Open Access Maced J Med Sci **electronic publication ahead of print,**
published on December 05, 2017 as https://doi.org/10.3889/oamjms.2017.178

ID Design 2012/DOOEL Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences.
https://doi.org/10.3889/oamjms.2017.178
eISSN: 1857-9655
Clinical Science

Profile of Skin pH in Leukaemia's Children with Chemotherapy Treatments at Haji Adam Malik General Hospital, Medan

Radha Siregar*, Sri Purnama, Salia Lakswinar

Haji Adam Malik General Hospital, Dermatology and Venereology, Medan, Indonesia

Citation: Siregar R, Purnama S, Lakswinar S. Profile of Skin pH in Leukaemia's Children with Chemotherapy Treatments at Haji Adam Malik General Hospital, Medan. Open Access Maced J Med Sci. https://doi.org/10.3889/oamjms.2017.178

Keywords: Leukemia; Chemotherapy; Skin pH; Children; Skin barrier.

***Correspondence:** Radha Siregar. Haji Adam Malik General Hospital, Dermatology and Venereology, Medan, Indonesia. E-mail: dha_1302@yahoo.com

Received: 29-Jul-2017; **Revised:** 13-Sep-2017; **Accepted:** 21-Sep-2017; **Online first:** 05-Dec-2017

Funding: This research did not receive any financial support.

Competing Interests: The authors have declared that no competing interests exist.

Abstract

BACKGROUND: One of the treatments for leukaemia is chemotherapy. Side effects and toxicity of this treatment can be seen on the skin, adnexal, and mucous membranes. They might increase potential hydrogen (pH) value on the skin surface, therefore, disrupting epidermal barrier defences.

AIM: To describe the pH of the skin in children with leukaemia who received chemotherapy.

SUBJECT AND METHOD: This study was an observational descriptive, cross-sectional study, conducted from March until December 2016 with 32 children with leukaemia who treated at Haji Adam Malik General Hospital, Medan as subjects. Skin pH was measured by a pH meter.

RESULT: We found mean skin pH in ALL (6.28 ± 0.58), CML (5.9 ± 0) and AML (6.5 ± 0.50). The mean skin pH after 1-5 weeks of chemotherapy was 6.13 ± 0.49, at 6-10 weeks (6.32 ± 0.51), and at 11-15 weeks (7.12 ± 0.36). The mean skin pH of patients with two drugs (5.98 ± 0.44), four drugs (6.28 ± 0.55), and six drugs (6.63 ± 0.56).

CONCLUSION: The highest mean of skin pH were obtained in AML group, 11-15 weeks length of chemotherapy and group with six drugs regimen.

Introduction

Leukaemia, commonly known as blood cancer or bone marrow cancer, is the uncontrolled growth of abnormal cells (neoplastic cells) as a result of normal cell mutation [1]. Acute Leukaemia in children accounts for 97% of all leukaemia in children.

According to the blood lineage affected, acute leukaemia can be divided into Acute Lymphoblastic Leukaemia (ALL) 82% and Acute Myeloblastic Leukaemia (AML) 18% [2]. ALL is cancer that frequently occurs in children. There are approximately 3000 new cases of ALL per year in the United States, 5000 cases in Europe, and roughly 2000 to 3000 cases in Indonesia [3].

Chemotherapy is a type of treatment that plays a role in killing neoplastic cells, but also indirectly affects normal cells [1]. Many of the side effects and toxicities of chemotherapy can be seen on the skin, adnexa, and mucous membranes of patients undergoing chemotherapy. In the skin, the side effects of chemotherapy include dry skin, allergic drug reaction, photosensitivity, hyperpigmentation, nail abnormalities, and hair abnormalities [4, 5].

In general, chemotherapy drugs can cause side effects on the skin by damaging the skin barrier [6]. The pH acidity of the skin surface is important for epidermal barrier defence function and the establishment and maintenance of epidermal integrity/ cohesion [7, 8]. The pH of the skin in children is reported to be the same as in adults that is around 4.0 - 6.0 [9].

Considering the side effects of chemotherapy on the skin and the important role of the skin barrier, it is essential to assess the effect of chemotherapy on skin pH. Until now, there is no data regarding the skin pH of children with leukaemia who undergo chemotherapy.

This research is a preliminary study to determine the effects of chemotherapy on skin pH.

Material and Methods

This is an observational descriptive study with a cross-sectional design. This research was conducted from March until April 2016 involving 32 leukemic children.

This research was conducted from March 2016 until all the required samples are acquired. The research was done in the Rindu B4 inpatient room, RSUP Haji Adam Malik, Medan. The target population of this research is leukaemia patients who had chemotherapy at RSUP Haji Adam Malik, Medan. The accessible population is the children with leukaemia who received chemotherapy at Rindu B4 inpatient room, RSUP Haji Adam Malik, Medan since March 2016. The sample of this study is the accessible population that meets inclusion and exclusion criteria. The inclusion criteria were informed consent signed by patient's parents. Patients with generalised skin conditions (e.g., ichthyosis, necrolysis epidermal toxic, atopic dermatitis, Netherton syndrome) were excluded.

After receiving permission from the subject's parents and the informed consent were signed, baseline data was recorded, and the patient's skin pH was measured using pH meter (Skincheck, Hanna Instruments, HI 99181N, USA).

