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Original Research Article

Oral health status in children undergoing chemotherapy for acute lymphocytic leukaemia: A cross-sectional study with emphasis on paediatric palliative care in a tertiary hospital setting

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Abstract

Aim: This study Lymphoblastic Leukaemia (ALL), a type of cancer that affects white blood cells. The investigation specifically concentrated on potential oral complications associated with the treatment and aimed to identify correlations with demographic characteristics. The primary objective was to mitigate the risk of additional complications.

Materials and Methods: A consecutive sampling approach was used in a cross-sectional survey conducted among all 56 eligible children receiving chemotherapy for Acute Lymphocytic Leukemia (ALL) at a tertiary care hospital in Western Rajasthan. Socio-demographic and clinical data were documented. The Oral Assessment Guide (OAG) tool was employed to assess the oral health of the participants. Descriptive and inferential statistics were applied for analysis using SPSS version 23.

Results: The study revealed that 69.6% of participants had compromised oral health. Most of the participants were male (66.1%). About 46.4% were in the maintenance phase of chemotherapy. According to the OAG tool, oral mucositis was present in 46.4% of children after the first dose of chemotherapy. Nearly 25% did not have any oral issues. Two-thirds of the participants (66.1%) brushed daily. Oral mucositis correlated significantly ($p<0.05$) with age, education, age at ALL diagnosis, and frequency of mouthwash use. Pamphlets on oral care for children undergoing chemotherapy were prepared, and demonstrations on oral hygiene were shown to parents and children through videos. Handouts on oral health were also provided.

Conclusion: Chemotherapy for childhood acute lymphoblastic leukemia (ALL) is a risk factor for oral mucositis. Early assessment and monitoring of oral health status can enhance the quality of life for children affected by ALL.

Keywords: Complete Denture, Remedies, Troublesome dentures

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1. Introduction

Leukaemia, characterized by the abnormal proliferation of White Blood Cells (WBC), is a prevalent cancer among children[1] Globally, incidence of childhood cancer ranges from 50 to 200 per million children, with Leukaemia and Lymphoma being the most common malignancies. In India, cancer ranks as the ninth leading cause of death among children aged five and 14, with nearly 45,000 cases an diagnosed annually.[2] Approximately 80%, of ALL cases are diagnosed in children.[3] Despite being a responsive yet challenging scenario for treatment. ALL constitutes roughly a quarter of childhood cancer instances, peaking between the ages of two and six years. five-year relative survival rate stands at 80%-85%.[4-5]

Despite advancements in leukaemia treatment that have enhanced survival rates, the impact on quality of life remains a concern. The myriad of side effects, both from the disease and its treatment, often lead to a decline in the overall well-being of children with ALL. Among these side effects, oral manifestations are widespread.[6] Oral lesions, often the initial

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signs of leukaemia, can worsen during or after chemotherapy due to the drug's non-discriminatory effect on both cancerous and normal cells. Common oral symptoms in leukaemia include gingival bleeding, hyperplasia, bone alterations, and opportunistic infections.[7]

Complications in children with leukaemia are classified into primary, secondary, and tertiary. Primary complications, such as gingival enlargement and common oral lesions, results directly from the disease condition and can be identified during routine oral health check-ups. Secondary complications, including increased susceptibility to bleeding, infection, and ulceration, arise due to the direct effects of chemotherapy and radiation. These complications are prevalent in patients with conditions such as anaemia, thrombocytopenia, and granulocytopenia. Tertiary complications include ulceration, gingival bleeding, opportunistic infections, xerostomia, mucositis, taste changes.[8]

Dental issues such as caries, decayed teeth, microdontia, malformed teeth, and enamel hypoplasia, are common in children with ALL, emphasizing the need for early intervention.[9] Preventive measures include recommending oral examinations one month before initiating chemotherapy to minimize complications. During treatment, frequent oral care with 0.12% chlorhexidine and sodium bicarbonate, or normal saline or warm water with baking soda for rinses, can help alleviate symptoms. recommended to maintain good health during treatment.[10]

The oral cavity plays a pivotal role in functions such as grinding, bacterial control, and nutrition, all of which are essential for overall well-being. Advances in childhood cancer treatment necessitate addressing therapy side effects to enhance survivor's quality of life. Creating a healthy oral environment, as highlighted by hygiene improvement, is recommended in all cases. Proper oral hygiene care and education are crucial for children undergoing chemotherapy.[11]

