https://doi.org/10.23925/2176-2724.2020v32i4p562-573

Central nervous system tumor and the pediatric patient: speech-language alterations

Tumor de sistema nervoso central e o paciente pediátrico: alterações fonoaudiológicas

Tumor del sistema nervioso central y el paciente pediátrico: trastornosdelhabla y ellenguaje

*Gabriela Pereira da Silva**
*Rafaela Pagani Palermo**
*Camila Lucia Etges**
*Roberta Alves da Silva**
*Maria Cristina de Almeida Freitas Cardoso**
*Cláudio Galvão de Castro Junior**
*Lisiane De Rosa Barbosa**

Abstract

Introduction: Central nervous system (CNS) tumors are the second most frequent neoplasm in children. The disorders treated by the speech therapy team most observed in patients with tumors are: dysphagia, dysphonia, language disorders, temporomandibular joint disorder, dysacusis, dysarthria and facial paralysis. Early detection of speech-language pathology changes in patients with pediatric tumors, at the stage of diagnosis or initiation of treatment, is essential for a more appropriate therapeutic management. **Objective:** to describe speech disorders in pediatric patients diagnosed with a tumor of the central nervous system in care during hospitalization. **Method:** Retrospective study, with collection performed through the research of data extracted from electronic medical records, with data of patients

* Hospital da Criança Santo Antônio – Irmandade Santa Casa de Misericórdia de Porto Alegre/RS - Brazil.

Authors' contributions:
GPS: development of proposal, data collection, writing of the article.
RPP: data collection:
CLE: development of proposal, scientific writing, study guidance.
RAS, MCAFC and CGCJ: scientific writing.
LDRB: elaboration of proposal, scientific writing, study orientation.

Correspondence e-mail: Gabriela Pereira da Silva - gabrielapereira.s@gmail.com
Received: 12/04/2020
Accepted: 26/08/2020

hospitalized from March 2016 to August 2018. To evaluate the association between categorical variables, Pearson's Chi-square test was applied. The level of significance adopted was 5% ($p < 0.05$). **Results:** There was greater relevance in the data related to swallowing disorders and orofacial motricity. Statistical significance was observed in the local variable of the lesion - in the posterior fossa -, with the presence of speech-language disorders. **Conclusion:** The sample of pediatric cancer patients demonstrated speech-language disorders, especially in the areas of dysphagia and orofacial motricity.

Keywords: Pediatrics; Child; Central nervous system; Speech therapy.

Resumo

Introdução: Os tumores do sistema nervoso central (SNC) constituem a segunda neoplasia mais frequente na criança. Os distúrbios tratados pela equipe de fonoaudiologia mais observados em pacientes com tumores são: disfagia, disfonia, alterações de linguagem, transtorno da articulação temporomandibular, disacusia, disartria e paralisia facial. A detecção precoce de alterações fonoaudiológicas em pacientes com tumores pediátricos, na fase do diagnóstico ou início do tratamento, é essencial para um manejo terapêutico mais adequado. **Objetivo:** descrever as alterações fonoaudiológicas de pacientes pediátricos com diagnóstico de tumor de sistema nervoso central em atendimento durante internação hospitalar. **Método:** Estudo retrospectivo, com coleta realizada através da pesquisa de dados extraídos de prontuário eletrônico, com dados dos pacientes internados de março de 2016 a agosto de 2018. Para avaliar a associação entre as variáveis categóricas, o teste Qui-quadrado de Pearson foi aplicado. O nível de significância adotado foi de 5% ($p<0,05$). **Resultados:** Verificou-se maior relevância nos dados relacionados aos distúrbios de deglutição e motricidade orofacial. Observou-se significância estatística na variável local da lesão - em fossa posterior -, com presença de alterações fonoaudiológicas. **Conclusão:** A amostra de pacientes oncológicos pediátricos demonstrou alterações fonoaudiológicas, principalmente nas áreas de disfagia e de motricidade orofacial.

Palavras-chave: Pediatria; Criança; Sistema nervoso central; Fonoaudiologia.

Resumen

Introducción: Los tumores del sistema nervioso central (SNC) son la segunda neoplasia maligna más frecuente em niños. Los trastornos tratados por el equipo de terapia del habla más observados en pacientes con tumores son: disfagia, disfonía, transtornos del lenguaje, trastorno de la articulación temporomandibular, disacusis, disartria y parálisis facial. La detección temprana de los câmbios em la patologia del habla y el linguaje en pacientes con tumores pediátricos, em la etapa de diagnóstico o inicio del tratamiento, es esencial para un manejo terapéutico más adecuado. **Objetivo:** describir los transtornos del habla y el lenguaje de los pacientes pediátricos diagnosticados con tumor del sistema nervioso central em la atención durante la hospitalización. **Método:** Estudio retrospectivo, com recopilación realizada a través de la investigación de datos extraídos de registros médicos electrónicos, com datos de pacientes hospitalizados de marzo de 2016 a agosto de 2018. Para evaluar la asociación entre variables categóricas, se aplico la prueba de Chi-cuadrado de Pearson. El nivel de significancia adoptado fue del 5% ($p<0,05$). **Resultados:** Hubo mayor relevância em los datos relacionados com los trastornos de la deglución y la motricidad orofacial. Se observo importancia estadística em la variable local de la lesión, em la fosa posterior, com la presencia de alteraciones de la patologia del habla y el lenguaje. **Conclusión:** La muestra de pacientes com cáncer pediátrico demostró la presencia de transtornos del habla y el lenguaje, especialmente em las áreas de disfagia y motricidad orofacial.

