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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებშიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи.** Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html. В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე, დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემავსებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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DETECTION OF HEPATITIS B AND C VIRAL INFECTION AMONG CHILDREN WITH ACUTE LEUKAEMIA

Saeed H. Hussein¹, Hiba M. Ahmed², Ahmed A. Ahmed¹.

¹Department of Microbiology, College of Medicine, University of Mosul, Mosul, Iraq.

²Ibn Al-Ather Teaching Hospital, Nineveh Health Directorate, Ninevah, Iraq.

Abstract.

Background: Viral hepatitis, particularly Hepatitis B (HBV) and Hepatitis C (HCV), represents a significant health complication in immunocompromised patients, including children diagnosed with acute leukaemia. These patients are at increased risk of getting infections due to frequent blood transfusions, invasive procedures, and immunosuppressive therapy. The study aimed to evaluate the occurrence of hepatitis B and C virus infection among children with acute leukaemia treated in the pediatric haematology unit at Ibn Al-Ather Teaching Hospital in Mosul city, compare them with a control group and evaluate associated risk factors, including vaccination status.

Methods: This study enrolled a total of 180 children attending Ibn-Al-Atheer Teaching Hospital (Mosul City, Iraq), comprising 90 patients diagnosed with Acute Leukemia and 90 age- and sex-matched controls. The control group included children attending the hospital for conditions unrelated to haematological diseases or predisposing factors for Hepatitis B and Hepatitis C, and had no history of chronic illness. Blood samples were collected and tested for HBV surface antigen (HBsAg) and anti-HCV antibodies using enzyme-linked immunosorbent assay (ELISA) kits. Demographic and clinical data, including vaccination history, were reported and statistically analysed.

Results: No significant variation was observed between cases and controls in sex, age, or residency ($P > 0.05$). HBsAg positivity was higher in cases (26.7%) than controls (10.0%) ($P = 0.005$). Anti-HCV was also higher in cases (10.0%) vs controls (2.2%) ($P = 0.035$). HBV vaccination was protective (7.4% vs 34.9%, $P = 0.004$). Blood transfusion was strongly associated with infection (60.0% vs 4.4%, $P < 0.001$).

Conclusion: HBV and HCV infections were significantly higher in leukemic children. Blood transfusion was a major risk factor, while HBV vaccination had a protective effect. Strengthening screening and vaccination is essential.

Key words. Hepatitis B virus, Hepatitis C virus, leukemia, vaccination.

Introduction.

Acute leukaemia is the commonest paediatric malignancy, and therapeutic advancements have increased survival rates over the last few years; however, therapies are associated with a wide range of infectious and therapy-related complications that can negatively affect their prognosis and quality of life [1,2]. Children diagnosed with acute leukaemia are highly exposed to acquiring blood-borne viral infections, including HBV and HCV [3]. This increased exposure is linked to immunosuppression caused by chemotherapy, frequent hospital admissions, and frequent exposure to blood transfusions and invasive medical procedures [4-6].

Hepatitis B and Hepatitis C infections remain major global community health concerns and are main causes of chronic liver disease, cirrhosis, and hepatocellular carcinoma. Despite advances in vaccination and preventive measures, viral hepatitis continues to impose a substantial burden worldwide, particularly in developing countries [7,8]. Hundreds of people are chronically infected with HBV or HCV, resulting in marked morbidity and mortality [9]. In pediatric populations, the epidemiology of hepatitis viruses differs from adults; however, a considerable number of children are affected worldwide [10]. Although the prevalence of hepatitis C virus infection in children is relatively low, many cases remain undiagnosed and may progress to long-term complications [11]. Similarly, hepatitis B virus infection remains a challenge despite the existence of successful vaccination programs [12,13]. In leukemic children, viral hepatitis is associated with liver dysfunction necessitating dose titration of life-saving chemotherapy in accordance with liver injury [14].

Parenteral viral transmission in the leukemic population is common, particularly during blood product transfusions. Before the application of good donor screening practices, the transfusion-related HCV infection percentage was relatively high, particularly in those patients with frequent blood transfusion [15], such as those with thalassemia [16] or leukaemia [15]. Even though screening practices improved, hepatitis infection rates are still high in malignant children in need of transfusion, especially in perturbed clinical settings [17]. Recent studies in the Middle East reported positive hepatitis seroprevalence rates in pediatric patients with leukaemia, reflecting the chronic status of this challenge [18,19]. Despite all blood screening measures and vaccination programs—especially for hepatitis B—have reduced transmission rates, the risk of infection persists. In addition, immunocompromised children may have a reduced immune response to vaccination, which increases their susceptibility to infection [20,21].