Paediatric palliative care emphasizes holistic well-being, including oral health. Oral issues impact communication, eating, and intimacy, affecting the overall quality of life for palliative care patients. Neglecting oral care may lead to pneumonia.[12] Unfortunately, patients often feel healthcare staff overlook their oral health concerns, highlighting the need for greater attention and support.[13] Therefore a detailed oral assessment is crucial for all children with leukaemia during chemotherapy to sustain a healthy oral status and potentially improve their quality of life.[14] This study was carried out to evaluate the oral health status of children diagnosed with ALL receiving chemotherapy at a tertiary care hospital in Western Rajasthan and to determine the association of the oral health status with selected demographic and clinical variables includes age group ,gender, educational status ,type of family, socioeconomic class ,living area, clinical variables like type of acute lymphoblastic leukaemia, age at diagnosis, dentition type ,number of teeth present, phase of chemotherapy ,time of starting chemotherapy, oral mucositis development, chemotherapy drugs used ,radiotherapy ,dental care practices, brushing frequency, mouthwash, use dental visits.

2. Materials and Methods

2.1. Study design

A quantitative cross-sectional study was conducted among children diagnosed with Acute Lymphoblastic Leukemia (ALL) and undergoing chemotherapy at a tertiary care hospital in Western Rajasthan, India. The study aimed to evaluate the oral health status of these children and determine the association between oral health and specific demographic factors (age, educational status, socioeconomic class, family type, and residence) as well as clinical variables (type of ALL, chemotherapy details, and oral hygiene habits).

2.2. Sample size and sampling technique

A total of 56 children were included in the study, selected using a non-probability consecutive sampling technique. All eligible children available during the data collection period were included. The inclusion criteria encompassed children diagnosed with acute lymphoblastic leukemia (ALL) who were undergoing chemotherapy. Exclusion criteria included children on ventilators, unconscious, and those scheduled for their first dose of chemotherapy.

2.3. Data collection procedure

Data collection was conducted over one month. The study's purpose was explained to participants and their guardians. Socio-demographic and clinical data were collected. Individual oral care assessments took 15–20 minutes per child. Following the assessment, a video demonstration on oral hygiene was shown to parents and children, and handouts containing oral health education materials were distributed.

2.4. Ethical considerations

Approval was obtained from the Institutional Ethics Committee (/IEC/2023/4348, dated 09/03/2023). Informed consent was the parents, and assent was obtained from the children.

2.5. Pilot study

A pilot study was conducted in January 2023 with six children (10% of the sample) to test the feasibility and practicality of the data collection tools.

2.6. Assessment tools

The data collection tool (questionnaire) included three sections:

1. Socio-Demographic and Anthropometric Data

2. Clinical Data (Type of ALL, chemotherapy details, and oral hygiene habits)
3. Oral Assessment Guide (OAG): Used to evaluate oral health based on specific criteria, including voice, swallowing, lips, tongue, saliva, mucous membrane (buccal mucosa, palate, and labial mucosa), and gingival health.

2.7. Scoring and categorization

Based on the OAG criteria, children were classified into three groups:

1. Normal (Score: up to 8)
2. Poor (Score: 9 to 16)
3. Severely Poor (Score: 17-24) This tool is standardized. The socio-demographic and clinical data tools underwent expert validation, and modifications were made to enhance accuracy and relevance.

2.8. Data analysis

1. Data were entered into Microsoft Excel and analysed using SPSS version 23.
2. Descriptive statistics summarized demographic and clinical characteristics through frequency distribution tables.
3. Inferential statistics included the Chi-square test and Fisher's Exact test to assess associations between OAG scores and selected demographic/clinical variables.

Table 1: Demographic variables of the participants N: 56

Variables	**No.**	**(%)**
Age		
Infant(0-1year)	1	1.8
Toddler(2-3year)	6	10.7
Preschooler(4-6year)	10	17.9
Schooler(7-12year)	25	44.6
Adolescent(13-17year)	14	25
Gender		
Male	37	66.1
Female	19	33.9
Educational status		
Not started schooling	11	19.6
Pre-primary	8	14.3
Primary	13	23.2
Secondary	11	19.6
High school	13	23.2
Type of family		
Nuclear	28	50
Joint	28	50
Score of socioeconomic class		
Upper middle	1	1.8
Lower middle	22	39.3
Upper lower	29	51.8
Lower	4	7.1
Living area		
Rural	43	76.8
Urban	13	23.2

Table 2: Distribution of participants in terms of clinical presentations (n= 56)

Variables	**No.**	**(%)**
Type of ALL		
B-cell ALL	44	78.6
T-cell ALL	12	21.4
Age at the time of diagnosis		
Infant (0-1 year)	1	1.8
Toddler (2-3 years)	8	14.3
Preschooler (4-6 years)	10	17.9
Schooler (7-12 years)	23	41.1
Adolescent (13-17 years)	14	25