Palabras clave: Pediatría; Niño; Sistema nervioso central; Terapia del habla.

Introduction

Central nervous system (CNS) tumors are the second most frequent neoplasms in children, accounting for 15 to 20% of childhood and adolescence neoplasms. Most of those tumors are located in the posterior fossa (50-60%) in a region called infratentorial. The clinical signs and symptoms of a child with a brain tumor will depend on age and tumor location[1]. Infratentorial tumors may lead to hydrocephalus, intracranial hypertension, ataxic symptoms, and symptoms such as facial paralysis, hearing loss, and breathing pattern changes[2]. Disorders treated by the speech therapy team that are most often observed in patients with head and neck tumors are: dysphagia, dysphonia, language disorders, temporomandibular joint disorder, dysacusis, dysarthria, and facial paralysis. In most cases, the functional disorder corresponds to an alteration caused by the presence of a tumor and may become worse with the treatment indicated for the disease[3,4].

Patients with a posterior fossa tumor deserve special attention for the risk of dysphagia, as the neurological structures in that region play a key role in the precision and the efficiency of the movements involved in swallowing.[5] The impairment of swallowing will depend on the type of neoplasm, the affected area and the resected area. Major changes in the swallowing and speech process are directly related to the cranial nerve pairs involved, these being the glossopharyngeal (CN XI), the vagus (CN X), the accessory (CN XI) and the hypoglossal nerves(CN XII) [6]. Deglutition is a mechanism that can be affected by tumors that compromise the base of the skull and tumors of the posterior fossa, such as ependymoma, medulloblastoma and pilocytic astrocytoma, which show greater long-term impairment of swallow. Other complications following tumor resection include muscle weakness, sensory changes, imbalance, and cognitive dysfunction[5,6,7].

Antineoplastic treatment can be performed by surgery, chemotherapy and radiotherapy, either in combination or not, in accordance with medical advice. With the technological advances in therapeutic modalities, a major impact has been observed on the overall survival rates of these patients[8].

The team treating patients with childhood and adolescent cancer must be a multidisciplinary one in order to obtain a broader view of each case[8]. The speech therapist is one of the professionals that is part of the team and plays a role in pediatric oncology by assessing, diagnosing and rehabilitating communication, deglutition and orofacial motricity disordersl[9]. Not only can deglutition be assessed clinically, but also by means of supplementary objective examinations, including the videofluoroscopic swallow study (VFSS)[10].

The practice of the speech therapist is aimed at actions such as dysphagia rehabilitation, reintroduction of safe oral feeding, change in food consistency, sometimes with the use of facilitating postural maneuvers, tracheostomy weaning with occlusion training; phonation valve adaptation, exercises for pneumo-phono-articulatory coordination, in addition to hearing monitoring and rehabilitation, among other procedures that benefit patients and their families or caregivers[5,11,12].

The early detection of speech and language alterations in patients with pediatric tumors at the stage of diagnosis or initiation of treatment is crucial for a more adequate therapeutic management[9]. Thus, the aim of the study is to describe speech and language alterations in pediatric patients diagnosed with a CNS neoplasm and being treated during hospitalization.

Methods

This is a retrospective study approved by the Research Ethics Committee at Hospital da Criança Santo Antônio (HCSA) and Irmandade Santa Casa de Misericórdia de Porto Alegre (ISCMPA), under opinion number CAEE 79882617.1.0000.5683 and CEP 2.489.122. Data collection was performed by surveying data from the medical records of patients hospitalized from March 2016 to August 2018. The inclusion criteria were patients diagnosed with a CNS tumor treated during their hospital stay by the pediatric oncology team of Hospital da Criança Santo Antônio and under 18 years of age. The exclusion criteria were patients with incomplete speech and language evaluation and follow-up data in the medical records.

The analyzed patients underwent a speech and language evaluation based on a request for interconsultation and/or a multidisciplinary discussion of the team's cases. The evaluation was performed at different stages of the patient's oncological treatment. The speech therapy service uses the Protocol for Clinical Evaluation of Pediatric Dysphagia - PAD-PED as a basis for the clinical evaluation

of dysphagia[13]. Information on aspects related to voice, orofacial motricity, language and hearing was compiled in a form used by the speech therapy service from data mentioned in the medical records.

