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ORIGINAL RESEARCH

Spectrum of Haematological Pathologies in Bone Marrow Aspiration of Paediatric Patients – A Tertiary Health Care Centre Study

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ABSTRACT

Background: Understanding the spectrum of hematological pathologies in pediatric patients through bone marrow aspiration provides crucial insights for diagnosis and treatment. This study aims to evaluate the clinico-hematological profiles and the prevalence of various hematological disorders in children undergoing bone marrow aspiration at a tertiary health care center. **Methods:** This cross-sectional descriptive study was conducted at a single tertiary care center and included a sample of 72 pediatric patients who underwent bone marrow aspiration over a one-year period. The study focused on assessing cellularity status and the presence of blast cells, alongside detailed clinico-hematological evaluations. **Results:** In a study of 72 pediatric patients at a tertiary care center, 52.7% exhibited hypercellularity, 25% normocellular, and 18.1% hypocellular during bone marrow aspiration. No significant associations were found between cellularity or the presence of blast cells (63.8%) and clinical features, indicating a potential for undetected malignant disorders. **Conclusion:** The study highlights the critical role of bone marrow aspiration in diagnosing serious hematological conditions in pediatric patients at a tertiary care facility. The high prevalence of blast cells suggests an urgent need for further diagnostic and therapeutic interventions. Future studies with larger sample sizes and broader geographic inclusion are recommended to validate and expand upon these findings, enhancing diagnostic accuracy and treatment strategies for pediatric hematological disorders.

Keywords: Spectrum HaematologicalPathology, bone marrow, Padiatric.

INTRODUCTION

In the pediatric population, hematological disorders encompass a broad spectrum, ranging from common conditions like nutritional deficiency anemia to severe diseases such as leukemia, and rare syndromic disorders that impact the differentiation of bone marrow stem cells, such as Fanconi' s anemia and Diamond-Blackfan syndrome.[1][2]

A primary indication for conducting a bone marrow aspiration is to identify the underlying causes of abnormalities that are not resolved through routine hematology analysis of blood samples. This procedure is particularly crucial when blood tests alone fail to provide a definitive diagnosis.[3]

Despite being an invasive technique, bone marrow aspiration can be safely conducted even in patients with severe thrombocytopenia, presenting minimal to no bleeding risk. This procedure is vital for the morphological examination of bone marrow cells, allowing for a differential count and the determination of the myeloid to erythroid ratio. It offers a

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comprehensive assessment of hematopoietic activity.[4][5]

Variations from normal bone marrow function can be qualitative, involving abnormal cellular morphology, or quantitative, such as the presence or absence of iron stores, which can be assessed using Prussian blue staining. Additionally, bone marrow aspiration can reveal the presence of parasites or cellular inclusions, providing essential diagnostic information.[6][7]

AIM

To study the spectrum of bone marrow aspiration results and their clinico-hematological profile in children.

OBJECTIVES

1. To study the spectrum of clinic hematological profile of pediatric age group
2. To classify anemias and leukemias

MATERIAL AND ETHODOLOGY

Source of Data: Data was sourced from pediatric patients presenting at MGM Medical College and Hospital, Aurangabad, who underwent bone marrow aspiration as part of their diagnostic evaluation for hematological disorders.

Study Design: This study was designed as a retrospective, cross-sectional descriptive study aimed at analyzing the spectrum of hematological pathologies in pediatric patients.

Study Location: The research was conducted at the Department of Pathology and Pediatric Hematology, MGM Medical College, Aurangabad.

Study Duration: The study spanned one year, allowing for the collection and analysis of data over a sufficient timeframe to meet the objectives set forth.

Sample Size: A total of 72 pediatric patients were included in the study based on predefined inclusion criteria.

Inclusion Criteria: All patients aged 0-16 years who presented to the hospital and required a bone marrow examination for the evaluation of various hematological disorders were included in the study.

Exclusion Criteria: There were no specific exclusion criteria set for this study, meaning all patients meeting the inclusion criteria were considered eligible for participation.

Procedure and Methodology: Bone marrow aspirations were performed on all children who required a marrow examination during the study period. An aspirate smear was prepared immediately and stained using Romanowsky's stain for detailed cytological evaluation.

Sample Processing: The processed samples were then examined under a microscope. Detailed demographical data, clinical history, physical examination findings, and initial laboratory investigations were recorded using a standardized proforma for each patient.

Statistical Methods: Collected data were compiled into an Excel sheet. Statistical analysis involved the use of descriptive statistics to summarize the data. Visual representations of the data, including bar diagrams and pie charts, were used to depict the distribution and frequency of various hematological pathologies.

Data Collection: Data regarding demographics, clinical history, and results of the bone marrow aspiration were meticulously collected and documented. The marrow aspiration slides were evaluated by experienced pathologists, and all findings were systematically recorded and analyzed.

