Traumatic brain injury (TBI) and cancer-induced growth hormone deficiency (GHD)

TBI-induced GHD

How can TBI cause GHD?

TBI can result in primary mechanical events and consequent secondary effects that lead to hypopituitarism (Figure 1).

The anatomy of the pituitary gland (Figure 2) places TBI patients at higher risk of GHD than other pituitary deficiencies.

Leading causes of TBI are:
- Falls (24%)
- Motor vehicle accidents (14%)
- Organs struck, e.g. sports injuries (14%)
- Prevented or associated with vehicle motor accidents (14%)
- Older children (5–14 years): being struck, e.g. sports injuries, violence
- Adolescents (aged 15–17 years): motor vehicle accidents

When does GHD manifest after TBI?

The acute stress response confounds evaluation of GHD in the initial phases after TBI (Figure 3).

Reduced depression

How common is GHD after TBI?

There were >837,000 TBI-related emergency department visits and hospitalizations in the USA for children in 2014.

GHD prevalence is highest after severe TBI.

Prevalence varies because of different study populations, different time intervals between TBI and GHD assessment, and lack of standardization of GHD testing.

GHD prevalence is higher after severe TBI.

Mild: 16.8%
Moderate: 10.9%
Severe: 35.3%

When does GHD manifest after cranial radiotherapy?

After lower doses of cranial radiotherapy (eg 18–24 Gy), pubertal GH insufficiency is often seen 5 years after cranial radiotherapy (Figure 4).

Cancer-induced GHD

How can cancer or cancer treatment cause GHD?

GHD can be induced by a tumor (eg optic pathway glioma or pituitary macroadenoma), neurosurgery or radiotherapy in the hypothalamic–pituitary (HP) area.

GHD can also be induced by immune checkpoint or tyrosine kinase inhibitors.

The level of HP damage by radiotherapy depends on the scatter of the radiotherapy dose, which varies with the type of radiotherapy (Figure 7).

How common is GHD in childhood cancer survivors (CCS)?

GHD is usually the first hormone to be affected by radiotherapy, and GHD is the most common anterior pituitary dysfunction in CCS.

Almost all patients treated with HP irradiation of 30–50 Gy (eg for high-risk medulloblastoma, pituitary adenoma, CNS germinoma) develop GHD by 5 years after cranial radiotherapy.

When does GHD manifest after cranial radiotherapy?

Decreased peak GH level is seen earlier and is more pronounced after higher doses of cranial radiotherapy (Figure 5).

How should cancer-induced GHD be detected and treated?

The diagnostic accuracy of dynamic tests for GHD in CCS is the same as for non-CCS.

How should cancer-induced GHD be detected and treated?

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11. Ruggieri B et al. Hormone (Peptide) 2010;203:2–7

References