INTRODUCTION

Childhood cancer survivors (CCS) of Central Nervous System tumours are at lifelong increased risk of endocrinopathies; as a consequence of cranial or craniospinal radiotherapy and alkylation agents. Hypothalamic-pituitary dysfunction, thyroid dysfunction and gonadal failure are frequently seen.

Growth hormone (GH) deficiency has been associated with radiotherapy doses of ≥1800cGy to the hypothalamic region. Hypogonadotropic hypogonadism (HH), hypothyroidism or ACTH insufficiency have been associated with radiotherapy doses of ≥3000cGy.

AIM

To explore the endocrine monitoring following completion of treatment for central nervous system tumours within a regional paediatric oncology service.

METHOD

Children who received radiotherapy as part of treatment for CNS tumours between 2004-2019, identified from a departmental database, were included.

Confirmatory tests used to exclude or diagnose were:
- GH stimulation test (arginine test) for GH deficiency
- TSH & free T4 for hypothyroidism
- ACTH stimulation test for pituitary-adrenal axis
- Gonadotrophins (LH, FSH) for hypogonadotropic hypogonadism
- Oestradiol & AMH (girls) and testosterone & AMH (boys) for gonadal failure (GF)

RESULTS

Of 100 CCS (38 treated for medulloblastoma, 62 for other CNS tumours), 43 (43%) completed treatment successfully.

<table>
<thead>
<tr>
<th>Endocrine test</th>
<th>ALL</th>
<th>Medulloblastoma</th>
<th>Other CNS Tumours</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>GH stimulation</td>
<td>1.3 (0.3, 6.5)</td>
<td>1.3 (0.8, 3.3)</td>
<td>1.5 (0.5, 6.5)</td>
<td>0.22</td>
</tr>
<tr>
<td>TSH &amp; free T4</td>
<td>1.4 (0.1, 6.9)</td>
<td>1.1 (0.1, 3.3)</td>
<td>1.8 (0.3, 6.5)</td>
<td>0.210</td>
</tr>
<tr>
<td>ACTH stimulation</td>
<td>2.3 (0.7, 8.1)</td>
<td>2.0 (0.8, 8.8)</td>
<td>2.5 (0.7, 7.8)</td>
<td>0.518</td>
</tr>
<tr>
<td>Gonadotrophins</td>
<td>1.7 (0.1, 6.9)</td>
<td>1.7 (0.1, 6.6)</td>
<td>2.3 (0.5, 6.9)</td>
<td>0.471</td>
</tr>
<tr>
<td>Gonadal function</td>
<td>3.0 (0.1, 6.6)</td>
<td>2.9 (0.1, 6.6)</td>
<td>4.9 (1.0, 6.6)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Medulloblastoma</th>
<th>Other CNS Tumours</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>GH Deficiency</td>
<td>30/33 (90%)</td>
<td>14/14 (100%)</td>
<td>16/19 (84%)</td>
<td>0.89</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>16/36 (44%)</td>
<td>11/16 (69%)</td>
<td>5/20 (25%)</td>
<td>0.018</td>
</tr>
<tr>
<td>ACTH Insufficiency</td>
<td>5/24 (15%)</td>
<td>1/15 (7%)</td>
<td>4/19 (21%)</td>
<td>0.58</td>
</tr>
<tr>
<td>MMH</td>
<td>4/33 (12%)</td>
<td>1/16 (6%)</td>
<td>3/17 (18%)</td>
<td>0.60</td>
</tr>
<tr>
<td>Gonadal failure</td>
<td>7/24 (29%)</td>
<td>1/15 (7%)</td>
<td>6/9 (67%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

CONCLUSIONS

The majority of children had appropriate monitoring for endocrine sequelae following treatment of CNS tumours; however, there was variability and occasionally a significant delay in the timing of the initial endocrine evaluation. A systematic approach to monitoring for endocrine complications would ensure timely management and treatment.

ACKNOWLEDGEMENTS

Many thanks to the paediatric endocrinology team for welcoming me and presenting me with such opportunities; to the paediatric oncology team for their input and involvement with this project; and a great big thank you to Dr. Kyriakou for his continuous support, guidance and encouragement.

REFERENCES


CONTACT INFORMATION

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Growth hormone (GH) stimulation test (arginine test) for GH deficiencies

Gonadotrophins (LH, FSH) for hypogonadotrophic hypogonadism

ACTH stimulation for pituitary dysfunction

Thyroid Function

Gonadal Function

Endocrine tests performed

ALL patients who had hypogonadotropic hypogonadism, hypothyroidism or ACTH insufficiency also had GH deficiency

AACTH insufficiency (n = 5)

Hypothyroidism (n = 16)

GHD (n = 30)

GHD + hypothyroidism + HH (n = 10)

GHD + hypothyroidism + HH + ACTH insufficiency (n = 16)

Overlap between endocrinopathies following radiotherapy treatment in childhood cancer survivors of CNS tumours

CENTRAL NERVOUS SYSTEM TUMOURS

CHILDREN TREATED FOR CENTRAL NERVOUS SYSTEM TUMOURS

Females

Age (years)

Years since completion of treatment

Total dose of radiotherapy received

0 10 20 30 40 50 60 70 80 90 100

0.02

Table 1: Characteristics of all children included

Table 2: Years since completion of cancer treatment to the endocrine test performed; comparison of medulloblastoma and other tumour types

Endocrine tests performed

Values: median (range) or number (percentage frequency)

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Figure 1: Endocrine tests and the percentage of children tested post-treatment; comparison of medulloblastoma and other tumour types

Figure 2: Relative proportions and overlap between endocrinopathies following radiotherapy treatment in childhood cancer survivors of CNS tumours

Table 1: Characteristics of all children included

Table 2: Years since completion of cancer treatment to the endocrine test performed; comparison of medulloblastoma and other tumour types

Values: number (percentage frequency)