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## **Use of ACTH Stimulation Test to Diagnose Adrenocortical Insufficiency in Children with Brain Tumors**

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# Use of ACTH Stimulation Test to Diagnose Adrenocortical Insufficiency

## in Children with Brain Tumors

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### BACKGROUND

Childhood cancer survivors with brain tumors (BT) are at high risk of developing adrenocortical insufficiency (AI).

### OBJECTIVE

Primary objective of study was to determine prevalence of AI in children with BT.

### STUDY DESIGN & METHODS

- Retrospective review to identify children with BT who underwent adrenocortical function evaluation by ACTH stim testing at our institution
- ACTH stim tests were performed by:
  - Low-dose: 1 mcg cosyntropin intravenously and measuring serum cortisol at 0, 10, 20 & 30 minutes; or
  - High-dose: 15 mcg/kg (max 250 mcg) cosyntropin and measuring serum cortisol levels at 0, 30 & 60 minutes
- AI diagnosed if peak serum cortisol level < 18 mcg/dL
- AI was classified as:
  - Central AI due to direct effect on HP region by tumor, surgery, or cranial radiation therapy; or
  - Adrenal Suppression from effects of exogenous glucocorticoids or other medications on hypothalamic-pituitary (HP) axis; or
  - Primary AI due to adrenal gland pathology

Table 1: Demographics of Children with Brain Tumors who had ACTH stim testing

	Total (%)	ACTH Stim (%)
Total patients	401 (100)	54 (100)
Male	211 (53)	30 (56)
Female	187 (47)	24 (44)
Diagnosis		
Astrocytoma	117 (29.4)	15 (27.8)
Atypical Teratoid/Rhabdoid Tumor	14 (3.5)	3 (5.6)
Choroid Plexus Carcinoma/Papilloma	18 (4.5)	2 (3.7)
Craniopharyngioma	3 (.75)	1 (1.9)
Ependymoma	32 (8)	4 (7.4)
Ganglioglioma	32 (8)	1 (1.9)
Glioblastoma/Malignant Glioma	70 (17.6)	5 (9.3)
Medulloblastoma/DNET/PNET	78 (19.6)	17 (31.5)
Other (ex: oligodendroglioma, meningioma, germinoma)	34 (8.5)	5 (9.3)
Treatment modalities		
Surgery	315 (79.1)	47 (87)
Radiation	132 (33.2)	33 (61.1)
Chemotherapy	164 (41.2)	41 (75.9)

