.6% <sup>3</sup>
2012	RT was adjusted according to metastasis	Overall 83% <sup>4</sup>
1999-2006	cisplatin 30 mg/m <sup>2</sup> /day D 1–5, etoposide 100 mg/m <sup>2</sup> /day D 1–5 bleomycin 15 units/m <sup>2</sup> /day D 2	Overall 96.8% <sup>1</sup> (CSI 21–24 Gy for germinoma and 30–36 Gy for NGGCT )
2006-2018	Germinoma: carboplatin 560 mg/m <sup>2</sup> /day D 1 etoposide 150 mg/m <sup>2</sup> /D 1–3 NGGCT: carboplatin 560 mg/m <sup>2</sup> /day D 1 etoposide 150 mg/m <sup>2</sup> /day D 1–3 ifosfamide 1,800 mg/m <sup>2</sup> /day D 1–3	



1 Worawongsakul R et al Unpublished data

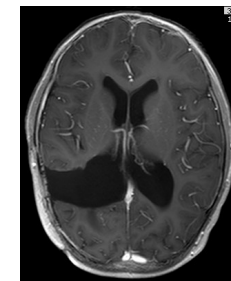
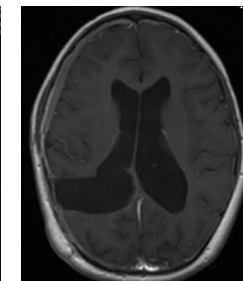
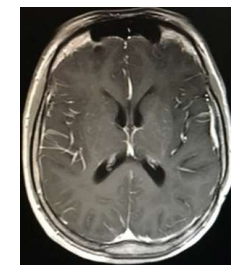
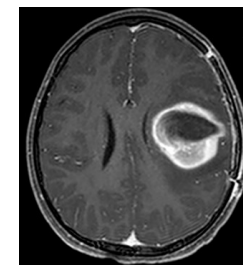
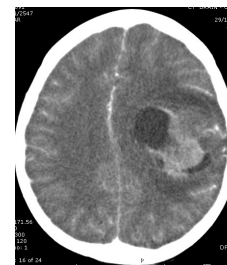
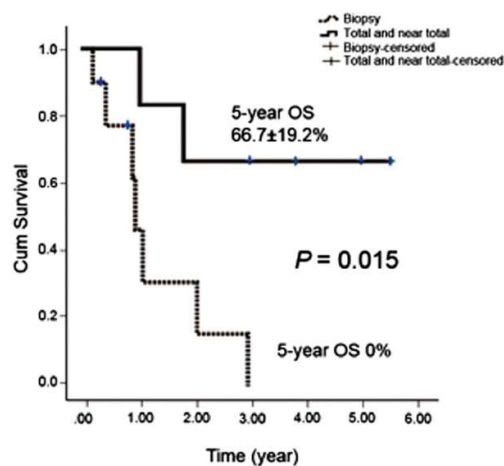
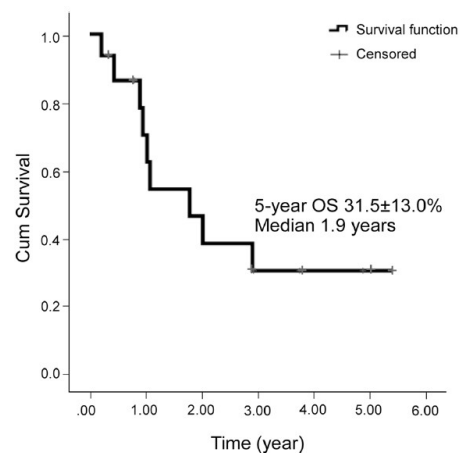
2 Chitapanarux I et al Med Assoc Thai 2006; 89: 415-21