The requirements before skin pH measurements are: (1) the subject's parents are asked to bathe the patient with soap until the skin is clean and it is not allowed to apply cosmetics or any topical preparations on the patient's lower arm. The measurement was performed at least 4 hours after the shower subject; (2) measurements were made at a stable room temperature with air conditioner (20°C) with a humidity of 40% and subjected to a minimum of 20 min; and (3) measurements are made in the volar area and if it is not possible, measurements can be made on the arm, upper leg or abdomen of the subject.

The collected data is then processed and then presented in the form of frequency distribution table and analysed descriptively based on several characteristics (duration of chemotherapy, types of leukaemia, number of chemotherapy drugs type).

Result

Most of the patients were male (62.5%), in 6-10 years old group (range 2-17 years old). 27 patients had ALL, and only one patient had CML. Most of them (62.5%) had been in chemo for 1-5 weeks (range 1-13 weeks). Based on protocol therapy that was given, samples were divided into two drugs group (Methotrexate, Vincristine), four drugs group (Methotrexate, Vincristine, Doxorubicin, L-Asparaginase), six drugs group (Methotrexate, Vincristine, Doxorubicin, L-Asparaginase, Mercaptopurine, Hydroxyurea). Most patients had four drugs regimen.

The mean skin pH in ALL patients is 6.28 ± 0.58. In CML and AML patients, the mean skin pH is 5.9 ± 0 and 6.5 ± 0.50, respectively (Table 1).

Table 1: Skin pH distribution based on types of leukaemia

Types of Leukemia	Mean ± SD	pH Value	pH Value
ALL	6.28±0.58	5.3	7.4
CML	5.9±0	5.9	5.9
AML	6.5±0.50	6.1	7.2

The mean skin pH after 1-5 weeks of chemotherapy was 6.13 ± 0.49, at 6-10 weeks was 6.32 ± 0.51, and at 11-15 weeks was 7.12 ± 0.36. Based on these results, the longer the duration of chemotherapy the higher the pH of the skin (Table 2).

Table 2: Skin pH distribution based on chemotherapy phase

Phase of Chemotherapy	Mean ±SD	pH Minimum Value	pH Maximum Value
1-5 weeks (n=20)	6.13±0.49	5.3	6.9
6-10 weeks (n=8)	6.32±0.51	5.6	7.1
11-15 weeks (n=4)	7.12±0.36	6.6	7.4

Based on the number of chemotherapy drugs type, the mean skin pH of patients with two types of drugs was 5.98 ± 0.44, four types of drugs were 6.28 ± 0.55, and six types of drugs was 6.63 ± 0.56. These results indicate that the more types of drugs used, the higher the pH of the skin. (Table 3)

Table 3: Skin pH distribution based on types of chemotherapy

Types of Chemotherapy	Mean ±SD	pH Minimum Value	pH Maximum Value
2 drugs	5.98±0.44	5.3	6.8
4 drugs	6.28±0.55	5.6	7.1
6 drugs	6.63±0.56	5.6	7.4

Discussion

This study found that the average skin pH is increased in ALL (6.28 ± 0.58,) and AML (6.5 ± 0.50). Hoeger et al. in his study reported that normal skin pH in children aged > 4 weeks ranged from 5.0-5.5. The average skin pH in this study is higher than the normal pH range for children. In Indonesia, it has been reported that the normal skin pH range of children ages one month to 14 years is 4.76-5.067 [10].

The result of this study demonstrated that an increase in skin pH is directly proportional to the

duration of chemotherapy use. The skin pH after 1-5 weeks of chemotherapy is 6.13 ± 0.49, at 6-10 weeks is 6.32 ± 0.51, and at 11-15 weeks is 7.12 ± 0.36. This is the study conducted by Haedary et al. which found that most of the effects of chemotherapy on the skin depend on the dose and duration of chemotherapy [11].

The results showed that the average skin pH on the use of 2 types of drugs was 5.98 ± 0.44, on four types of drugs 6.28 ± 0.55, and on six types of drugs 6.63 ± 0.56. These results indicate that the more types of drugs used, the higher the pH of the skin. This is in line with the study by Wohlrab et al. which states that the nonspecific effects of chemotherapy drugs on skin epithelium and surrounding tissue can be observed in about 30% of cancer patients, regardless of the type of cancer. Factors that play a role in the emergence of such effects is regimens and combinations of chemotherapy used [12].

Webster et al. also revealed that the type, concentration, and dose of chemotherapy are the determining factors of skin toxicity on the course of administration of chemotherapy. Chemotherapy drugs and their metabolites will be excreted through the sweat glands. As a result, there are direct toxic effects in their accumulation on the stratum corneum, particularly in the plantar and palmar skin [13]. The effect of chemotherapy drugs on the skin barrier frequently occurs by interfering with the function of proliferation and differentiation of interfollicular keratinocytes and epidermal stem cells [14].

In conclusion, the potential of hydrogen on the skin of patients with ALL and AML was increased. In this study, we found higher pH in patients with longer duration of chemotherapy and subjects with a larger amount of drug types used. More research with longitudinal design, with bigger samples and a longer period of study, are needed to examine further about skin pH in leukemic children with chemotherapy.

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