### CAUSES OF AI IN CHILDREN WITH BRAIN TUMORS

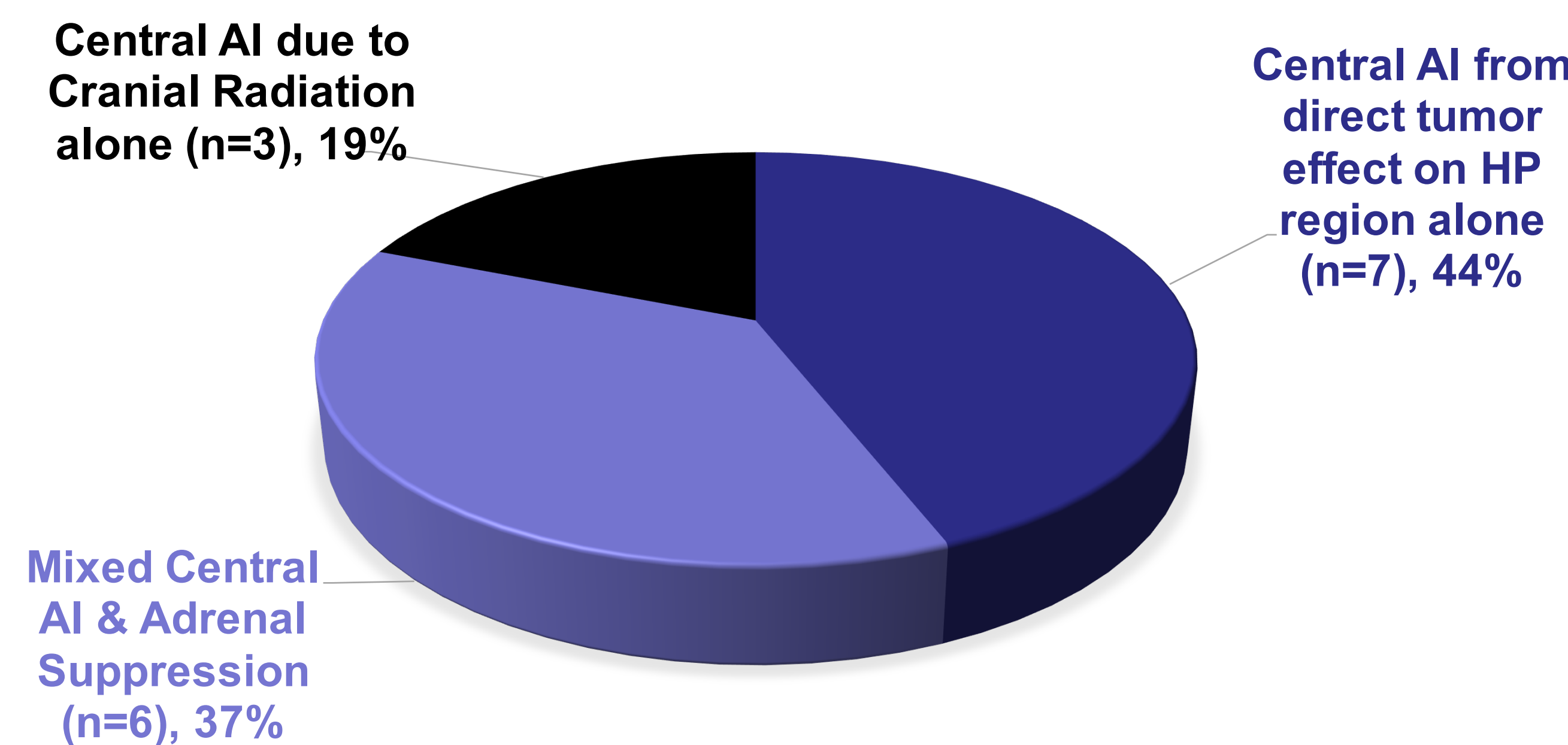


Table 2. Indication for ACTH stim testing in Children with Brain Tumors

Indication for ACTH Stim Testing	Total Tested	Adrenocortical	
		Insufficient Children	Sufficient Children
	n=56 (100%)	n=16 (100%)	n=40 (100%)
Tumor location	27 (48.2)	10 (62.5)	17 (42.5)
Other pituitary hormone deficiencies present	17 (30.4)	8 (50)	9 (22.5)
Exogenous Steroids	11 (19.6)	5 (31.3)	6 (15)
Signs/Symptoms suggesting AI	22 (39.3)	5 (31.2)	17 (42.5)
Surgical resection	10 (17.9)	3 (18.8)	7 (17.5)
Radiation	18 (32.1)	3 (18.8)	15 (37.5)
Chemotherapy	4 (7)	1 (6.3)	3 (7.5)
Other meds: megestrol/voriconazole/fluconazole	1 (2)	1 (6)	0
Other	7 (12.5)	0	7 (17.5)

### RESULTS

- Between 2006-2017, 401 children (median age 8 years, range: 0.1-19) were diagnosed with BT
- 56/401 (14%) underwent ACTH stim testing
- 72 ACTH stim tests were performed with no adverse effects
  - 52 high-dose, 13 low-dose, 7 low-dose followed by high-dose
- Prevalence of AI in children who had stim testing was 16/56 (29%)
- Central AI was diagnosed in all cases
  - Exogenous glucocorticoids or megestrol causing adrenal suppression contributed in 4 (25%)
- Amongst those tested, other endocrinopathies were common (43/56, 77%)
- We observed a higher rate of AI in children with
  - direct involvement of HP region by tumor (41% vs. 21%), and
  - undergoing surgery in HP region (63% vs. 21%), and
  - other endocrinopathies (33% vs. 18%)

### CONCLUSIONS

- There was high prevalence of AI in children with BT
- Children with BT involving HP region are at high-risk and should have adrenal function evaluated early, especially prior to intracranial surgery.
- Children with medulloblastomas who received cranial radiotherapy, and those with multiple endocrinopathies should be screened for late onset central AI.
- ACTH stim test is a useful and objective measure of HPA function and should be considered in routine management of this high-risk population.