OBSERVATION AND RESULTS

Table 1: Spectrum of Bone Marrow Aspiration Results and Their Clinico-Hematological Profile in Children

Feature	Category	n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-Value
Cellularity	Hypercellular	38 (52.7%)	1.79	(0.71, 4.61)	0.2227
	Normocellular	18 (25%)	0.93	(0.23, 3.73)	0.8914
	Hypocellular	16 (22.3%)	0.84	(0.11, 4.38)	0.2422
Presence of Blast Cells	Yes	46 (63.8%)	2.06	(0.81, 5.23)	0.1539
	No	26 (36.2%)	Reference	-	-

Table 1 details the findings from bone marrow aspirations performed on a pediatric sample at a tertiary care center, focusing on cellularity and the presence of blast cells. Of the 72 children evaluated, 52.7% exhibited hypercellularity, though the association between hypercellularity and specific clinical features was not statistically significant (OR = 1.79; P = 0.2227). Normocellularity was noted in 25% of cases and showed no significant correlation with clinical features either (OR = 0.93; P = 0.8914). Hypocellularity was present in 22.3% of the sample, again without significant clinical correlations (OR = 0.84; P = 0.2422). The presence of blast cells was observed in 63.8% of the sample, suggesting a high occurrence of potential malignancies, although this result did not reach statistical significance (OR = 2.06; P = 0.1539).

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Table 2: Spectrum of Clinico-Hematological Profile of Pediatric Age Group

Feature	Category	n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-Value
Erythro Profile	Normal or Hyperplasia	17 (23.6%)	1.45	(0.32, 6.54)	0.5021
	Suppressed (included in normal)	2 (2.7%)	Reference	-	-

In Table 2, the clinico-hematological profiles based on erythro characteristics are presented. Normal or hyperplasia in erythro profiles was seen in 23.6% of patients. This group had a higher, yet non-significant, odds of presenting with specific clinical features associated with these erythro profiles (OR = 1.45; P = 0.5021). The suppressed category, included with normal for analysis due to small numbers, comprised only 2.7% of the sample and served as the reference group.

Table 3: Classification of Anemias and Leukemias

Feature	Category	n (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P-Value
Diagnosis	Leukemia	34 (47.3%)	1.10	(0.20, 6.06)	0.8435
	Anemia	0 (0%)	Reference	-	-

Table 3 focuses on the diagnosis of anemias and leukemias among the children. Leukemia was diagnosed in 47.3% of the patients, indicating a substantial proportion of serious hematological disorders within the sample. However, the association of leukemia with specific clinical features relative to the reference group (anemia, which had no cases) was not statistically significant (OR = 1.10; P = 0.8435).

DISCUSSION

The findings regarding cellularity and the presence of blast cells are significant. While hypercellularity showed a higher odds ratio (1.79), indicating a trend towards an association with certain clinical features, it was not statistically significant. This aligns with previous studies suggesting variable rates of hypercellularity in pediatric hematological disorders, depending on the underlying pathology Goyal S *et al.*(2014).[8] Similarly, the presence of blast cells, though indicative of potential malignancies such as leukemia, showed no significant association in this sample, which can vary widely based on disease stage and treatment status as noted in literature Balasubramanian M*et al.*(2022).[9]

The analysis of erythro profiles, showing a non-significant higher odds ratio for normal or hyperplasia profiles, suggests a tendency for these conditions to be associated with certain clinical symptoms or histories. This is consistent with findings from other studies that have examined erythrocyte maturation disruptions in contexts like nutritional deficiencies or bone marrow infiltrative disorders Zivot A*et al.* (2018).[10]

The predominance of leukemia in the studied population, although not statistically significant, suggests a specific focus of the healthcare facility or the selection bias of the sample. The absence of anemia in the sample is unusual and may point to specific referral or diagnostic practices at the study site. Literature often shows a higher incidence of anemia in pediatric populations, particularly in contexts of chronic disease or malnutrition Gebreegziabher T*et al.*(2023).[11]

CONCLUSION

The study has provided invaluable insights into the clinico-hematological profiles observed in pediatric patients undergoing bone marrow aspiration at a tertiary health care facility. The investigation revealed distinct patterns of cellularity, with hypercellularity being the most common condition observed, albeit not reaching statistical significance in its association with specific clinical features.

Despite the non-significant results concerning the odds ratios for hypercellularity, normocellularity, and hypocellularity, these findings are crucial for understanding the variability and complexity of hematological diseases in children. The presence of blast cells in nearly half of the cases underscores the importance of bone marrow aspiration in diagnosing serious conditions such as leukemia, even though the statistical significance was not established in this sample. Furthermore, the study highlighted the predominance of leukemia diagnoses among the subjects, while anemia was notably absent, suggesting either a specific focus of the facility or potential referral biases. These findings emphasize the need for ongoing research and vigilance in the hematological assessment of pediatric patients, ensuring that bone marrow aspiration continues to be a critical tool in the early and accurate diagnosis of complex diseases.

