Awareness of Classical and Advanced Hematology Concepts among Medical Postgraduates in Kerala: A Cross-Sectional Study

Aakash Chozakade[a], Bobby Abraham[a], Anupa Jacob[a], Bonnie Anna George[a], Chepsy Philip[a]

a. Believers Medical College Hospital, Thiruvalla, Kerala, India*

ABSTRACT

Published on 30th December 2024

Background: Clinical hematology is advancing rapidly, addressing both benign and malignant blood disorders. However, in Kerala, specialized hematology services remain limited. We undertook a survey to evaluate the awareness of classical and emerging hematology concepts among medical postgraduates in Kerala.

Methods: A cross-sectional, web-based survey was conducted using a 30-item multiple-choice questionnaire. It assessed knowledge of classical hematology topics and advanced therapies (e.g., bone marrow transplantation, CAR-T therapy, Next-Generation Sequencing [NGS]). Respondents' knowledge was categorized as Excellent (≥85%), Good (70–84%), Satisfactory (50–69%), or Needs Improvement (<50%). Awareness levels were further stratified into high (>90%), moderate (75–90%), partial (50–75%), and low (<50%).

Results: Among respondents, 30% demonstrated excellent knowledge, 36.7% good, 30% satisfactory, and 3.3% needed improvement. High awareness (>90%) was observed in the clinical features of aplastic anemia (93.2%), multiple myeloma (97.7%), and the role of NGS (100%). Moderate awareness (75–90%) included immunosuppressive therapy for aplastic anemia (81.8%) and CAR-T therapy (81.8%). Partial awareness (50–75%) was noted for viral associations with aplastic anemia (52.3%) and autologous transplantation for multiple myeloma (68.2%). Low awareness (<50%) was seen in peripheral smear findings for aplastic anemia (43.2%) and diagnostic tools for multiple myeloma (SPEP 34.1%, bone marrow biopsy 36.4%).

Conclusion: While awareness of traditional concepts is strong, areas such as CAR-T therapy side effects, diagnostic tools, and transplant options could benefit from educational interventions. Establishing dedicated hematology departments and incorporating these topics into postgraduate curricula could bridge these gaps.

Keywords: Hematology, Cross-Sectional Study

*See End Note for complete author details

BACKGROUND

Clinical hematology is a specialized field of medicine that addresses both benign and malignant blood disorders, encompassing a wide array of conditions, including classical hematology (such as anemia, bleeding disorders, and bone marrow failure) and hematologic oncology (including lymphoma, leukemia, and multiple myeloma).[1] The field is evolving rapidly, particularly with the introduction of novel diagnostic tools and therapies, such as CAR-T cell therapy and Next-Generation Sequencing (NGS).[2] Despite the availability of the Doctorate of Medicine (DM) course in clinical hematology in India for over 25 years, it remains a scarce specialty, with limited or no training opportunities at numerous universities.[3] This shortage of specialized training has contributed to the lack of dedicated hematology departments in many medical colleges across the country.[4]

Kerala is widely recognized for its robust medical education system and healthcare services, with its healthcare model often lauded for ensuring broad access to medical care.[5,6] Nevertheless, the state faces a shortage of specialized training opportunities in hematology, coupled with the absence of dedicated hematology departments.[7] While postgraduate medical education in Kerala is highly regarded and covers a

Cite this article as: Abraham B, Jacob A, George BA, Philip C. Awareness of Classical and Advanced Hematology Concepts among Medical Postgraduates in Kerala: A Cross-Sectional Study. Kerala Medical Journal. 2024 Dec 30;17(4):200–6.
DOI: https://doi.org/10.52314/kmj.2024.v17i4.678

Corresponding Author:
Dr. Chepsy Philip MD, DM, Regional Advanced Centre for Transplant, Haemato-lymphoid Oncology & Marrow Diseases, Believers Church Medical College Hospital, Thiruvalla, Kerala, India-689103 E-mail: chepsyphilip@bcmch.edu.in

broad spectrum of specialties, the lack of specialized hematology departments may result in healthcare professionals possessing varying levels of understanding, particularly with regard to emerging therapies and advanced diagnostic techniques.

