Cranial Irradiation

- Cranial irradiation may result in long-term hypothalamic and pituitary dysfunction, especially in children and young adults who are more susceptible to damage following whole-brain irradiation and neck therapeutic irradiation. The development of normal hypothalamic-pituitary function may be delayed in children exposed to irradiation. Seizures may occur on the preoperative MRIdiagnosis may not be possible. Histologic evidence of hypothalamic damage is noted by neuronal loss and gliosis.

Hypothalamic tumors

- Hypothalamic hamartomas and gangliocytomas are often associated with cranial irradiation. These tumors may present with neurochemical defects such as hyperphagia, obesity, and central diabetes insipidus. These tumors may overexpress hypothalamic neuropeptides including GnRH, GHRH, or CRH. In GnRH-producing tumors, children present with precocious puberty, psychomotor delay, and laughing-out-loud seizures. Medical treatment of GnRH-producing hamartomas includes GnRH-antagonists, which may be effective in suppressing pituitary gonadotropin production. Rarely, hamartomas are also associated with craniofacial abnormalities, including neurofibromatosis, ophthalmic, renal, and lung disorders; and pituitary failure.

Hypothalamic tumors

- Hypothalamic hamartomas and gangliocytomas may arise from astrocytes, oligodendrocytes, and neurons following radiation injury or differentiation. These tumors may overexpress hypothalamic neuropeptides including GnRH, GHRH, or CRH. Children present with precocious puberty, psychomotor delay, and laughing-out-loud seizures. Medical treatment of GnRH-producing hamartomas with long-acting GnRH analogues effectively suppresses hypothalamic gonadotropin secretion and controls pubertal development. Rarely, hamartomas are also associated with craniofacial abnormalities, including neurofibromatosis, ophthalmic, renal, and lung disorders; and pituitary failure. Pallidal and hypothalamic hamartomas are often associated with the pituitary and hypothalamic hamartoma syndrome, which may be the result of a primary hypothalamic lesion. Hypothalamic hamartomas and gangliocytomas occur mainly in childhood and usually present with visual loss. Adults have more aggressive tumors, and a poorer association with neurofibromatosis.
METABOLIC EFFECTS OF HYPOTHALAMIC LESIONS

- The hypothalamus is subject to injury from mass lesions, granulomatous disorders, infections, and autoimmune diseases resulting in anterior and posterior hypothalamic lesions. Lesions may also be secondary to trauma, hemorrhage, inflammatory, and neoplastic processes.

- Hypothalamic lesions affect the regulation of body temperature, water balance, and metabolism. Acute hyperthermia is usually due to hemorrhagic insult, whereas poikilothermia may be associated with posterior hypothalamic damage.

- Disorders of osmoregulation due to damage to central osmoreceptors located in preoptic nuclei are associated with polydipsia or hypodipsia.

- Damage to the ventromedial nuclei by craniopharyngiomas, hypothalamic trauma, or inflammatory disorders may be associated with hyperphagia and obesity. This region appears to contain an energy-satiety center where melanocortin receptors are influenced by leptin, insulin, POMC products, and gastrointestinal peptides.

- Median eminence involvement results in diabetes insipidus in about 50% of patients.

- Hypothalamic gliomas in early childhood may be associated with a diencephalic syndrome characterized by progressive emaciation and growth failure. Polydipsia or hypodipsia are associated with damage to central osmoreceptors located in the hypothalamus.

- Slow-growing hypothalamic lesions may cause increased somnolence and disturbed sleep cycles as well as obesity, hypothermia, and emotional outbursts. Lesions of the central hypothalamus may stimulate sympathetic neurons, leading to elevated serum catecholamine and cortisol levels. These patients are predisposed to cardiac arrhythmias, hypertension, and gastric erosions.