Technical and relational aspects in the radiotherapy path of pediatric patients with ependymoma

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Abstract

Ependymoma is a rare brain tumor that affects approximately 0.26 per 100,000 children aged 0 to 14 years. Radiation therapy is subsequent to surgical treatment. The success of the radiotherapy treatment is given by a good psychological condition of the child and the ability of the Radiology Technician to create effective communication and a relationship of trust. The study demonstrates the importance of new training courses to increase the hard and soft skills of the radiology technician's core competence. The analysis was performed at Salerno Hospital, in the period between January and July 2022, on five pediatric patients aged between 18 months and 17 years affected by grade III ependymoma and treated with VMAT Radiotherapy according to the SIOP protocol Ependymoma II randomized in stratum 1. Two children were treated in narcosis. The systematic and random errors produced during the positioning phase were esti-mated on the analysis of the shifts occurred during the treatments. The core competence of the Radiology Technician was supported by an effective communication and the formation of a relationship of trust, to obtain maximum collaboration from the pediatric patient and consequently achieve optimal results, even in treatments without anesthesia.

Introduction

Ependymomas are the third most common pediatric brain tumor, with an incidence of 10% [1]. Postoperative adjuvant radiotherapy plays a fundamental role in the treatment [2]. The key competence of the Radiology Technician (RT) in pediatric treatment without the use of narcosis gave a great contribution to the experience gained at "A.O.U. San Giovanni di Dio e Ruggi d'Aragona" facility. Currently this pathology is treated in radiotherapy with VMAT techniques which involve the irradiation of multiple contiguous isocenters. The precision in execution must be millimetric, to obtain the best result. For these reasons, treatment does not last long, and maximum immobility is essential.
During this process a cross-sectorial approach was followed, allowing the optimization of ra-diotherapy treatment without the use of anesthesia. A flexible, dynamic and integrated profes-sional practice guarantees added value to care and assistance processes. The study shows the effectiveness of a multidisciplinary approach in terms of optimizing pediatric radiation treatment.

Materials and Methods

The study was conducted at the Radiotherapy Unit of the A.O.U. "San Giovanni di Dio e Ruggi d'Aragona" in Salerno, in the period between January 2022 and July 2022, on 5 pediatric pa-tients, aged between 18 months and 17 years, affected by grade III ependymoma (CNM-WHO 2021) [3], treated with VMAT radiotherapy technique according to the SIOP Ependymoma II pro-tocol randomized in stratum 1 [4]. According to this protocol, we made a post-surgical irradiation with a total dose of 59.4 Gy and a fractionation of 1.8 Gy/fraction, 5 fractions/week. The dose is reduced to 54 Gy in patients under 18 months of age and/or in case of multiple surgical opera-tions. Three patients had the tumor in the posterior cranial fossa and two patients in the su-pratentorial region. Considering the patients' compliance, two out of five underwent the CT sim-ulation and radiotherapy treatment under narcosis (Figure 1).

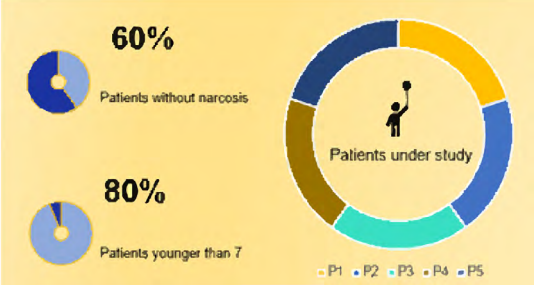

Figure 1 *Study data.*

As regards the preparation phase, during the simulation CT was tried to welcome the child in a peaceful and calm manner. It was essential to understand the child's hidden fears, establish a relationship of mutual trust and illustrate the immobilization techniques used, creating a climate of serenity. Two