The complexity of conditions such as aplastic anemia, lymphoma, and myeloma is increasing, and it is essential for healthcare professionals to remain well-informed about both traditional and emerging treatments.[8] Previous studies have documented significant knowledge gaps among medical professionals regarding these advancements.[9-12] Given the limited availability of specialized hematology departments and the increasing complexity of hematological disorders, we hypothesized that a similar knowledge gap may exist among medical postgraduates in Kerala. To investigate this, we conducted a web-based survey to assess the awareness and understanding of hematology among medical postgraduates across various medical colleges in Kerala with an emphasis on classical concepts, the management of aplastic anemia, and advanced therapies such as bone marrow transplantation (BMT), CAR-T cell therapy, and Next-Generation Sequencing (NGS). The objective was to identify gaps in knowledge regarding standard-of-care practices and emerging therapies.

METHODS

Study Design

A descriptive, cross-sectional, web-based survey was conducted to assess the awareness and understanding of clinical hematology among medical postgraduates in Kerala.

Study Participants

All participants who completed the survey were included in the analysis.

Inclusion Criteria: Postgraduate students currently enrolled in recognized medical programs such as internal medicine, transfusion medicine, pathology, or pediatrics at medical colleges in Kerala, who agreed to participate in the study.

Exclusion Criteria: Post graduates in other medical postgraduate programs or those from unrelated disciplines, such as surgery or radiology, were excluded from the study.

Sampling and Data Collection

Materials Used: A 30-question web-based questionnaire was developed after reviewing relevant literature. The questionnaire aimed to assess knowledge in key areas of clinical hematology, including classical topics like anemia, bleeding disorders, and bone marrow failure, as well as emerging areas like aplastic anemia, multiple myeloma, CAR-T cell therapy, NGS, and lymphoma. The questionnaire consisted of multiple-choice questions designed to evaluate awareness.

Duration: The data collection occurred over a three-month period, from May to July 2024, allowing time for wide distribution and participant responses.

Distribution: The survey was distributed electronically via email to postgraduates who had previously attended a clinical hematology workshop organized by our center, as well as through the institutional networks of participating medical colleges. Additionally, we contacted participants for the 2024 annual hematology conference, where the survey was included as a voluntary submission within the conference survey. Responses were collected anonymously through the survey platform, and all data were securely stored to maintain confidentiality.

Data Analysis

Descriptive statistics were used to analyze the collected data, with results presented as percentages for each knowledge area.

Ethical Considerations

This survey was conducted in compliance with the International Committee of Medical Journal Editors (ICMJE) guidelines. Informed consent was acquired from all participants, ensuring their voluntary participation. To encourage participation and protect privacy, no demographic or identifying information was collected, ensuring anonymity and minimizing potential response bias. All data were handled confidentially, adhering to established ethical standards.

Calculation Formula

To grade the 30-question responses, the percentage of correct answers for each respondent was calculated. Grading was done based on the following scale:

- A (Excellent): 85% or more correct responses
- B (Good): 70% to 84% correct responses
- C (Satisfactory): 50% to 69% correct responses
- D (Needs Improvement): Below 50% correct responses

The percentage of correct responses was calculated using the formula:

Percentage of correct responses =
(Number of correct responses/44)×100

The knowledge areas were categorized based on the percentage of correct responses:

1. **High Awareness (90%+):** Topics with over 90% correct responses, indicating strong understanding.
2. **Moderate Awareness (75%-90%):** Topics with 75%-90% correct responses, showing good but incomplete understanding.
3. **Partial Awareness (50%-75%):** Topics with 50%-75% correct responses, indicating significant gaps in knowledge.
4. **Low Awareness (<50%):** Topics with less than 50% correct responses, highlighting critical knowledge gaps.

RESULTS

The knowledge areas were identified and categorized based on the responses to the survey, with the aim of pinpointing the strengths and weaknesses in the participants' understanding of clinical hematology **(Figure 1 & 2).** They were categorized to highlight areas where further education and awareness efforts are needed to bridge existing gaps.