Overall, this study contributes to the broader body of knowledge in pediatric hematology, offering a foundation for future research to explore deeper into the causes, implications, and treatments of various hematological disorders. Further investigations with larger sample sizes and broader diagnostic scopes are recommended to enhance the understanding and management of these conditions in pediatric populations.

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Limitations of Study

1. **Sample Size and Diversity**: The study was conducted with a relatively small sample size of 72 patients, which may not fully capture the diversity of hematological pathologies across different demographics or geographic regions. This limitation may affect the generalizability of the findings to wider pediatric populations.
2. **Statistical Significance**: Many of the observed associations in the study did not reach statistical significance, which may limit the conclusiveness of the findings. The lack of significant results could be due to the small sample size, the variability of the diseases, or the stage at which the patients were diagnosed.
3. **Selection Bias**: The study was conducted at a single tertiary care center, which might have introduced selection bias. Patients referred to a tertiary center are often those with more severe or complex conditions, which may not represent the general pediatric population or those with milder forms of hematological disorders.
4. **Absence of Anemia Cases**: Remarkably, no cases of anemia were reported in the study sample, which is unusual given the prevalence of anemia in pediatric populations. This absence might reflect specific referral patterns, diagnostic criteria, or patient selection methods at the study site, which could bias the spectrum of pathologies observed.
5. **Retrospective Design**: The retrospective nature of the study may lead to limitations related to data completeness and accuracy. Records and samples collected retrospectively are susceptible to inconsistencies in diagnostic criteria, data recording, and interpretation, which could influence the study's outcomes.
6. **Diagnostic Techniques**: The study relied on the results of bone marrow aspiration alone. While this is a standard method, combining it with other diagnostic techniques like molecular or genetic testing could provide a more comprehensive understanding of the hematological conditions.
7. **Lack of Longitudinal Follow-up**: The study did not include longitudinal follow-up of the patients, which limits the ability to observe the progression of diseases or the long-term outcomes of the patients. Such follow-up could provide more insights into the efficacy of treatments and the prognosis of the disorders diagnosed.

REFERENCES

1. Baichoo M, Musoke R, Githanga J. The spectrum of pathologies found in bone marrow amongst children below 18 years at Kenyatta national hospital, Kenya. *HematolTransfus Int J*. 2018;6(5):171–175.
2. Ali I, Mir ZH, Qureshi OA, Ahmad K. Spectrum of bone marrow aspirations and their clinico-hematological profile in children. Int J ContempPediatr2015;2:25-8.
3. Baig MA. Int J Res Med Sci. 2015 Oct;3(10):2775-2779. Evaluation of bone marrow aspirate in paediatric patients with pancytopenia: a 2 years study
4. Lalita Y. Patil, Yoganand V. Patil, Grace D'Costa, Arvind Valand. Diagnostic utility of bone marrow aspiration and biopsy in paediatric age group. International Journal of Contemporary Medical Research 2016;3(8):2310-2313
5. Majumdar A, Wasim NA, Jana A, Biswas S, Bhattacharyya S. Diagnostic outcome of bone marrow aspiration in a pediatric center in Kolkata, India. Indian j health sci 2015;8:125-9.
6. Rahim F, Ahmad I, Islam S, Hussain M, Khattak TA, Bano Q. Spectrum of hematological disorders in children observed in 424 consecutive bone marrow aspirations/biopsies. Pak J Med Sci 2005;21:433-6.
7. Githang'A JN, Dave P. Bone marrow examination at a paediatric hospital in Kenya. East Afr Med J. 2000;78:37-9.
8. Goyal S, Singh UR, Rusia U. Comparative evaluation of bone marrow aspirate with trephine biopsy in hematological disorders and determination of optimum trephine length in lymphoma infiltration. Mediterranean journal of hematology and infectious diseases. 2014;6(1).
9. Balasubramanian M, Sangoi NN. Utility of Bone Marrow Examination in Pediatric Age Group: Experience of a Tertiary Healthcare Centre in India. Cureus. 2022 Jul 20;14(7):e27056. doi: 10.7759/cureus.27056. PMID: 36000100; PMCID: PMC9389958.
10. Zivot A, Lipton JM, Narla A, Blanc L. Erythropoiesis: insights into pathophysiology and treatments in 2017. Mol Med. 2018 Mar 23;24(1):11. doi: 10.1186/s10020-018-0011-z. PMID: 30134792; PMCID: PMC6016880.
11. Gebreegziabher T, Sidibe S. Prevalence and contributing factors of anaemia among children aged 6-24 months and 25-59 months in Mali. J Nutr Sci. 2023 Nov 9;12:e112. doi: 10.1017/jns.2023.93. PMID: 37964977; PMCID: PMC10641697.