In this study, a Sample Characterization Form was completed for each patient, and the following variables were taken into account: oncological diagnosis, presence of comorbidities, type of treatment carried out, ventilatory support at the time of evaluation, time of the patient's speech and language evaluation in relation to the admission date, nutritional diagnosis, and feeding route used by the patient.

Similarly, a Speech Therapy Form was completed, considering deglutition data such as the consistency of the foods used in the evaluation (solid, liquid, pasty, thin paste, thickened liquid), description of oral phases (search reflex, lip seal, food escape from the mouth, incoordination of suction, breathing and swallowing, oral disorganization, oral stasis, sucking pattern) and the pharynx (cervical auscultation, vocal quality, vital signs) and the occurrence of dysphagia signs and symptoms, such as cough, choking, cyanosis, pallor, respiratory distress, nausea, vomiting or nasal reflux of food, as well as refusal to eat. Moreover, data on voice, orofacial motricity, language, hearing (puretone and vocal audiometry and immittance testing, when performed) were described and, finally, the conclusion and speech therapy were reported.

In addition to the data collection described above, aspects regarding the reason for patient admission at the time of the speech and language evaluation and also the objective assessment of deglutition through a videofluoroscopic swallow study (VFSS), when indicated by the medical and speech therapy teams, were used.

Data were entered by the investigators into an Excel data bank, Microsoft Office Professional Plus 2016 version.

The quantitative variables were expressed as mean and standard deviation, and the categorical variables as absolute and relative frequency. To assess the association between categorical variables, Pearson's chi-square test was applied. The level of significance adopted was 5% ($p<0.05$), and the analyses were performed using the SPSS software, 21.0 version.

Results

The sample characterization data showed that, among the 30 participants for whom information about the care provided by the speech therapy team was collected, age was described as a median with a value of 71.5 months, with 17 (56.7%) male and 13 (43.3%) female patients. Regarding the place where they lived, the metropolitan area of Porto Alegre was mentioned by 13 (43.3%) patients, followed by residents from the interior of the Rio Grande do Sul State, with 12 (40%) of the patients, and five (16.7%) were Porto Alegre residents.

Regarding the time of the speech and language evaluation: nine (30%) patients were assessed during hospitalization following the diagnosis of the CNS tumor, ten (33.3%) were assessed when hospitalized due to disease-related complications, five (16.7%) were assessed when hospitalized as a result of tumor relapse, and six (20%) were assessed during hospitalization for end-of-life care.

The data on diagnosis, tumor location, comorbidities and treatment, are described in Table 1, and it is possible to see the presence of eight (26.7%) patients diagnosed with astrocytoma; most of the sample - 16 (53.3%) - having the tumor located in the posterior fossa, and nine (30%) with neurological comorbidities mostly.

Table 1. Characteristics of diagnosis, comorbidities and intervention in CNS tumors.

Variables	n(%)
Diagnosis	
Medulloblastoma	4 (13.3)
Glioblastoma	5 (16.7)
Germinoma	1 (3.3)
Ependymoma	5 (16.7)
Astrocytoma	8 (26.7)
Diffuse glioma	4 (13.3)
PNET	2 (6.7)
Carcinoma	1 (3.3)
Tumor location	
Intracranial midline	1 (3.3)
Left temporal lobe	1 (3.3)
Posterior fossa	16 (53.3)
Ventricles	4 (13.3)
Brain glands	2 (6.7)
Mastoid	1 (3.3)
Choroid plexus	1 (3.3)
Thoracic spine	2 (6.7)
Diencephalon.	1 (3.3)
Lumbar spine	1 (3.3)
Comorbidities	
Respiratory	3 (10.0)
Neurological	9 (30.0)
Digestive	1 (3.3)
Treatment-related surgery n(%)	26 (86.7)
Type of surgery	
Resection	17 (65.4)
Palliative	3 (11.5)
Both	6 (23.1)
Ongoing chemotherapy	14/5 (46.7)
Chemotherapy completed	9 (64.3)
Ongoing radiotherapy	16/2 (53.3)
Radiotherapy completed	14 (87.5)
Chemotherapy + radiotherapy	8 (26.7)

Key: n = 30; PNET: Primitive neuroectodermal tumor.

In Table 2, called "Clinical status at the time of speech and language evaluation", it is possible to analyze data on ventilatory support, with the majority of the sample ventilated in ambient air - 21 (70%); 17 (56.7%) using an exclusive alternative feeding route, with the nasoenteral tube being the most frequent type, in 15 (83.3%) patients.

Table 2. Clinical status at the time of speech and language evaluation.