Previous studies have reported variable occurrence rates of HBV and HCV infections among children with leukaemia. While some studies showed higher infection rates compared to healthy controls, others found no significant difference. These may be due to variations in geographic location, healthcare application, sample size, and preventive plans [4,22-24]. The present study sought to investigate the rate of HBV and HCV among children with leukaemia and identify the associated risk factors in this particular population.

Materials and Methods.

Study Design and Setting: This comparative cross-sectional study was conducted at the Pediatric Haematology Unit in Ibn Al-Atheer Hospital (Mosul City, Iraq), from February 2021 to October 2022. The study included 90 children diagnosed with

Acute Leukemia as the case group and 90 age- and sex-matched children attending the hospital for conditions unrelated to haematological disorders as the control group. The control group was selected to provide a comparison of hepatitis B virus (HBV) and hepatitis C virus (HCV) prevalence in immunocompetent children.

A total of 90 cases were enrolled based on the following equation.

$$n = \frac{z^2 p(1 - \rho)}{e^2}$$

Where,

n= sample size (90)

Z= confidence level (90%)

P= population proportion (10%)

e= margin of error (5%)

Based on the formula, the sample size was approximately 90 for each group. We recruited the number of patients based on a 20% maximum prevalence of HBsAg in the leukemic population and a 5% maximum prevalence in the healthy population. Using a significance level of 0.05 and a power of 80%, the sample size calculated was close to 73 subjects per group; the sample size was set at 90 subjects per group to account for 20% incomplete data and attrition.

Ethical Approval: Ethical approval was obtained from the Medical Research Ethics Committee at the University of Mosul (Approval letter number UOM/COM/MREC/2019(14) on 26/3/2019). Written informed consent was received from parents or guardians of all participants.

Inclusion Criteria: Cases with Acute Leukemia aged 1–16 years with newly diagnosed Acute Leukemia (both Acute Lymphoblastic Leukaemia [ALL] and Acute Myeloid Leukemia [AML]) who had not received prior antiviral therapy for HBV or HCV.

Exclusion: Children with pre-existing chronic liver disease, previous HBV or HCV infection

Controls: Children aged 1–16 years attending the hospital for non-haematological conditions (e.g., minor infections, routine check-ups), with no history of leukaemia or immunodeficiency. **Exclusion:** Children with known liver disease, immunodeficiency, or previous HBV/HCV infection.

Sample Collection: Approximately 3–5 mL of venous blood was collected from each person involved under aseptic conditions. Blood samples were centrifuged at 3000 rpm for 5 minutes, and serum was separated and stored at –20°C until testing. All procedures followed standard biosafety guidelines. The serum samples were collected from the control group and newly diagnosed leukemic cases at the time of diagnosis, during the first 24 hours of hospitalisation, before starting therapy or blood transfusion. The samples from controls were collected from children at their routine visits and were well matched for age and sex.

Detection of HBV and HCV: Serum samples were used for detection of HBV and HCV using available ELISA kits supplied by Qingdao Hightop Biotech (China) for HBsAg and Anti-HCV. Collected serum samples were thawed at room temperature. The samples and standards were loaded onto the

standard plate previously coated with capture antibody. After a two-hour incubation, the plates were washed three times with diluted washing buffer, and then wells were loaded. Next, the wells were exposed to enzyme-labelled antibody and incubated for 30 minutes at room temperature. In the last step, the plate was washed with washing buffer and stop solution was added to terminate the reaction of substrate with enzyme conjugate. The absorbance was detected at a wavelength 450nm using a calibrated plate reader against blank samples.

The tested sample was considered positive for the antibody test if the absorbance was greater than the cutoff value, and lower values were considered negative. The cutoff values were calculated based on the absorbance for the negative control sample at the specified optical density. To consider the results of each run as valid, the absorbance for negative control samples was less than 0.1 and positive control samples greater than 0.8, with sensitivity values of 94.3% (95% CI: 90.5–96.9) and specificity of 99.3% (95% CI: 96.3–100) for both kits as reported by the manufacturer. A positive test result reflects a serological clue of exposure to HCV but is not confirmatory for active viremia because the study sought to identify seroprevalence rather than detection of active cases.