High Awareness Areas (More than 90%)

The awareness of key concepts related to hematology and hematologic conditions was evaluated across various areas. High awareness was found in several domains, with over 90% of respondents demonstrating strong knowledge. These included the hallmark feature of aplastic anemia (hypocellularity) and drug-induced aplastic anemia (chloramphenicol), both with a 93.2% correct response rate. Additionally, 90.9% of participants correctly identified markers for progression to PNH (CD55 & CD59 deficiency). There was also a high awareness of the clinical manifestations and complications of multiple myeloma, with 97.7% correctly identifying bone pain as a common symptom and renal impairment as a common complication. The awareness of NGS (Next-Generation Sequencing) and its uses in hematology was exemplary, with 100% of respondents correctly identifying its role in genetic profiling, and 95.5% understanding its capabilities for detecting chromosomal translocations, gene mutations, and copy number variations.

Moderate Awareness Areas (75%-90%)

In the 75%-90% range, several areas showed good but not universal awareness. The first-line immunosuppressive therapy for aplastic anemia (Cyclosporine & ATG) was correctly identified by 81.8% of respondents, reflecting a solid understanding of treatment protocols. However, awareness of the role of HSCT (Hematopoietic Stem Cell Transplantation) in aplastic anemia was lower at 65.9%, suggesting some gaps in knowledge regarding its indications, particularly for younger patients with sibling donors. Knowledge about CAR-T therapy for hematologic malignancies was also moderate, with 81.8% of participants understanding its application. While most respondents had a good grasp of NGS's advantages over traditional diagnostic methods, a 77.3% correct response rate showed room