Variables	n(%)
Ventilatory support	
AA	21 (70.0)
NC	5 (16.7)
TCT	4 (13.3)
Current feeding	
Exclusive oral feeding	10 (33.3)
Oral feeding + alternative feeding	3 (10.0)
Exclusive alternative feeding	17 (56.7)
Type of alternative feeding	
NET	15 (83.3)
GTT	1 (5.6)
PN	2 (11.1)
If oral feeding, which form	
Pasty	12 (92.3)
Solid	9 (69.2)
Soft solid	11 (84.6)
Liquid	10 (76.9)
Nutritional diagnosis	
Extreme malnutrition	4 (13.3)
Eutrophy	22 (73.3)
Overweight	4 (13.3)

Key: n=30; AA: ambient air; NC: Nasal cannula; TCT: Tracheostomy; NET: Nasoenteral tube; GGT: Gastrostomy; PN: Parenteral nutrition.

Of the patients who underwent a clinical evaluation of swallowing with food intake, seven (26.9%) underwent a complementary evaluation through an objective examination of swallowing, VFSS, with the following results: in the oral phase, there was an early posterior escape of food into the oropharynx in six (85.7%) patients; in the pharyngeal phase, there was a delay in the pharyngeal response of swallowing, being triggered in piriform recesses in three (42.8%) of the cases; solid food stasis in the region of the vallecula, piriform recesses and posterior pharyngeal wall in six (85.7%), and with pasty food in two (28.5%) patients; food reflux into the nasopharynx with all consistencies in two (28.5%) patients; supra vocal fold penetration in four (57.1%) patients of the sample, with thin liquid in two (28.5%), with honey thickening in one (14.2%) and a solid consistency in one (14.2%) patient ; laryngeal penetration with thin liquid in one (14.2%) patient and silent tracheal aspiration with thin and thick fluid in five (71.4%) patients. The presence of moderate to severe oropharyngeal dysphagia in eight (26.7%) and severe oropharyngeal dysphagia in seven (26.9%) patients of the sample is noteworthy. The data for the clinical evaluation of deglutition are shown in Table 3.

Table 3. Findings from the clinical assessment of deglutition and speech-language pathology diagnosis.

Variables	n=30
Assessment with foods = n(%)	**26 (86.7)**
Solid	14 (53.8)
Liquid	19 (73.1)
Pasty	17 (65.4)
Thin pasty	8 (30.8)
Thick liquid	5 (19.2)
Vital signs	
Maintenance during supply	25/26 (96.2)
Change during supply	1/26 (3.8)
Effective coughing	8/26 (30.7)
Ineffective coughing	3/26 (11.5)
Choking	3/26 (11.5)
Respiratory distress	2/26 (7.7)
Nausea	2/26 (7.7)
Vomiting	1/26 (3.8)
Refusal to eat	4/26 (15.4)
Clinical evaluation conclusion - n(%)	
Normal deglutition	3 (11.5)
Mild oropharyngeal dysphagia	6 (23.0)
Moderate to severe oropharyngeal dysphagia	8 (30.7)
Severe oropharyngeal dysphagia	7 (26.9)
No oral readiness	2 (7.6)

Table 4, called "Association of speech and language alterations with the presence of the most frequent CNS tumors", shows the predominant presence of deglutition changes in the sample under study.

Figure 1 is representing data related to the "Association between the oncological diagnosis and the presence of a speech and language disorder". In 100% of the patients with medulloblastoma, germinoma, primitive neuroectodermal tumor and carcinoma, speech and language disorders occurred, mostly with the presence of oropharyngeal dysphagia.

Regarding the "association between the presence of a speech and language disorder and CNS tumor location", as shown in Figure 2, it was possible to observe at a statistically significant value ($p = 0.020$) that patients with a posterior fossa tumor had more speech and language disorders than those with tumors in other regions.

At the end of the survey, 16 (53.3%) patients were submitted to medical outpatient follow-up, and six (20%) of these were under concomitant speech therapy outpatient follow-up. In addition, two (6.6%) were hospitalized by the pediatric oncology team, one (3.3%) in the ward and another (3.3%) in the Intensive Care Unit (ICU), three (10%) were without medical and speech therapy outpatient follow-up for more than six months, one (3.3%) was being followed up in another pediatric oncology service, and eight (26.6%) eventually died during this study.

Table 4. Association of speech and language alterations with presence of the most frequent CNS tumors.

Alterations	Total (n=30)	Glioblastoma (n=4)	Ependymoma (n=4)	Astrocytoma (n=6)	Diffuse glioma (n=3)	p
	n (%)	n (%)	n (%)	n (%)	n (%)	
Deglutition	23 (100)*	4 (100)	4 (100)	6 (100)	3 (100)	-
Voice	1 (4.0)*	0 (0.0)	0 (0.0)	1 (16.7)	0 (0.0)	0.856
OM	12 (48.0)*	3 (60.0)	3 (60.0)	4 (66.7)	0 (0.0)	0.280
Language	6 (24.0)*	1 (20.0)	2 (40.0)	1 (16.7)	2 (66.7)	0.410

Key: OM = Orofacial motricity; * considering the overall results of the sample, including less frequent diagnoses.