HBsAg cut-off = mean of negative controls × 2.100

Anti-HCV cut-off = mean of negative controls × 0.120

Data Collection: Population characteristics and clinical information, including age, sex, vaccination status, history of blood transfusions, and prior hospitalisations, were recorded using a structured questionnaire. The vaccination status was based on vaccination cards and parents' information, which are highly authenticated documents for children and regulated by the National Health System.

Statistical Analysis: Data were analysed using SPSS version 26. The Chi-square test was used to compare prevalence between the case and control groups. p-values <0.05 were regarded as statistically significant.

Results.

The study recruited a total of 180 children for the present study: 90 acute leukemic children and 90 healthy control children. Demographic characteristics were well matched for age and sex (Table 1).

The rate of HBsAg seropositivity was significantly (p=0.005) higher in the leukemic group (26.7%) compared to the control group (10.0%). Moreover, the percentage of detection of anti-HCV antibodies was significantly (p=0.035) higher in the leukemic group (10.0%) compared to the control group (2.22%).

In the leukemic group, HBV vaccination was associated with significantly (p=0.004) lower HBsAg positivity (7.4%) compared to unvaccinated (34.9%), with an odds ratio (OR) of 0.15 and a 95% confidence interval (Table 3).

Out of 33 children with a positive HBsAg test, 23 (69.7%) with blood transfusion history, whereas 10 (30.3%) were with no transfusion history. The remaining 147 children had negative HBsAg test, up to 76.2% with no previous blood transfusion, and 23.8% with blood transfusion history (p=0.001, odds ratio of 7.36 at 95% CI: 3.17–17.08). Out of 11 children with a positive anti-HCV test, 2 (18.2%) with blood transfusion history, while 9 (81.8%) were with no transfusion history.

Table 1. Demographic and Clinical Characteristics of Study Participants.

Variable		Cases (n = 90)	Controls (n = 90)	P-value
Sex	Male	49 (54.4%)	44 (48.9%)	0.551
	Female	41 (45.6%)	46 (51.1%)	
Age, years	≥1	8 (8.9%)	12 (13.3%)	0.544
	2–5	23 (25.6%)	25 (27.8%)	
	6–10	28 (31.1%)	30 (33.3%)	
	11–16	31 (34.4%)	23 (25.6%)	
Residency	Rural	34 (37.8%)	47 (52.2%)	0.072
	Urban	56 (62.2%)	43 (47.8%)	

Data are expressed as frequencies and percentages.

P values <0.05 are considered statistically significant using the Chi-square test at a 95% confidence interval.

Table 2. Frequency of HBV and HCV among Cases and Controls (Positive and Negative).

Variable		Cases (n = 90)	Controls (n = 90)	P-value
HBsAg	Positive	24 (26.7%)	9 (10.0%)	0.005
	Negative	66 (73.3%)	81 (90.0%)	
Anti-HCV	Positive	9 (10.0%)	2 (2.22%)	0.035
	Negative	81 (90.0%)	88 (97.78%)	

Data expressed as frequency and percentage

P values <0.05 are considered statistically significant using the Chi-square test at a 95% confidence interval.

Table 3. Prevalence of HBsAg according to HBV vaccination status among leukemic children.

Variable		Vaccinated (n=27)	Unvaccinated (n=63)	P-value	OR (95% CI)
HBsAg status	Positive	2 (7.4%)	22 (34.9%)	0.004	0.15 (0.03–0.67)
	Negative	25 (92.6%)	41 (65.1%)		

Data expressed as frequency and percentage

P values <0.05 are considered statistically significant using Fisher's exact test at a 95% confidence interval.

Table 4. Association between history of blood transfusion and hepatitis status in study groups.

Hepatitis status		Transfusion (n=58)	No transfusion (n=122)	P-value	OR (95% CI)
HBsAg	Positive	23 (69.7%)	10 (30.3%)	0.001	7.36 (3.17–17.08)
	Negative	35 (23.8%)	112 (76.2%)		
Anti-HCV	Positive	2 (18.2%)	9 (81.8%)	0.180	0.44 (0.09–2.17)
	Negative	56 (33.1%)	113 (66.9%)		

Data are expressed as frequencies and percentages.

P values <0.05 are considered statistically significant using the Chi-square test at a 95% confidence interval.

The remaining 169 children with negative anti-HCV-negative, 56 (33.1%) were with previous blood transfusion, and 113 (66.9%) with no previous blood transfusion ($p=0.180$), with an odds ratio of 0.44 at 95% CI: 0.09–2.17) (Table 4).