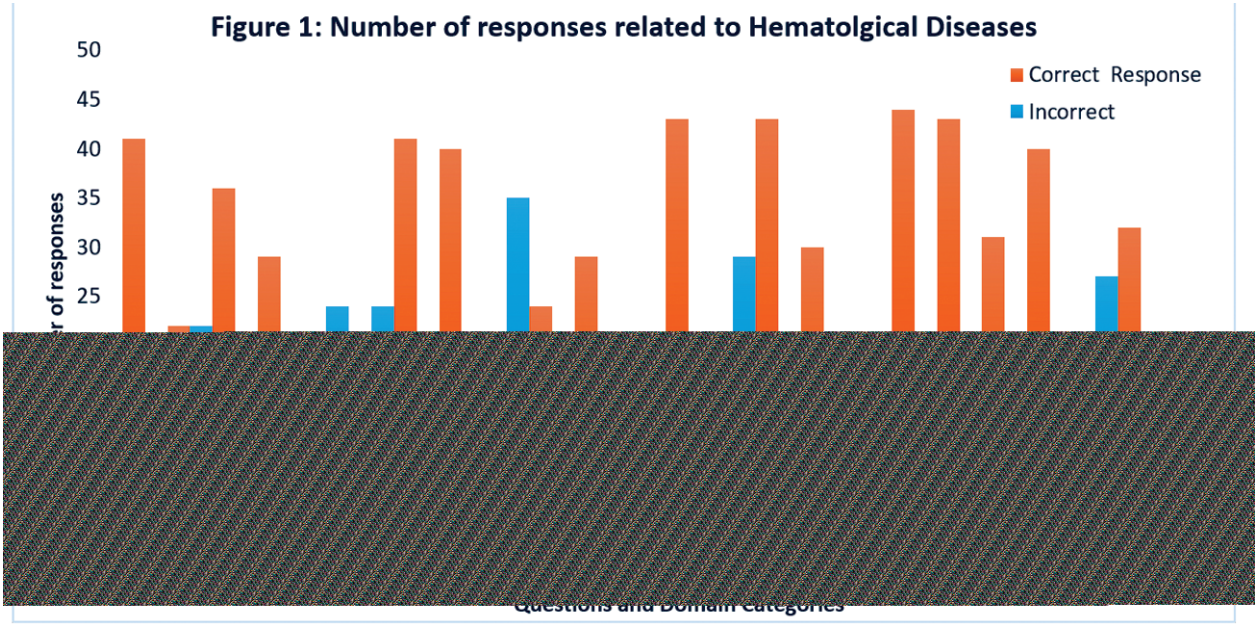

Figure 1. **Number of responses related to Hematological Diseases**

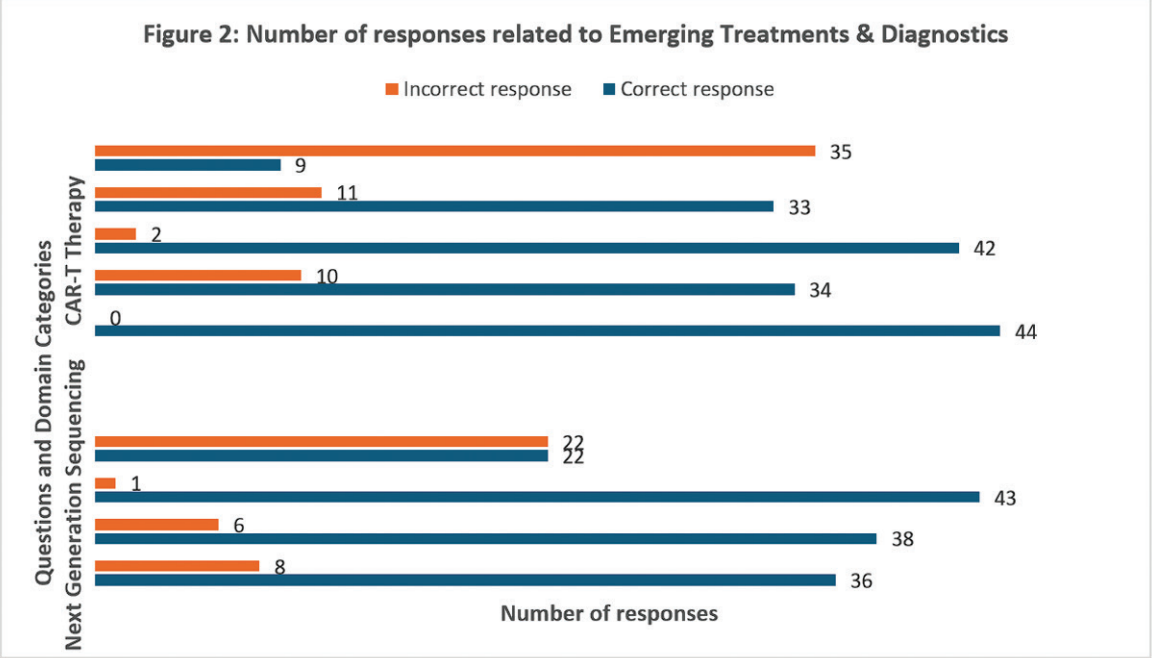

Figure 2. **Number of responses related to Emerging Treatments & Diagnostics**

for improvement in understanding its sensitivity and accuracy.

Partial Awareness Areas (50%-75%)

In the 50%-75% range, areas with moderate awareness included the viral association with aplastic anemia, where only 52.3% of respondents correctly identified Parvovirus B19 as a relevant pathogen. Supportive care measures like iron chelation therapy for aplastic anemia showed a 54.5% correct response, indicating gaps in knowledge of appropriate supportive treatments. Understanding of transplant options for severe aplastic anemia was also limited, with 54.5% correctly identifying allogeneic transplant as the preferred type. Awareness of CAR-T therapy side effects such as cytokine release syndrome was somewhat better at 68.2%, but it still highlighted the need for further education. Similarly, 68.2% of respondents had a partial understanding of the role of autologous stem cell transplantation in multiple myeloma.

Low Awareness Areas (less than 50%)

Several areas displayed low awareness, with less than 50% of respondents demonstrating a solid understanding. Peripheral smear findings in aplastic anemia, were correctly identified by only 43.2%, and the ability to differentiate aplastic anemia from MDS using bone marrow biopsy and the utility of bone marrow transplant in myeloma and aplastic anemia was also poor, with only 45.5% providing correct answers. Post-CAR-T evaluation markers, specifically the absence of CD19, were recognized by only 25% of respondents, showing significant gaps in this area. Additionally, diagnostic tests for multiple myeloma, such as SPEP and bone marrow biopsy, had split responses (34.1% and 36.4%), indicating a lack of consensus on the appropriate methods for diagnosing this condition.

Knowledge Grading

Respondents' knowledge was graded into four categories: Excellent, Good, Satisfactory, and Needs Improvement. In terms of overall knowledge, 30% of respondents performed excellently (85% correct answers), 36.7% demonstrated good understanding (70-84% correct), and 30% had satisfactory knowledge (50-69% correct). However, 3.3% of respondents scored below 50%, highlighting the need for further study in certain areas.

