

FREQUENCY OF HEARING LOSS AMONG CHILDREN DIAGNOSED WITH RETINOBLASTOMA AFTER USING CARBOPLATIN CHEMOTHERAPY

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ORIGINAL ARTICLE

ABSTRACT

Background: Retinoblastoma is a rare form of cancer. The retina, which is the layer of cells at the back of your eye that senses light, is where retinoblastoma begins. It's the most prevalent type of eye cancer in Pediatric population. Chemotherapy is the process of killing cancer cells with drugs. This kind of cancer treatment functions by preventing the growth and division of cancer cells.

Objective: To determine the frequency of hearing loss among children diagnosed with retinoblastoma after using carboplatin chemotherapy. **Methodology:** Cross sectional observational study was conducted to find out the frequency of asymmetrical hearing loss in retinoblastoma population on a sample of 21 patients with both male and female babies with Non-probability purposive sampling technique. This study was conducted in two hospitals (Children Hospital Lahore and INMOL Cancer Hospital).

Duration of this study was 6 Month from June 2023 to November 2023. Patients with age 0 to 2 years were included. **Results:** Out of 21 Patients, the patients who diagnosed with retinoblastoma were 21 (100%) in number, the patients with age 0 to 8 months were 12 (57.1%) in number, female babies were 11 (52.4%) in number, the patients who referred OAES were 7 (33.3%) in number in right ear and were also 7 (33.3%) in number in left ear. **Conclusion:** The study concluded that some retinoblastoma patients who underwent carboplatin treatment experienced bilateral hearing loss.

Key words: Retinoblastoma Hearing Loss, Hearing Loss, Screening test

INTRODUCTION

The term "Hearing loss" refers to a loss of hearing ability to the broadest extent imaginable, ranging from subjectively barely audible to complete deafness¹. The most common kind of hearing loss is sensorineural. Sensorineural hearing loss refers to causes of hearing loss due to cochlear, auditory nerve, or central nervous system pathologies². In the United States, congenital Syndromic

Sensorineural Hearing Loss (SNHL) is almost three times more common than Down syndrome³. Different medical problems might result in conductive hearing loss. This is because any condition can produce conductive hearing loss, which can affect the pinna, external auditory meatus, and the foot of the stapes bone⁴. Common causes include otitis externa, tympanic membrane perforation, ossicular fixation, and otosclerosis⁵.

Worldwide, 8,000 children are diagnosed with retinoblastoma, a rare cancer of the developing retina, each year. A malignant tumour of the retina, retinal retinoblastoma primarily affects children under the age of four. The illness may be non-hereditary (always unilateral) or hereditary (usually bilateral)⁶. The primary treatment options for retinoblastoma include targeted therapy, chemotherapy, and in more extreme situations, enucleation. Chemotherapy is frequently used to shrink tumours before pursuing more focused treatments. Focal therapies are used to target and remove tiny tumours inside the eye. The surgical removal of the afflicted eye, known as enucleation, is seen as a last resort to stop the cancer from spreading⁷.

Chemotherapy is well established to be linked to ototoxicity, or the risk of auditory system damage and hearing loss. Numerous chemotherapy medications, such as those based on platinum, such as carboplatin and cisplatin, have been associated with variable degrees of ototoxicity. In a recent study, moderate to severe hearing loss was found in 43.8% of the 1481 patients who received cisplatin⁸. Depending on the particular chemotherapy agent, the dosage, and the length of treatment, there may be differences in the degree and kind of hearing loss. For patients receiving chemotherapy, audiological monitoring and interventions are frequently advised in order to identify and address any potential hearing-related problems⁹. Lately, research indicates after receiving first-line cisplatin-based chemotherapy for testicular cancer (TC), 74% of survivors reported ototoxicity, including 68% tinnitus, 59% hearing loss, and 52% both¹⁰. Twenty percent have mild hearing loss, twenty-nine have moderate hearing loss, and twenty-eight have severe hearing loss out of 270 childhood cancer survivors who received platinum-based chemotherapy¹¹.