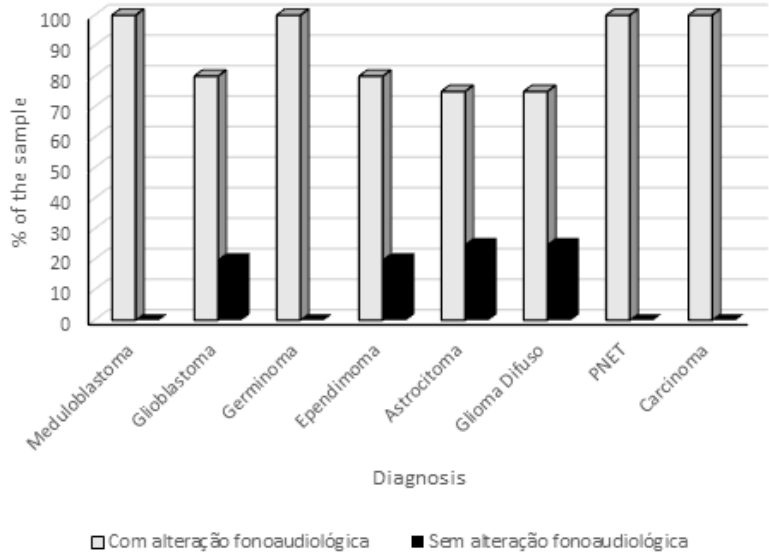
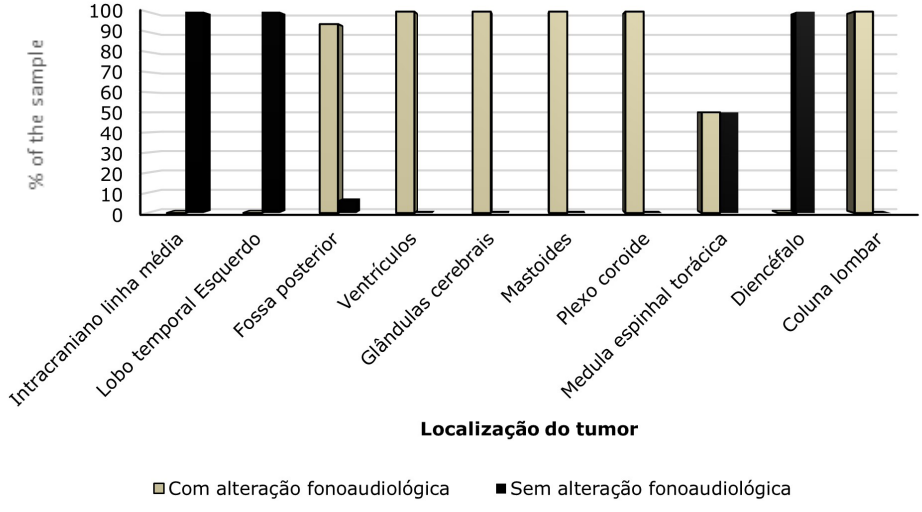


Figure 1. Association between tumor diagnosis and speech and language disorder (p=0.943).



Key: PNET Primitive neuroectodermal tumor.

Figure 2. Association between speech and language disorder and tumor location (p=0.020).

Discussion

The median age of the patients under study was 71.5 months; however, the literature points out earlier pediatric age groups - zero to four years - as the most prone to cancer development, with CNS cancer being the second most prevalent type[14-17].

Most patients in the study are from the metropolitan area of Porto Alegre, followed by patients from the interior of the state. According to a study[18], this finding may be explained by the survey being conducted in a referral pediatric hospital specializing in pediatric oncology in the state.

Regarding the reason for hospitalization at the time of the speech and language evaluation, no aspects were found in the literature regarding the mentioned stages, except about the end of life, a point on which the authors[19] agree with the present study and mention the importance of speech and language evaluation at that time, especially regarding the predictive signs for bronchial aspirations or complaints that cause discomfort in patients' feeding process, which can be ameliorated with the help of a speech therapist.

The diagnostic data demonstrated the prevalence of the diagnosis of astrocytoma, followed by glioblastoma and ependymoma. This finding is in agreement with investigators[15] who described a greater incidence of astrocytoma in their study, although followed by medulloblastoma and ependymoma. Their study also described data related to the tumor site, showing a greater tumor incidence in the posterior fossa [16] (53.3%). This finding is consistent with the literature, in which specific articles on the presence of posterior fossa tumors were examined[20-22].