DISCUSSION

The results of this survey indicate a strong foundational understanding of clinical hematology among medical postgraduates in Kerala, particularly in fundamental areas such as aplastic anemia, multiple myeloma, CAR-T therapy, Next-Generation Sequencing (NGS), and lymphoma. While the majority of respondents demonstrated a solid grasp of these topics, certain gaps in more advanced subjects, including immunotherapy in lymphoma, drug-induced aplastic anemia, and the limitations of NGS, were identified.[13] These gaps suggest areas requiring further educational intervention. Despite these deficiencies, the majority of participants showed a high level of proficiency in the complex

areas of hematology, suggesting that the existing curriculum is effectively imparting core knowledge but requires refinement to address more specialized topics.

We also observed that specific areas such as diagnostic methods, treatment protocols, and the differentiation between various hematological conditions remain areas of concern. These findings highlight the need for enhanced practical training and educational interventions, particularly in the areas of diagnostic accuracy and therapeutic decision-making. Continuing improvements in postgraduate education will be essential in ensuring that medical professionals are well-equipped to handle complex hematological cases.[14]

The awareness of emerging diagnostic tools, especially NGS, was particularly high, with 100% awareness among respondents. This suggests that current postgraduate education is effectively integrating the latest technological advancements in hematology. However, the survey also pointed to significant weaknesses, particularly in diagnostic challenges. There were notable gaps in differentiating between aplastic anemia and myelodysplastic syndromes (MDS), with only 45.5% of respondents able to correctly make the distinction. Additionally, only 43.2% showed a clear understanding of peripheral smear findings, indicating a need for stronger diagnostic training. Another gap was in the therapeutic aspects of hematology, especially regarding bone marrow transplantation (BMT) for aplastic anemia and multiple myeloma, where only 54.5% of respondents demonstrated adequate knowledge.

Our analysis revealed reasonable awareness of CAR-T therapy (81.8%), but the understanding of specific details, such as disease progression markers (25%) and management of side effects like cytokine release syndrome (68.2%), was limited. This suggests the need for more in-depth coverage of CAR-T therapy in postgraduate curricula. There was also a marked deficiency in awareness regarding supportive care measures, such as iron chelation therapy for MDS and aplastic anemia, with only 54.5% of respondents being familiar with these strategies.[15-17] This highlights the need for better education on patient management beyond primary treatments.[18-19] While there was reasonable awareness of CAR-T therapy, the knowledge of how to monitor and manage its side effects remains incomplete, emphasizing the need for a more comprehensive integration of emerging therapies into postgraduate education.

Certain areas, such as viral associations (e.g., Parvovirus B19) and specific complications, were underrepresented in respondents' knowledge.[20,21] Additionally, some diagnostic tests, such as bone marrow biopsy and serum protein electrophoresis (SPEP) for multiple myeloma, were inconsistently recognized, suggesting variability in exposure to these diagnostic technique.[22,23] This reflects the need for more consistent training across different regions and institutions to ensure uniformity in the knowledge base of postgraduate students.[24,25]

To address these gaps, some educational recommendations can be inferred from our survey findings. Focused training on differentiating between similar hematological conditions, such as aplastic anemia and MDS, is essential, along with greater emphasis on diagnostic findings like peripheral smears.[26] Incorporating more case-based learning into the curriculum would help postgraduates develop the practical skills needed to manage complex hematological conditions. Additionally, implementing regular Continuing Medical Education (CME) programs and workshops focusing on emerging therapies like CAR-T therapy and supportive care would help reinforce knowledge and address observed gaps.[27]

We also observed a gap in awareness about bone marrow transplantation (BMT) as a curative treatment for aplastic anemia and as the standard of care for multiple myeloma in our survey.[28,29] This gap is particularly concerning given that multiple myeloma is among the most common hematological malignancies in Kerala.[30] The lack of awareness about BMT may be attributed to the relatively low number of transplants performed in the region, which limits exposure to this treatment modality. Increasing access to BMT and improving communication about its benefits could help mitigate this knowledge gap.[31,32] Additionally, although BMT is increasingly accessible in Kerala, there remains a communication gap regarding its availability. It is crucial to raise awareness among healthcare professionals and the general public about the accessibility and benefits of BMT.[33,34]