The platinum-based chemotherapy medication carboplatin has become a vital part of the treatment regimen for retinoblastoma. In order to specifically target and inhibit tumour growth within the eye, carboplatin is frequently used as an intravenous chemotherapy agent in conjunction with other chemotherapeutic medications. This method is especially helpful in cases with bilateral or severe retinoblastoma, where globe-sparing therapies are necessary to protect young patients' eyesight and general quality of life¹².

The platinum-based chemotherapy medication carboplatin is known to carry a risk of ototoxicity, which can lead to hearing loss. Ototoxicity occurs in 32.1% of children receiving cisplatin or carboplatin treatment¹³. While carboplatin is useful in treating a variety of malignancies, including tumours in children like retinoblastoma, it can harm the cochlea and impair hearing. Individual differences exist in the occurrence and severity of carboplatin-induced hearing loss, and variables including cumulative dosage and treatment duration influence the degree of harm. For paediatric patients in particular, audiological monitoring is usually advised both during and after carboplatin therapy in order to identify and address any potential hearing-related problems¹⁴.

Very limited data is available regarding it to focus on frequency of hearing loss among children diagnosed with retinoblastoma after using carboplatin chemotherapy in developing countries like Pakistan.

MATERIAL AND METHODS

Study design: Cross-sectional observational

Setting: This study was conducted Children Hospital Lahore and Inmol Cancer Hospital.

Duration: 6 months (June 2023 to November 2023).

Sample size: Sample size of 21 children which was calculated through online calculator. Sample size was calculated by using 95%

confidence level and 5% confidence interval.

Sampling technique: Non-probability purposive sampling technique was used for data collection.

Sample selection criteria

Inclusion criteria

- Patients with retinoblastoma were included.
- Male and Female of age 0 to 2 years were included.

Exclusion criteria

- Patients with other comorbid factors like congenital anomalies, disabled babies were excluded from this research.

Data collection procedure

Self-structured questionnaire and otoacoustic emissions (OAEs) were used to accumulate the data. After getting written consent from the Parents of children who had retinoblastoma, Demographic information and the questionnaire were filled out by the parents then, the children's hearing was assessed through OAEs, and before starting, the researcher guided the parents on how to perform this procedure. As per instructions guided by the researcher, the mother/father of the baby sat on a wooden chair with the baby in his/her lap and then the researcher put the probe in the baby's ear and OAEs were performed. Hearing loss was labeled through the Otoacoustic Emissions Test. There are two

criteria for OAEs one is the Pass and the other is refer. If the machine shows a pass then there is no hearing loss but if it shows refer it indicates the cochlea is not functioning normally and there is hearing loss. Data was analyzed through SPSS version 27.0 package

RESULTS

Out of 21 children, patients within the age group of 0 to 8 months were 12 (57.1%), 9 to 16 months were 6 (28.5%) and 17 to 24 months of age were 3 (14.2%). Patients of male gender were 10 (47.6%) and female were 11 (52.4%). Of the 21 children diagnosed with retinoblastoma, 18 (85.7%) had the disease in both eyes, while only 3 (14.2%) had it in just one. As part of their treatment, every child 21 (100.0%) with retinoblastoma underwent carboplatin chemotherapy. Seven (33.3%) had hearing problems before or during their retinoblastoma. Before beginning carboplatin chemotherapy, only nine (42.9%) patients with retinoblastoma had baseline hearing evaluations. Out of 21 patients in total, there were 14 patients (66.6%) who passed the otoacoustic emission (OAEs) screening in the right ear, and there were 7 (33.3%) who were referred. Additionally, 14 patients (66.6%) in the left ear passed the otoacoustic emission (OAEs) screening; the number of patients who were referred was 7 (33.3%)

Table 1: Demographics information of patients

Variables	Sub Variables	Frequency (Percentage %)
Age	0 to 8 months	12 (57.1%)
	9 to 16 months	6 (28.5%)
	17 to 24 months	3 (14.2%)
Gender	Male	10 (47.6%)
	Female	11 (52.4%)