3 Shotelersuk K J Med Assoc Thai 2003; 86: 603-611

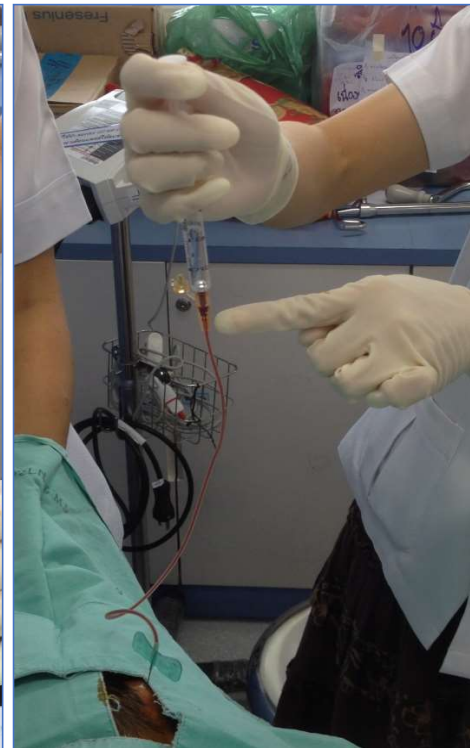
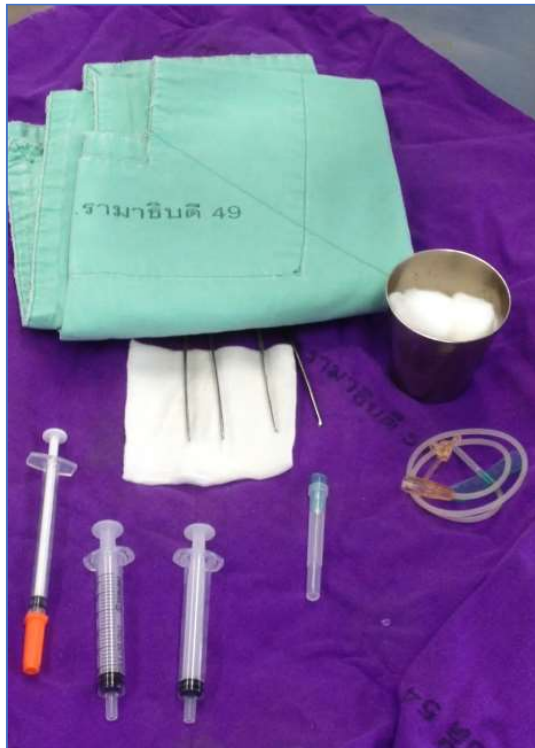
4 Raiyawa T et al J Med Assoc Thai 2012; 95: 1327-34

# Treatment of High Grade Gliomas : Chemotherapy

Year	Protocol	5-year OS
1999-2009	Carboplatin 560 mg/m <sup>2</sup> day 1 Irinotecan 125 mg/m <sup>2</sup> day 1	54.0%
2010	Nimotuzumab 150 mg/m <sup>2</sup> /week 1, 3 Irinotecan 125 mg/m <sup>2</sup> week 1-3	31.5%