The restricted exposure to BMT in medical colleges in Kerala possibly hinders postgraduate students' understanding of its therapeutic potential.[7] To address this, awareness campaigns, including workshops, CMEs, and advocacy programs, should be conducted to highlight the importance of BMT in managing conditions like aplastic anemia and multiple myeloma.[35,36] Successful case studies should be emphasized to build confidence in the treatment and encourage timely referrals for transplant evaluation.[32] Updating the postgraduate medical curriculum to incorporate the latest advancements in hematology, including the role of BMT, CAR-T therapy, and modern diagnostic tools, will better equip future physicians to manage complex

hematological disorders.[37,38] Promoting collaboration between hematology centers and general practitioners can help demystify BMT and make it more accessible. Additionally, educating patients and the broader public about the availability and efficacy of these treatments is crucial for improving acceptance and adoption.

CONCLUSION

Our analysis indicates that while postgraduates in Kerala have a solid grounding in basic hematology, there are gaps in advanced diagnostic techniques, therapeutic strategies—including bone marrow transplants—and emerging treatments such as CAR-T therapy. The findings emphasize the need for enhanced training and exposure to diagnostic skills, therapeutic decision-making, and cutting-edge therapies to better equip medical professionals in hematological diseases. Notably, myeloma and lymphoma are frequently among the top 10 malignancies in the region, highlighting the importance of future physicians understanding bone marrow transplants as a standard care treatment option.

Limitation

The limitations of our analysis include a focus on postgraduates restricted to the state of Kerala, limiting generalizability to other regions. The sample size may also not fully represent the population, introducing potential sampling bias. We also acknowledge that the self-reported data could lead to recall or social desirability bias, and the study's cross-sectional nature limits the assessment over time. The analysis focused mainly on theoretical knowledge, which may not reflect practical skills, and didn't include a control group for comparison. Also, differences in training across institutions could lead to varied exposure. Despite these limitations, this is a useful study to assess hematology awareness in Kerala and provides useful insights to address knowledge gaps

END NOTES

Author Informations

1. Aakash Chozakade, Believers Medical College Hospital, Thiruvalla, Kerala, India
2. Bobby Abraham, Believers Medical College Hospital, Thiruvalla, Kerala, India
3. Anupa Jacob, Believers Medical College Hospital, Thiruvalla, Kerala, India
4. Bonnie Anna George, Believers Medical College Hospital, Thiruvalla, Kerala, India
5. Chepsy Philip, Believers Medical College Hospital, Thiruvalla, Kerala, India

List of Abbreviations:

- CAR-T: Chimeric Antigen Receptor T-cell therapy
- AML: Acute Myeloid Leukemia
- BMT: Bone Marrow Transplant

Explanations of Terminologies:

- **Bone Marrow Transplant (BMT):** A medical procedure in which damaged or diseased bone marrow is replaced with healthy marrow. It is a standard treatment option for many hematological malignancies.
- **Chimeric Antigen Receptor T-cell (CAR-T) Therapy:** A type of immunotherapy where a patient's T cells are genetically modified to attack cancer cells.
- **Myeloma:** A type of blood cancer that affects plasma cells, a component of bone marrow.
- **Lymphoma:** A cancer that originates in the lymphatic system, affecting lymph nodes and other lymphatic tissues.

Conflicts of Interest Statement: The authors declare no conflicts of interest related to this study.

Acknowledgements: We thank Dr Ramasamy N.V and Dr Shinto Francis Thekkudan, The Cochin Hematology Group, postgraduate students and medical institutions in Kerala for their participation and valuable insights, which made this analysis possible.

Financial Support: The authors declare no funding for this study

REFERENCES

1. Pathologists TRC of. Haematology [Internet]. [cited 2024 Dec 15].
2. Mohty M, Nagler A, Savani B. Clinical Hematology International: Why a New Journal in Hematology? Clin Hematol Int. 2019 Mar 18;1(1):1.
3. DM in Haematology – Department of Haematology – Christian Medical College [Internet]. [cited 2024 Dec 15].
4. Hematology education and training in India in 2022 – Scope and the hope - Journal of Hematology and Allied Sciences [Internet]. [cited 2024 Dec 15].
5. Nabae K. The Health Care System in Kerala - Its Past Accomplishments and New Challenges - 2003.
6. Kelkar S. India's Public Health Care Delivery: Policies for Universal Health Care [Internet]. Singapore: Springer; 2021 [cited 2024 Dec 15].
7. Philip C, Abraham B, George B, Jacob A, Raju N, Abraham S, et al. Pioneering clinical hematology and bone marrow transplant services in Central Travancore, Kerala: a transformative journey. Believers Med J. 2023 Dec;6(1):20–7.

