Introduction

- Tumors of the posterior fossa are the most common pediatric brain tumors and are found near the cerebellum and brainstem. Although these tumors have a high survival rate, a newer emphasis is placed on maximizing cognitive outcomes.
- Radiation therapy, chemotherapy, and neurosurgical resection are used as treatment options. Radiation improves survival outcomes; however, it also increases deficits in cognition and independent living skills. IQ has been found to be affected most by radiation treatment.
- The SIB-R-assesses adaptive functioning and includes tasks performed for daily living (e.g., money management, scheduling appointments) that require the use of other cognitive processes like attention, working memory, and processing speed—domains that are often impaired post-treatment.
- Sex differences in cognitive deficits have been shown in previous studies to have significant, specifically, females are reported to have a greater risk.
- The present study evaluates the impact of radiation and sex differences on adaptive functioning, attention, working memory, IQ, and processing speed in long-term survivors of brain tumors.

Hypothesis

It was hypothesized that radiation would produce deficits across all core cognitive domains and adaptive functioning, which would be exacerbated in females.

Methods

Participants:

Table 1: Demographic Variables

<table>
<thead>
<tr>
<th></th>
<th>Male Participants (n=21)</th>
<th>Female Participants (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of radiation (N)</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Age at testing (mean ± SD)</td>
<td>25.33±2.95</td>
<td>25.25±3.06</td>
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<tr>
<td>Years post-diagnosis (mean ± SD)</td>
<td>15.52±6.14</td>
<td>17.26±7.49</td>
</tr>
<tr>
<td>Years of education (mean ± SD)</td>
<td>13.24±2.21</td>
<td>13.88±2.38</td>
</tr>
</tbody>
</table>

Measures:

- Scales of Independent Behavior-Revised (SIB-R): The SIB-R consists of a series of questionnaires that evaluates activities of daily living and contains of 4 broad domains (motor skills, social communication, personal living, community living skills) with multiple subcategories of skills within each domain.
- Wechsler Abbreviated Scale of Intelligence (WASI): WASI is an abbreviated IQ test that assesses different dimensions of cognition.
- Wechsler Memory Scale-III (WMS): The WMS assesses attention through a digit span forward (DSF) measure and working memory through a digit span backward (DSB) measure.
- Oral Symbol Digits Modality Test (OSDMT): The OSDMT assesses processing speed in 90 seconds as participants orally identify the number that corresponds to the appropriate symbol presented in a key.

Analyses:

- Two by two ANOVAs were conducted to assess the relationship between sex and history of radiation treatment on SIB-R z scores. They were also used to evaluate the relationship between sex and radiation on FSIQ, OSDMT, DSF, and DSB z-scores.
- Correlational analyses were used to determine the relationship between core cognitive skills (IQ, working memory, attention span, and processing speed) and SIB-R scores within survivors.

Results

- There was a main effect of radiation on all core cognitive measures (p=0.005-0.041) and adaptive functioning domains (p=0.001-0.014) where survivors without radiation scored higher across cognitive measures than survivors who underwent radiation.
- There was an interaction between sex and radiation for community living skills (F(1,44)=4.62, p=0.037, η²=0.10) as well as processing speed (F(1,43)=5.37, p=0.026, η²=0.12) such that there was no difference in performance between males regardless of radiation status but females without radiation exhibited greater cognitive performance than females who received radiation.

Methods (cont’d.)

- Overall, females survivors of childhood posterior fossa brain tumors displayed more impairment due to radiation than their male counterparts in community living skills with potentially similar patterns of impairment in personal living and broad independent living scores.
- Broadly, radiation negatively impacted all measures of cognition and adaptive functioning.
- Community living skills consists of advanced skills such as handling money and daily work skills which may be more impacted by changes in cognitive functions such as IQ, working memory, attention, and processing speed than other domains of SIB-R.
- The interaction of sex and radiation on processing speed aligns with the a neurocognitive model proposed by King and colleagues in which radiation negatively impacts processing speed and leads to higher order cognitive deficits.
- Sex differences may be attributed to external factors such as different expectations and internal factors such as biological, genetic, and hormonal differences.
- These findings highlight the importance of understanding the multifactorial nature of cognitive outcomes to develop interventions and treatments pertaining to optimizing survivors’ everyday

Table 2: Correlations between FSIQ, DSF, DSB, and OSDMT and SIB-R subscales

<table>
<thead>
<tr>
<th></th>
<th>FSIQ</th>
<th>DSF</th>
<th>DSB</th>
<th>OSDMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIB-R Motor Skills</td>
<td>0.40</td>
<td>0.42</td>
<td>0.36</td>
<td>0.36</td>
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<tr>
<td>SIB-R Social Communication</td>
<td>0.56</td>
<td>0.52</td>
<td>0.48</td>
<td>0.48</td>
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<tr>
<td>SIB-R Personal Living Skills</td>
<td>0.36</td>
<td>0.40</td>
<td>0.29</td>
<td>0.33</td>
</tr>
<tr>
<td>SIB-R Community Living Skills</td>
<td>0.52</td>
<td>0.52</td>
<td>0.40</td>
<td>0.66</td>
</tr>
<tr>
<td>SIB-R Broad Independent Living Skills</td>
<td>0.51</td>
<td>0.53</td>
<td>0.38</td>
<td>0.65</td>
</tr>
</tbody>
</table>

References


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