As for the respiratory status, it was possible to observe that most of the sample was in ambient air at the time of the assessment - 21 (70%) -, and among those dependent on ventilatory support, five (16.7%) were ventilated through a nasal oxygen cannula, and four (13.3) made use of a tracheostomy. The respiratory impairment, although concomitantly associated with the neurological impairment, may cause disorders such as incoordination of breathing and swallowing functions, fatigue when eating, increased heart and respiratory rate, and drop in saturation[23]. Oxygen therapy and mechanical ventilation are among the commonly used strategies in a hospital setting. While the literature points out that the use of oxygen therapy and invasive mechanical ventilation can be considered risk factors for dysphagia in certain cases[23], in cases in which patients have previous neurological involvement, a hypothesis can be raised that such a respiratory status is associated with an increased degree of dysphagia, as nine (30%) patients seemed to meet this risk criterion.

The study in question showed that more than half of the sample - 18 (60%) - used some type of alternative feeding route, and four (13%) patients in the sample had a nutritional diagnosis of extreme malnutrition. According to investigators[23], intensive cancer treatment is able to cause the development of protein-energy malnutrition, being more common in children with highly malignant cancer and occurring more frequently among children with advanced -stage solid tumors in view of complications from gastrointestinal and oral toxicities, when compared to children with localized disease or leukemia. No specific information was found on the nutritional diagnosis for children with CNS tumors in the literature; however, regarding the alternative exclusive feeding route, the literature [24] describes the presence of feeding disorders, and this can be explained by the fact that the CNS commands vital functions such as swallowing.

With respect to the presence of oropharyngeal dysphagia in patients, data from another study are consistent with the findings in this study: oropharyngeal dysphagia occurs mainly with tumors located in the posterior fossa due to the risk of injury to the cranial nerve pairs. Changes in swallowing require special attention in view of the nutritional and pulmonary impairment induced by the tracheal aspiration of saliva or food[25].

Some patients have also been observed to complain about the acceptance of food during cancer treatment, which could be found in this study in patients with an eating disorder evaluated by the speech therapy team. There was agreement with the topic of a study[26] that reports that children may have sensory changes due to antineoplastic treatment or behavioral problems, such as refusal to eat or food selectivity. Moreover, the development of acute or late oral complications arising from chemotherapeutic or radiotherapeutic treatment may also contribute to diet intake by oral feeding. The complications include mucositis, xerostomia, fungal, bacterial and viral infections, radiation-induced caries, trismus, osteoradionecrosis, neu-

rotoxicity, and bone, muscle and dental formation impairment[27].

According to VFSS[28] data, severe deglutition deficits and high rates of penetration and aspiration in adult patients with head and neck cancer prior to cancer treatment deteriorate further following surgical, radiotherapeutic and chemotherapeutic treatment.

Investigators[9] described the incidence of speech and language alterations in children and adolescents under cancer treatment and showed that 81% of patients had some type of speech and language disorder. Complaints related to voice, speech, language, deglutition and orofacial motricity were reported in a study[7], with orofacial motricity disorder, dysphonia and language disorders being the most frequent speech and language alterations. The present study found speech and language changes in the areas mentioned above in patients diagnosed with a CNS tumor; however, greater relevance was seen in the data related to the deglutition and orofacial motricity disorders.

Regarding the presence of speech and language alterations associated with the tumor diagnosis, the alterations in this study are consistent with a study[29] in which disorders such as dysphagia and dysarthrophonia are evidenced in the sample composed of patients diagnosed with ependymoma, astrocytoma and primitive neuroectodermal tumor (PNET).

Significant speech and language alterations were also observed in patients with a posterior fossa tumor, as shown in the literature[22], tumors of the posterior fossa are more likely to present speech and language disorders.

It should be noted that this study brought a modest sample, which may have contributed to most results failing to have statistical significance. Moreover, it was necessary to use studies conducted in adults to discuss the pediatric findings due to the scarce literature about specific data that the present work addresses in pediatric oncology in connection with speech therapy.

Nevertheless, it should be noted that this study brought a modest sample, which may have contributed to most results failing to have statistical significance. Moreover, it was necessary to use studies conducted in adults to discuss the pediatric findings due to the scarce literature about specific data that the present work addresses in pediatric oncology in connection with speech therapy, and this lack of scientific references about the topic is a limitation of this study.

Therefore, it is suggested that further studies be conducted with more robust samples prospectively, aiming at descriptive results and better therapeutic measures to be implemented in pediatric oncology services.

Conclusion

The sample of pediatric oncology patients under study shows speech and language alterations, most notably dysphagia and orofacial motricity issues.

References

1. Botelho I. Tumores do Sistema Nervoso Central.Recife/PE: Núcleo de Apoio à Criança com Câncer – Nacc. ata(s) de registro [2014 Jun 25; acesso em 2018 Sept 17] Disponível em: http://www.nacc.org.br/tumores-sistema-nervoso-central/.

2. Rondinelli PIP. Tumores do sistema nervoso central na infância. In: Jotz GP, Angelis EC, Barros APB. Tratado da Deglutição e Disfagia no Adulto e na Criança.Rio de Janeiro: Revinter; 2009. p. 245-46.