8. Engert A, Balduini C, Brand A, Coiffier B, Cordonnier C, Döhner H, et al. The European Hematology Association Roadmap for European Hematology Research: a consensus document. Haematologica. 2016 Feb;101(2):115–208.
9. Philip J, Kumar S, Chatterjee T, Mallhi RS. Knowledge of Transfusion Medicine Among Resident Doctors in Clinical Specialities: A Cross-Sectional Study from a Tertiary Care Centre. Indian J Hematol Blood Transfus. 2015 Sep 1;31(3):374–7.
10. Amgad M, Shash E, Gaafar R. Cancer education for medical students in developing countries: Where do we stand and how to improve? Crit Rev Oncol Hematol. 2012 Oct 1;84(1):122–9.
11. Tucunduva LTC de M, Sá VHLC de, Koshimura ET, Prudente FVB, Santos AF dos, Samano EST, et al. Estudo da atitude e do conhecimento dos médicos não oncologistas em relação às medidas de prevenção e rastreamento do câncer. Rev Assoc Médica Bras. 2004 Sep;50:257–62.
12. Pooe AM, Dlova AN, Ntuli ST. Medical practitioners' knowledge and awareness of multiple myeloma at public hospitals, Gauteng, South Africa. South Afr Fam Pract [Internet]. 2023 [cited 2024 Dec 15];65(3).
13. Mccay J. Passing The Frcpath Part 1 Examination: A Practical Guide For Haematology Registrars. World Scientific; 2024. 296 p.
14. Van Kraaij J, Veenstra M, Stalpers D, Schoonhoven L, Vermeulen H, van Oostveen C. Uniformity along the way: A scoping review on characteristics of nurse education programs worldwide. Nurse Educ Today. 2023 Jan 1;120:105646.
15. Awidi A, Alzu'bi M, Odeh N, Alrawabdeh J, Al Zyoud M, Hamadneh Y, et al. Myelodysplastic Syndromes and Myelodysplastic Syndromes/Myeloproliferative Neoplasms: A Real-World Experience From a Developing Country. JCO Glob Oncol. 2024 Feb;(10):e2300281.
16. Bruzzese A, Martino EA, Mendicino F, Lucia E, Olivito V, Bova C, et al. Iron chelation therapy. Eur J Haematol. 2023;110(5):490–7.
17. Gattermann N. Iron overload in acquired sideroblastic anemias and MDS: pathophysiology and role of chelation and luspatercept. Hematology. 2024 Dec 6;2024(1):443–9.
18. Lustberg MB, Kuderer NM, Desai A, Bergerot C, Lyman GH. Mitigating long-term and delayed adverse events associated with cancer treatment: implications for survivorship. Nat Rev Clin Oncol. 2023 Aug;20(8):527–42.
19. Unveiling the Significance and Challenges of Integrating Prevention Levels in Healthcare Practice - Yousif AbdulRaheem, 2023 [Internet]. [cited 2024 Dec 15].
20. Fukuoka R, Suzuki K, Yamada K, Ariga Y, Yoshikawa T, Yamano T, et al. Human parvovirus B19 induced aplastic crisis in a patient with folate deficiency. | EBSCOhost [Internet]. Vol. 65. 2023
21. Fukui S, Hojo A, Sawada U, Kura Y. Aplastic crisis due to human parvovirus B19. IDCases. 2023 Jun 16;33:e01820.
22. Gea A, Fernández T, Fernández-Luis S, Domínguez-García JJ, Francés I, Tobalina A, et al. Is Bone Marrow Trephine Biopsy Necessary in Multiple Myeloma Patients at Diagnosis? Clin Lymphoma Myeloma Leuk [Internet]. 2024 Dec 7 [cited 2024 Dec 15].
23. Putchen DD, Ramaprasad S. Laboratory approaches to enhance early detection of multiple myeloma and improve patient outcomes. Journal of Diagnostic and Academic Pathology. 2024 Jun;1(1):33.
24. Robbrecht M. Optimising workplace learning in postgraduate medical education. Towards supporting residents and supervisors in clinical practice. [Internet]. Ghent University; 2024 [cited 2024 Dec 15].