Dentition type		
Primary	11	19.6
Secondary	12	21.4
Mixed	33	58.9
No. of teeth child has		
0-10	2	3.6
11-20	12	21.4
21-30	42	75
Phase of Chemotherapy	12	21.4
Induction phase	18	32.1
Consolidation /Intensification phase		
Maintenance phase	26	46.4
Time of starting Chemotherapy Started on the same date as prescribed.	45	80.4
1 week after than prescribed date	8	14.3
2 weeks later than the prescribed date	3	5.4
Oral mucositis developed after		
1st dose	26	46.4
2nd dose	9	16.1
3rd dose	7	12.5
Absent after any dose	14	25
Chemotherapy drug		
Inj. Vincristine		
Inj. Cyclophosphamide		
Inj. Cytarabine		
Inj. Leunase		
Inj. methotrexate		
All of the above	56	100
Radiotherapy		
Yes	0	0
No	56	100
Dental care practice		
Frequency of brushing the teeth		
Once daily regularly	37	66.1
Twice daily regularly	11	19.6
Once daily irregularly	1	1.8
Sometimes	7	12.5
Frequency of using mouth wash		
Never	17	30.4
Once a day	6	10.7
Twice a day	20	35.7
As prescribed by dentist	13	23.2
Frequency of visit to a dentist		
Never visited.	49	87.5
Once in 3 months	1	1.8
Once in 6 months	1	1.8
Once a year	5	8.9

Table 3: Distribution of participants in terms of OAG score.

Variables	**Category**	**No.**	**%**
OAG score grading	Up to 8 (Normal)	17	30.4
	9 to 16 (Poor)	39	69.6
	17 to 24 (Severely poor)	-	-

Table 4: Association between demographic and clinical variables with oral assessment guide score

Variables	Oral Assessment Guide Score				
	Normal		Poor		P value
	Frequency	Percentage	Frequency	Percentage	
Age					
0-6 years	10	58.8	7	41.2	0.002[a]*
>6 years	7	17.9	32	82.1	
Gender					
Male	10	27.0	27	73.0	0.449[a]
Female	7	36.8	12	63.2	
Education					
Less than Primary	10	52.6	9	47.4	0.009[a]*
Primary and above	7	18.9	30	81.1	
Type of family					
Nuclear	6	21.4	22	78.6	0.146[a]
Joint	11	39.3	17	60.7	
Socio-economic Status					
Upper middle	7	30.4	16	69.6	0.992[b]
Lower	10	30.3	23	69.7	
Living area					
Rural	11	25.6	32	74.4	0.182[b]
Urban	6	46.2	7	53.8	
Type of ALL					
B-cell ALL	15	34.1	29	65.9	0.309[b]
T—cell ALL	2	16.7	10	83.3	
Age of diagnosis of ALL					
0-6 years	11	57.9	8	42.1	0.001[a]*
>6 years	6	16.2	31	83.8	
No. of Teeth					
<20	7	50.0	7	50.0	0.094[b]
20 and above	10	23.8	32	76.2	
Frequency of Brushing Teeth					
Once or Twice daily regularly	16	33.3	32	66.7	0.412[b]
Once daily irregularly or Sometimes	1	12.5	7	87.5	
Frequency of Using Mouthwash					
Never or Once a day	11	47.8	12	52.2	0.018[a]*
Twice a day for 2 week or as prescribed by dentist	6	18.2	27	81.8	
Frequency of Visit to Dentist					
Never visited	14	28.6	35	71.4	0.662[b]
At least once a year	3	42.9	4	57.1	
Chemotherapy phase	10	33.3	20	66.7	0.603[a]
Induction/ Consolidation	7	26.9	19	73.	
Maintenance Phase					
2	18.2	9	81.8	66.7	0.473[b]
Oral mucositis developed					
No	26	76.5	8	23.5	0.230[a]
1 week	5	19.2	21	80.8	
2 week	6	37.5	10	62.5	

a: Chi Square test; b: Fischer's Exact test, *- significant, P= <0.05

3. Results

The mean age of the participants was 8.71 years. Schoolers comprised 44.6% of the study group. Two-thirds (66.1%) were males. Educational status depicted a balanced distribution across primary and high school levels. The nuclear and extended families are equally represented (50% each). About 51.8% of the participants belonged to upper lower socioeconomic class followed by lower middle (39.3%). Rural residents had a notably higher rate (76.8%)

compared to urban dwellers. (**Table 1**). Majority of the children suffered from B-cell ALL (78.6%), with a substantial diagnosis during the schooler age (41.1%). Most exhibited a mixed dentition type (58.9%), with a higher count of teeth (20-30) observed among two-thirds (66.7%) of the participants.