3. Arakawa-Sugueno L. Fonoaudiologia e paciente pediátrico com tumor de cabeça e pescoço. In: Malagutti W, editor. Oncologia pediátrica, uma abordagem multiprofissional. São Paulo: Martinari; 2011. p. 243-51.

4. Durve DV, Kanegaonkar RG, Albert D, Levitt G. Paediatric rhabdomyosarcoma of the ear and temporal bone. ClinOtolaryngolAlliedSci.[Internet].2004Feb [acesso em 2020 Apr 30]; 29(1): 32-7. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/14961849.

5. Coça KL, Bergmann A, Ferman S, Angelis EC, Ribeiro MG. Prevalência de distúrbios da comunicação, deglutição e motricidade orofacial em crianças e adolescentes no momento da matrícula em um hospital oncológico. Codas [Internet]. 2018 [acesso em 2020 Apr 30]; 30(1): e20170123. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2317-17822018000100307&lng=en.

6. Douglas CR. Fisiologia da Deglutição. In: Douglas CR. Tratado de fisiologia aplicada à fonoaudiologia. São Paulo: Robe Editorial; 2002. p. 372-88

7. Andrade GC, Pereira MM, Oliveira AC. Disfagia. In: Nutrição e câncer infanto-juvenil. São Paulo: Manole Ltda; 2017. p. 152-72.

8. Coura CF, Modesto PC. Impacto dos efeitos tardios da radiação em crianças sobreviventes de câncer: revisão integrativa. Einstein (São Paulo). [Internet]. 2016 Mar [acesso em 2020 Apr 30]; 14(1): 71-6. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1679-45082016000100071&lng=en.

9. Gonçalves MIR, Dishtchekenian A, Iório MCM. Oncologia pediátrica: atuação fonoaudiológica. In: Malagutti W, editor. In: Oncologia pediátrica, uma abordagem multiprofissional. São Paulo: Martinari; 2011. p. 253-6.

10. Costa MMB. Videofluoroscopy: the gold standard exam for studying swallowing and its dysfunction. ArqGastroenterol. [Internet]. 2010 Dec [acesso em 2020 Apr 30]; 47(4): 327-8. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0004-28032010000400001&lng=en.

11. Caldas EA, Brito LMO, Caldas PA, Rocha SCM, Filho EDF, Chein MBC. Caracterização audiológica de crianças em tratamento oncológico. AudiolCommun Res. [Internet]. 2015 June [acesso em 2020 Apr 30]; 20(2): 104-9. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2317-64312015000200005&lng=en.

12. Avelino MAG, Maunsell R, Valera FCP, Neto JFL, Schweiger C, Miura CS, et al. FirstClinical Consensus and National Recommendations on Tracheostomized Childrenof the Brazilian Academy of Pediatric Otorhinolaryngology (ABOPe) and Brazilian Society of Pediatrics (SBP). Braz J Otorhinolaryngol. [Internet]. 2017 Oct [acesso em 2020 Apr 30]; 83(5): 498-506. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1808-86942017000500498&lng=en.

13. Sassi FC, Bühler KCB, Juste FS, Almeida FCF, Befi-Lopes DM, de Andrade CRF. Dysphagia and associated clinical markers in neurologically intact children with respiratory disease. PediatrPulmonol. [Internet] 2018 January[acesso em 2020 Apr 30];53(4):517-25. Disponível em: https://onlinelibrary.wiley.com/doi/full/10.1002/ppul.23955.

14. Bosetti C, Bertuccio P, Chatenoud L, Negri E, Levi F, La Vecchia C. Childhood cancer mortality in Europe, 1970–2007. Eur J Cancer. [internet] 2010 Oct [acesso em 2020 Apr 30] ;46:384-94. Disponível em: https://www.ejcancer.com/article/S0959-8049(09)00683-2/fulltext

15. Gonçalves MI, Radzinsky TC, da Silva NS, Chiari BM, Consonni D. Speech-Language and Hearing complaints of children and adolescents with brain tumors. Pediatr BloodCancer. [Internet] 2008 Mar [acesso em 2020 Apr 30] ; 50:706–8. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/17534932

16. Zouain-Figueiredo GP, Zandonade E, Amorim MHC, Figueiredo LZ, Binda LA. Perfil epidemiológico dos casos novos de câncer infanto-juvenil em hospital de referência no Espírito Santo, Brasil, de 1996 a 2010. Rev. Bras. Pesq. Saúde. [Internet] 2015 Nov [acesso em 2020 Apr 30];17(4):109-20. Disponível em: https://periodicos.ufes.br/rbps/article/view/14337

17. Da Silva DB, Pires MMS, Nassar SM. Câncer pediátrico: análise de um registro hospitalar. J. Pediatr. (Rio J.). [Internet] 2002 Jun [acesso em 2020 Apr 30]; 78(5): 409-14. Disponível em: https://www.scielo.br/pdf/jped/v78n5/7805409.pdf