25. Kayyali M. Navigating Challenges in Cross-Border Accreditation. In: Kayyali M, editor. Quality Assurance and Accreditation in Higher Education: Issues, Models, and Best Practices [Internet]. Cham: Springer Nature Switzerland; 2024 [cited 2024 Dec 15]. p. 293–319.
26. Bain BJ. Hematology: 101 Morphology Updates. John Wiley & Sons; 2023. 181 p.
27. Peloquin S, Cymbalista F, Dreyling M, Shah NN, Murray S, Del Fiacco R, et al. Knowledge, skills, and confidence gaps impacting treatment decision making in relapsed/refractory chronic lymphocytic leukemia and mantle cell lymphoma: a quantitative survey study in France, Germany, and the United States. BMC Cancer. 2024 Aug 13;24(1):1003.
28. DeZern AE, Zahurak M, Jones RJ, Brodsky RA. Uniform conditioning regardless of donor in bone marrow transplantation for severe aplastic anemia. Haematologica. 2023 Sep 7;109(2):657–60.
29. Storb R. Allogeneic bone marrow transplantation for aplastic anemia. Int J Hematol. 2024 Mar 1;119(3):220–30.
30. Gopan G, Narayanan G, Nair SG, Purushothaman P, Joseph R, Nair RA, et al. Outcome of Treatment in Elderly Myeloma—A Single-Centre Experience. In: Indian Journal of Medical and Paediatric Oncology [Internet]. Thieme Medical and Scientific Publishers Pvt. Ltd.; 2021 [cited 2024 Dec 15]. p. 4.
31. Yusuf RA, Preussler JM, Meyer CL, Schoeppner K, Sees Coles JA, Ruffin A, et al. Reducing barriers of access and care related to hematopoietic cell transplantation and cellular therapy: The mission-driven role of the national marrow donor program. Best Pract Res Clin Haematol. 2023 Jun 1;36(2):101480.
32. Juckett M, Dandoy C, DeFilipp Z, Kindwall-Keller TL, Spellman SR, Ustun C, et al. How do we improve the translation of new evidence into the practice of hematopoietic cell transplantation and cellular therapy? Blood Rev. 2023 Jul 1;60:101079.
33. Yusuf RA, Preussler JM, Meyer CL, Schoeppner K, Sees Coles JA, Ruffin A, et al. Reducing barriers of access and care related to hematopoietic cell transplantation and cellular therapy: The mission-driven role of the national marrow donor program. Best Pract Res Clin Haematol. 2023 Jun 1;36(2):101480.
34. McErlean G, Ashley C, Pradhan A, Yenson V, Paterson A, Farnham G, et al. A qualitative study on blood and marrow transplant recipients' perceptions of health professional roles following BMT and preferences for ongoing care. J Cancer Surviv [Internet]. 2024 Aug 17 [cited 2024 Dec 15].
35. Al-Shamsi HO, Abyad AM. Cancer Care in the UAE. In: Al-Shamsi HO, editor. Cancer Care in the United Arab Emirates [Internet]. Singapore: Springer Nature; 2024 [cited 2024 Dec 15]. p. 15–56.
36. Picca AJ. Exploring Learning in the Setting of Pediatric Hematology/Oncology Multidisciplinary Care Conferences [Internet]. The Ohio State University; 2023 [cited 2024 Dec 15].
37. Feng X, Wu W, Bi Q. Reform of teaching and practice of the integrated teaching method BOPPPS-PBL in the course "clinical haematological test technique." BMC Med Educ. 2024 Jul 19;24(1):773.
38. Kareff SA, Sridhar A, Dhawan N, Anampa-Guzmán A, Singhi EK, Velazquez AI. The Democratization of Hematology-Oncology Medical Education during the COVID-19 Pandemic. Cancer Invest. 2023 Jul;41(6):548–58.