# Treatment Craniopharygioma: Intraommmaya Chemotheray or Interferon



Interferon 3 MU, 3 days/wk x 4 wk

# Challenge in Treatment of Infant Brain Tumors



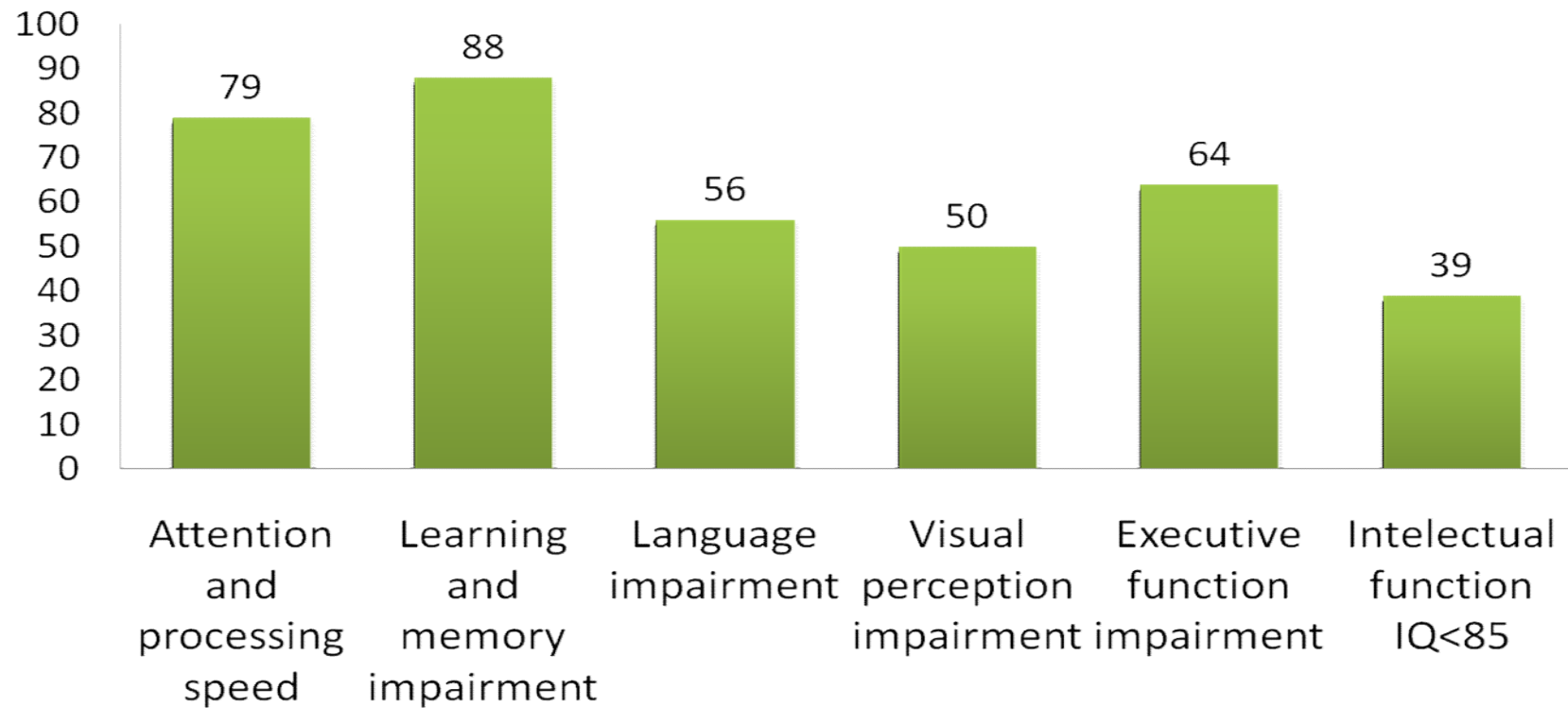
SYMPTOMS

~~Radiation~~

## Infant brain tumor protocol

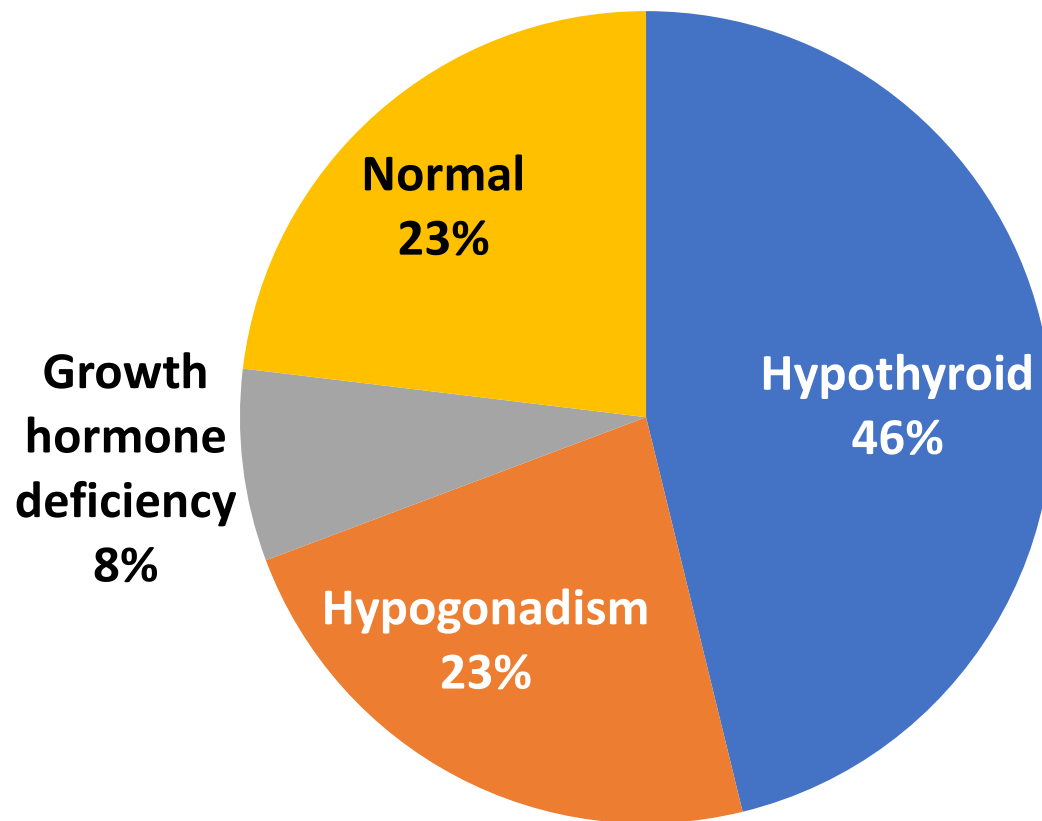
- Medulloblastoma
- Choroid plexus carcinoma
- Ependymoma
- Atypical teratoid rhabdoid tumor

# Neuropsychological Functioning of Survivor



*Ribi K et al Neuropediatrics 2005*

# Endocrine Problem in Medulloblastoma Survivors



*Ramathibodi Hospital*



# Multi-disciplinary Approach

- Physician
- Nurse
- Social worker
- Pharmacologist
- Pathologist
- Radiologist
- Oncologist
- Surgeon
- Etc.....



# Education and Family Support





# Various Activities



# Supporting Pediatric Cancer Survivors

- **Hospital's School Liaison Program**
  - Improved academic performance, home-school communication, and school-level understanding of unique student cognitive profiles and learning needs

*Northman L et al. J Pediatr Oncol Nurs. 2014*



-Enhance cognitive function during treatment  
-Neuropsychometric evaluation post treatment

# Summary

- **Prevalence of childhood CNS tumor is increasing**
- **Multi-disciplinary team is required**
- **Chemotherapy has a role in improving survival rate**
- **Supportive care and long-term follow-up is mandatory for CNS tumor survivors**

# Acknowledgements

- Data for Thai Pediatric Oncology Group and Ramathibodi Cancer Center
- All Collaborative Institutes
- All the multi-disciplinary team
- International collaboration
- All patients and families
- Prof Suradej Hongeng
- Kulvadee Surayuthpreecha



**Thank You For Your Attention**