18. Magalhães IQ, Gadelha MIP, Macedo CD, Cardoso TC. A Oncologia Pediátrica no Brasil: Por que há Poucos Avanços? Revista Brasileira de Cancerologia. [Internet] 2016 Jan [acesso em 2020 Apr 30];62(4): 337-41. Disponível em: http://www1.inca.gov.br/rbc/n_62/v04/pdf/06-artigo-opiniao-a-oncologia-pediatrica-no-brasil-por-que-ha-poucos-avancos.pdf

19. Carro CZ, Moreti F, Pereira JMM. Proposta de atuação da Fonoaudiologia nos Cuidados Paliativos em pacientes oncológicos hospitalizados. Distúrb Comum.2017 Dez [acesso em 2020 Apr 30];29(1):178-84. Disponível em: https://revistas.pucsp.br/dic/article/view/28946/22350

20. Mei C, Morgan AT. Incidence of mutism, dysarthria and dysphagia associated with childhood posterior fossa tumour. Childs NervSyst. [Internet] 2011 Jul[acesso em 2020 Apr 30] ; 27(7):1129-36. Disponível em: https://europepmc.org/article/med/21442268

21. Newman LA, Boop FA, Sanford RA, Thompson JW, Temple CK, Duntsch CD.Postoperative swallowing function after posterior fossa tumor resection in pediatric patients. Childs NervSyst. [Internet] 2006Oct[acesso em 2020 Apr 30]; 22(10): 1296-300. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/16761160

22. Lee WH, Oh BM, Seo HG, Kim SK, Phi JH, Chong S, et al. One-year outcome of postoperative swallowing impairment in pediatric patients with posterior fossa brain tumor. J Neurooncol. [Internet] 2016 MarchJul[acesso em 2020 Apr 30];127(1): 73-81. Disponível em: https://link.springer.com/article/10.1007/s11060-015-2010-z?shared-article-renderer#citeas

23. Rodrigues KA, Machado FR, Chiari BM, Rosseti HB, Lorenzon P, Gonçalves MIR. Reabilitação da deglutição em pacientes disfágicos traqueostomizados sob ventilação mecânica em unidades de terapia intensiva: um estudo de factibilidade. RevBras Ter Intensiva. 2015 Fev; 27(1): 64-71.

24. Assunção DT, Oliveira CM, Amaral ABCN, Pena GG. Avaliação do estado nutricional e de fatores associados à desnutrição em crianças e adolescentes com câncer em diferentes momentos do tratamento [monografia]. Uberlândia: Universidade Federal de Uberlândia; 2018.

25. Morgan AT, Sell D, Ryan M, Raynsford E, Hayward R. post-surgical dysphagia outcome associated with posterior fossa tumor in children. J Neurooncol.2008 May [acesso em 2020 Apr 30]; 87(3): 347-54. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/18209951.

26. Jesus LG, Cicchelli M, Martins GB, Pereira MC, Lima HS, Medrado AR. Repercussões orais de drogas antineoplásicas: uma revisão de literatura. RFO UPF. [Internet] 2016 Apr[acesso em 2020 Apr 30]; 21(1): 130-5. Disponível em: http://revodonto.bvsalud.org/scielo.php?script=sci_arttext&pid=S1413-40122016000100020&lng=pt&nrm=iso

27. Barreto ABR, Haack A, Santos ACS, da Silva APR. Perfil nutricional de pacientes pediátricos portadores de câncer, internados no Hospital da Criança em Brasília. Com. Ciências Saúde. [Internet] 2013 May [acesso em 2020 Apr 30]; 24(4): 315-20. Disponível em: https://bvsms.saude.gov.br/bvs/artigos/ccs/perfil_nutricional_pacientes_pediatricos_cancer.pdf.

28. Capsomidis A, Hall A, Daya H, Round J, Lancaster D, Bate J. Vocal cord palsy in children with câncer: a 10 year analysis of UK pediatric intensive care admissions. J PediatrHematolOncol. [Internet] 2017 May [acesso em 2020 Apr 30]; 39(4): 293-5. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/28099401.

29. Xinou E, Chryssogonidis I, Kalogera-Fountzila A, Panagiotopoulou-Mpoukla D, Printza A. Longitudinal Evaluation of Swallowing with Videofluoroscopy in Patients with Locally Advanced Head and Neck Cancer After Chemoradiation. Dysphagia. [Internet] 2018 Oct[acesso em 2020 Apr 30] ;33: 691-706. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/29572573.

30. Tomita T, Grahovavac G. Cerebello pontinsangle tumors in infants and children. Childs NervSyst. [Internet] 2015 Sep[acesso em 2020 Apr 30];31(10):1739-50. Disponível em: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4564453/.