Discussion.

In the present research, the rate of HBV and HCV infections in children with acute leukaemia versus healthy peers was examined, along with prospective risk and protective considerations. The results demonstrated that the rate of both HBV and HCV infections in leukemic patients was higher, with immunisation seeming to be a protective approach and blood transfusion as a risk factor. These data have crucial consequences for the medical care of oncology patients.

The present study revealed that HBsAg positivity was approximately tripled in leukemic children when compared to the healthy control group. Moreover, the proportion of seropositivity for anti-HCV was increased to more than fourfold in leukemic patients compared to healthy control peers. These high rates are potentially greater than those recorded in the

pediatric population in other countries, ranging from 1–5% for HBV and <1% for HCV in non-endemic regions [25,26]. However, they are consistent with findings from several developing countries where hepatitis viruses are more endemic, and healthcare resources may be limited [27]. In line with the present study, several studies have claimed the same findings of higher vulnerability of leukemic children for bloodborne viral infections. For instance, a systematic study documented HBV and HCV seroprevalence rates ranging from Egypt (15%), Pakistan (4.7%) and Taiwan (4.4%) among oncology patients [28].

The high rate of HBV and HCV positivity in leukemic children can be linked to many connected factors, including the triggering immunosuppressive status associated with malignant diseases and the rigorous anticancer treatment protocol used for these patients [29–32]. These together might escalate the vulnerability to new infections or recurrence of dormant viral infections. Moreover, children with leukaemia regularly need numerous hospitalisations, invasive operations, and blood transfusions, which overall increase their susceptibility risk

[1,33,34]. Moreover, the chronicity feature of leukaemia therapy necessitates prolonged large vein access and repeated venous puncture, ultimately increasing the chance of hospital-acquired infection and vital organ complications [35,36].

The present study confirmed the protective effect of HBV vaccination in the leukemic group, necessitating routine HBV vaccination programs, particularly in endemic regions. Perhaps these results suggest adding a booster dose of immunisation to the schedule of leukemic children. Alternatively, their anti-HBs might need to be measured regularly because anticancer immunosuppression may dampen vaccine-induced immunity, particularly when levels in immunocompromised patients are reduced to less than <10 mIU/ml as a protective threshold.

The present study demonstrated an association between blood transfusion and HBsAg positivity. In line with the present study, blood transfusion was reported as a main route of HBV transmission. The strong association between blood transfusion and leukaemia reflects that children with leukaemia have a higher likelihood of blood transfusion compared to healthy controls. Perhaps because blood transfusion in leukaemia patients is the gold standard therapy to replenish cytopenias induced by chemotherapy. Despite being essential and lifesaving, blood transfusion still carries a risk of viral transmission, which could potentially affect these antibody titers. Nonetheless, the causality might follow a dualistic mode: while blood transfusion carries a potential risk for viral transmission, some children with pre-existing asymptomatic HBV or HCV infections carry the potential to develop leukaemia [37-39]. These align with the study presented at the annual conference of the British HIV Association, which has confirmed a higher rate of HCV infection in transfused pediatric oncology patients [40], calling for good blood bank practices to reduce the chance of infections [41].

The clinical impact of these findings encourages screening for HBV and HCV during leukaemia diagnosis and repeated tests during treatment schedules. The vaccination records for the leukemic children need to be updated, and a booster dose scheduled before commencing immunosuppressive therapy. Blood transfusion should follow high-standard safety policies to avoid any error and reduce unnecessary transfusions.

Several limitations must be acknowledged, including a small sample size and a unicentre study, which limit the generalizability and reduce outcome precision; the cross-sectional design of the study means the associations cannot absolutely state that HBV/HCV infections preceded leukaemia or vice versa. Immunisation status was determined based on the medical records rather than precise measures of anti-HBs titers. The detection of Anti-HBs and anti-HBc is necessary to assess vaccination-induced immunity, earlier exposure, and vulnerability. Anti-HCV antibodies can be detected in serum for years even after successful therapy; therefore, we acknowledge the limitation that anti-HCV positivity was not confirmed by HCV RNA testing.

Conclusion.

The present study identified a higher rate of HBV and HCV viral infections in children compared to controls. Immunisation provided protection but was undermined by blood transfusion products as a risk factor, necessitating appropriate policies to

control infection via blood product screening and a universal vaccination program.

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