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out of five patients had no knowledge of the Italian language. In both cases, the mul-tidisciplinary collaboration was fundamental to avoid the social gap and the difficulties due to the language. In the other cases the approach was immediate and direct [5-6]. The setup of patients was performed using the All-In-One system and a thermoplastic mask which allowed the best re-producibility of the treatment. Cone Beam CT was used for error checking with a low dose acquisi-tion protocol. The shifts have been obtained by overlaying the images acquired daily with those acquired during the simulation CT [7]. (Figure 2 shows patient placements)

Figure 2 *Pediatric patient setup with and without anestesia.*

Results

Several assessments were carried out, studying patients' positioning and the multiple varia-bles related to patients' poor compliance. By analyzing the shifts along the axes in the three di-rections of space for each individual session, the arithmetic means and standard deviation (con-tained in Table 1) were obtained.
The study showed that an average displacement of 0/0.1 cm along all three axes occurred in patien-

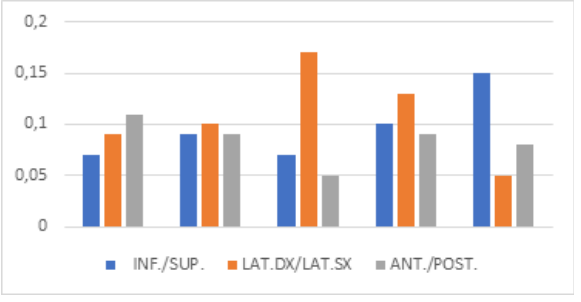

Table 1 *Standard deviation of the movements along the lower/upper axes; lateral right/left and anterior/posterior.*

ts under narcosis. In patients who performed the treatment without anesthesia, displace-ments along the three axes ranged from 0 cm to 0.2 cm. Figure 3 shows the contouring of the organs at risk in a case of ependymoma in the posterior cranial fossa.

Discussion

This study showed the degree to which the radiology technician's role is influential in the radiation therapy sessions of a pediatric patient [8-9]. The averages of the movements analyzed represent the systematic error made, that enlighten the shifts made during the treatment com-pared to the iso-

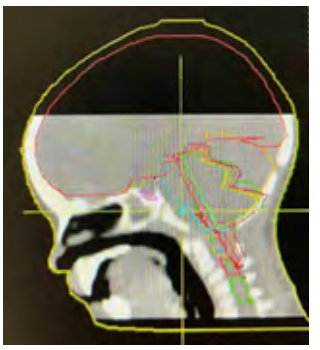

Figure 3 *Contouring of the organs at risk of ependymoma in the PCF.*

center of the positioning phase. The standard deviation, on the other hand, rep-resents the random error. The degree of dose conformation achievable with the radiotherapy technique guarantees a considerable control of ependymal tumors but it also requires maximum evaluation of the positioning of the treatment volume and the organs at risk.
These values must be interpreted as the result of correct preparation and execution of the radiation treatment, meaning not only the positioning of the patient is fundamental, but every-thing that precedes it. The choice to include treatments without anesthesia in the analysis al-lowed to study which actions would be the most useful to achieve maximum collaboration of the pediatric patient.
Regarding communication, the elimination of technical-clinical language in favor of informal vocabulary and the establishment of a relationship characterized by empathy and humanity, kindness and politeness were very relevant elements. The patients' trust produced a simplifica-tion of the reality they were facing, also supported by the strong humanization of the spaces around them. [10-11].

Conclusions

A key element of the study was taking care of patients in their therapeutic process, config-uring the profession of Radiology Technician as a link between pediatric patients and the multi-disciplinary clinical team. This has allowed the implementation of an actively participatory role throughout the treatment process, from planning with the pathology referring doctors, to the organization of simulation imaging, to total management [12-13]. This guaranteed assistance aimed at the person and not at the pathology, which translated into a better perceived quality of the care received, humanization of the treatment, greater satisfaction of the pediatric patient and his family and optimization of clinical results.
This underscores the importance of implementing training in the core competencies of the Radiology Technician: he or she does not have an auxiliary role compared to other professionals. Finally, the introduction of new training paths is also important, which can make the Radiology Technician an eclectic and multifaceted professional, capable of holding the art of care in his or her hands.

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