Around one third (32.1%) had received consolidation/intensification phase Chemotherapy. Majority had started receiving chemotherapy on the same day of prescribing (80.4%). Oral mucositis was seen after the first dose of chemotherapy (46.4%). The drugs Vincristine, Cyclophosphamide, Cytarabine, Leunase, and Methotrexate were found to be universally administered. None had received Radiotherapy. Brushing teeth once daily was noted among 66.1% of the children, while mouth wash usage varied. Majority (87.5%) had never visited a dentist (**Table 2**).

Concerning the OAG score, the majority (69.9%) fell into the "poor" category. None of the participants was in the "Severely Poor" category. (**Table 3**).

A significant association was noted between poor OAG scores and age greater than 6 years ($p = 0.002$), less than primary ($p = 0.009$), and greater than 6 years ($p = 0.002$) and less than primary ($p = 0.009$).Conversely, variables like gender, religion, socioeconomic status, type of family, living area, type of ALL, number of teeth, brushing frequency ,dental visits, chemotherapy phase, and doses of chemotherapy did not show significant associations with OAG scores($P>0.05$) (**Table 4**)

4. Discussion

The age group in our study aligned with previous studies, with a substantial proportion of school-age children (44.6%) and a small fraction of infants (1.8%). In this study, the majority of the children were male. Prior research by Moatiz Hassan M. Ali, Zazik, and Mostafa Neurelhuda[1] reported a predominance of males, ranging from 54.3% to 69.6%. The distribution of dental status among the participants regarding primary, secondary, and mixed dentition aligned with findings by Yan Wang et al.[15]

Regarding family structures and socioeconomic classes, the current study socioeconomic strata. The majority residing in rural areas (76.8%) was consistent with previous studies. Most of the children were school-goers. The age at diagnosis within the school-age group (41.1%) also reflected a similar trend to other studies. In terms of chemotherapy phases, the distribution among maintenance (46.4%), consolidation (32.1%), and induction (21.4%) mirrored the proportions observed by Umme Azher and Natasha Shiggaeon.[16]

The study highlights potential gaps in dental care access for children, which could impact their oral health during treatment. The occurrence of oral mucositis after chemotherapy was prevalent within 24 hours of the first dose (46.4%), aligning with prior findings. Regular brushing habits showed similarities with Moatiz Hassan M. Ali, Zazik Mostafa Neurelhuda's study, with a majority brushing once daily (66.1%) and a minority brushing twice daily (19.6%). However, a high proportion of participants (87.5%) had never visited a dental clinic, consistent with previous research.[1]

Regarding oral mucositis during chemotherapy, the current study demonstrated a prevalence of 75%, similar to the findings reported in studies by Lalla RV, Sonis ST, and Peterson DE (75-80%). Significant associations were noted between demographic and clinical variables and the OAG score, specifically with age, educational status, age at diagnosis, and mouthwashes usage, corroborating with earlier studies. Notably, a significant association was observed between older age (> 6 years) and the development of oral mucositis, consistent with a prior research finding by Moatiz Hassan M. Ali, Zazik Mostafa Neurelhuda.[1]

The OAG status of the participants suggested a concerning proportion being categorised as having 'poor' oral health, indicating potential oral health issues or challenges within this group. The absence of participants within the "Severely Poor" range may signify either a positive aspect of the sample's oral health or a specific limitation of this dataset due to the smaller sample size.

5. Conclusion

Addressing oral health challenges is enhancing outcomes in paediatric palliative care. The research highlighting the significant impact of chemotherapy on children's oral health, with factors such as age and education influencing outcomes. The prevalence of oral mucositis, particularly after initial chemotherapy, highlights a common and significant challenge during treatment. Notably, a considerable proportion of children never visiting a dentist signals potential gaps in dental care access, which can adversely affect their overall health. Prioritizing oral health interventions can contribute significantly to improving the quality of life for children with life-limiting illnesses, ensuring a more holistic and compassionate approach to paediatric palliative care.

5.1. Limitations

1. The study was conducted in a single setting, limiting generalizability.
2. The study did not analyse the frequency of flossing, which is an important oral hygiene factor.
3. BMI was not assessed, despite reported associations with oral health in previous literature.

6. Recommendations

1. Implementation of age-specific oral hygiene education during chemotherapy can promote regular dental visits and enhance the children's quality of life.
2. Establishing clear protocols for mouthwash use during chemotherapy to mitigate the risk of oral mucositis.
3. Integrating oral health into palliative care plans, ensuring comprehensive support for children with ALL, emphasizing the multidimensional nature of oral health.

7. Acknowledgement

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8. Source of Funding

None.

9. Conflict of Interest

None.

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