Table 2: Findings of questionnaire answered by parents

Variables	Yes		No	
	Frequency	Percentage %	Frequency	Percentage %
Has the child been diagnosed with retinoblastoma?	21	100.0%	0	0.0%
Were both eyes affected by retinoblastoma?	18	85.8%	3	14.2%
Has the child undergone carboplatin chemotherapy as part of their treatment for retinoblastoma?	21	100.0%	0	0.0%
Has the child experienced any hearing - related issues prior to or during retinoblastoma?	7	33.3%	14	66.6%
Were baseline-hearing assessments conducted before starting carboplatin chemotherapy?	9	42.9%	12	57.1%

Table 3: Otoacoustic Emission Findings

Variables	Pass	Refer
Right Ear	14 (66.6%)	7 (33.3%)
Left Ear	14 (66.6%)	7 (33.3%)

DISCUSSION

The current study's findings indicate that, of the 21 patients with retinoblastoma, 18 (85.8%) had retinoblastoma affecting both eyes, while 3 (14.2%) did not have retinoblastoma affecting both eyes. According to findings from a 2017 study by Tero T. Kivelä et al., unilateral retinoblastoma at diagnosis is frequent, but it has a very high chance of developing into bilateral retinoblastoma. Of the twelve neonatal family retinoblastomas in

the Dutch collection, five (40%) had unilateral first retinoblastomas. Within five months, all but one (92%) had bilateral illness. Seven (70%) of the ten inherited neonatal retinoblastomas in Finland were initially unilateral, but by four months, they were all bilateral. 26 (57%) of the 46 infant retinoblastomas in an earlier, bigger sample from New York were initially unilateral, and 22 (85%) of them developed to bilateral

involvement. Therefore, it is likely that 50% of newborn retinoblastomas will be unilateral upon diagnosis, but 90% of cases will involve the other eye before the patient is six months old.

The current study's results indicate that, of the 21 patients receiving carboplatin chemotherapy, patients who had ear discharge related symptoms were 1 (4.8%) in number, 7 (33.3%) experienced symptoms related to hearing loss during or after the treatment, and 4 (19.0%) had symptoms related to ear pain and patients with no complain were 9 (42.9%). In 2017, Sameh E. Soliman et al conducted a research. The study's findings indicate that 71 retinoblastoma patients had audiometric data accessible. When carboplatin was used to treat retinoblastoma, we found that 18 (or 25%) of the patients experienced ototoxicity.

The current study's results indicate that, of the 21 patients receiving carboplatin chemotherapy, patients who had ear discharge related symptoms were 1 (4.8%) in number, 7 (33.3%) experienced symptoms related to hearing loss during or after the treatment, and 4 (19.0%) had symptoms related to ear pain and patients with no complain were 9 (42.9%). In 2017, Sameh E. Soliman et al conducted a research. The study's findings indicate that 71 retinoblastoma patients had audiometric data accessible. When carboplatin was used to treat retinoblastoma, we found that 18 (or 25%) of the patients experienced ototoxicity¹⁶.

The current study's results indicate that, of the 21 patients, 14 (66.6%) passed the right ear screening, and 7 (33.3%) of them were referred for screening. Additionally, there were 14 (66.6%) patients who passed the left ear screening, and there were 7 (33.3%) patients who were referred for the right ear screening. In 2018, Sofia Waissbluth and

colleagues carried out a study. There were twenty-eight patients in total, according to the study's results; twenty-one of them received cisplatin, four received carboplatin, and three received both. Over a mean follow-up time of 21.5 months (range: 1–53 months), 28.6% of the patients developed sensorineural hearing loss¹⁷.

CONCLUSION:

The results of this study conclude that ototoxicity occurred bilaterally in some of the patients treated for retinoblastoma with carboplatin chemotherapy. As a result A follow up study should be under taken to confirm the frequency of hearing loss among children diagnosed with retinoblastoma after using carboplatin chemotherapy.

AUTHOR'S CONTRIBUTION

AA: Idea and main role, **SAB:** Data analysis and write up, **MBRK:** Data collection and literature search, **MA:** Data collection, **NA:** Data collection

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