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# Clinical features and management outcomes of hairy cell leukemia in routine clinical practice: a single center retrospective experience

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## ABSTRACT

**Aims**: This study aimed to evaluate the clinical features and treatment outcomes of patients with classic hairy cell leukemia (HCL) in routine clinical practice.

**Methods**: This is a single-center retrospective study conducted at University of Health Sciences, Adana City Hospital, Hematology Department between January 2018 and August 2025. The data of 33 patients with the diagnosis of classic HCL from the database of hospital records were analysed.

**Results**: First line treatment was cladribine in 27 (81.8%) patients, rituximab-cladribine in 2 (6.1%) patients, interferon in 1 (3%) patient and splenectomy in 3 (9.1%) patients. Thirty one (93.9%) patients responded to treatment and only 2 (6.1%) did not. The progression was observed in 8 (25.8%) of 31 responding patients. The probablity of progression free survival (PFS) at 10 years was 33%. When the data is analysed according to the age groups of <50 y, 50-60 y and >60 y, the probability of PFS was 42.9%, 83.3%, 31.3%, respectively (p=0.096). Also patients were grouped according to the age ≤60 y and >60 y; and the probability of PFS at 10 years were 40.8% v.s 31.3% (p=0.034). All patients were alive at the end of follow up period, so median OS was not reached.

**Conclusion**: Cladribin was verified to be an effective treatment modality in HCL with high response rate, but low PFS. And the differences in the PFS according to age groups should be reevalated in the era of rituximab-cladribine combination and novel agents.

**Keywords**: Hairy cell leukemia, purine nucleoside analogs, cladribine, rituximab, prognosis

## INTRODUCTION

Hairy cell leukemia (HCL) is an indolent B lymphoid malignancy classified under the splenic B cell lymphoma/leukemias in the last World Health Organization (WHO) classification 2022, and also in the International Consensus Classification (ICC). While HCL variant (HCLv) is among the subgroups of splenic B-cell lymphoma/leukemias with prominent nucleoli in WHO 2022 classification, it is a distinct entity as provisional under the splenic B-cell lymphoma/leukemias in ICC.[1,2] The classic and variant forms of HCL are considered separately, because the biological and clinical presentation of HCLv are quite different. Basically, BRAF mutation, a hallmark of HCL, is unavailable in HCLv, and HCLv is more aggressive and resistant to the conventional treatment compared to the classical variant.[1-3]

The accumulation of the mature-sized mature lymphocytes with hairy projections in the bone marrow, spleen and rarely extramedullary tissues, is the characteristic of HCL.[2-4] Although fatique and infection are encountered frequently at presentation of HCL, with the widespread health screenings mild pancytopenia has also emerged as an initial finding.[3,5] A trephine bone marrow biopsy examination is fundamental in the diagnosis of HCL.[2-5] Due to the indolent nature of the disease, patients with symptoms especially related to splenomegaly and with impaired hematological parameters that are either hemoglobin <11 g/dl or platelet count <100 000/µL or absolute neutrophil count <1000 µL should be treated.[2-4] The purine nucleoside analogs (PNAs) cladribine and pentostatin with rituximab constitutes first line treatment of HCL in recent years.[2-5] And novel agents such as vemurafenib, moxetumomab pasudotox, venetoclax and ibrutinib have come to use in relapse/refractory HCL patients.[2,4,5]

In this study, we aimed to review the clinical and treatment characteristics of classic HCL patients in the era of new developments in HCL.

## METHODS

This study was approved by the Scientific Researches Ethics Committee of Adana City Training and Research Hospital

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(Date: 15.01.2026, Decision No: 983). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This is a single-center retrospective study conducted at University of Health Sciences, Adana City Hospital, Hematology Department between January 2018 and August 2025. We evaluated the data of 40 patients with the diagnosis of classic HCL from the database of hospital records and included the patients who had adequate information about the diagnosis, past history and follow-up. So, the data of 33 patients were analysed. The data comprising age, gender, disease and treatment characteristics were recorded from the database of the hospital records.

We aimed to use response criteria according to Consensus Resolution.[3] However all the patients did not have bone marrow biopsy after the treatment. So we evaluated peripheral blood counts, and spleen size and when the patient fulfilled the criteria of at least partial response, it was accepted as response. The progression free survival was defined as the length of time from the date of treatment to the date of progression. The age groups were determined considering the age distribution of the cohort.

### Statistical Analysis

The data evaluation was made by IBM SPSS Statistics (version 24.0; IBM Corp., Armonk, NY, USA). Data were described as numbers and percentage or median and range, when appropriate. Kaplan-Meier and Cox regression survival analysis were used for survival analysis. The reverse Kaplan-Meier analysis was used for calculation of median follow-up duration. All p-values were 2-sided with statistical significance at 0.05 alpha levels.

## RESULTS

The clinical data of 33 patients is presented in Table 1. The median age of the patients at the time of diagnosis was 52 y (range, 33-76). Ten (30.3%) patients were female and 23 (69.7%) were male. The symptoms of the patients prior to the diagnosis were fatigue in 10 (30.2%) patients, bleeding in 2 (6.1%) patients, abdominal pain in 9 (27.3%) patients, flu-like symptoms in 2 (6.1%) patients, fever in 1 (3%) patient and 9 (27.3%) patients had no symptoms who were diagnosed due to abnormal complete blood counts during their rutin evaluation. The median hemoglobin was 9.7 g/dl (range, 6.5-15), white blood cell count was 2400x10$^3$/mm$^3$ (600-10700), neutrophil count was 560x10$^3$/mm$^3$ (range, 100-2800), monocyte count 100x10$^3$/mm$^3$ (range, 0-2300). Thirty-two (97%) patients had splenomegaly and 6 (18.2%) patients underwent splenectomy. The indication for treatment was constitutional symptoms in 11 (33.3%) patients, massive splenomegaly in 5 (15.1%) patients, anemia in 16 (48.5%) patients, thromboctopenia in 1 (3.1%), patient.

First line treatment was cladribine in 27 (81.8%) patients, rituximab-cladribin in 2 (6.1%) patients, interferon in 1 (3%) patient and splenectomy in 3 (9.1%) patients. The reason for splenectomy in 3 patients were; severe abdominal discomfort and massive splenomegaly in 2 patients and diagnostic purpose in 1 patient. Thirty one (93.9%) patients responded to the treatment and only 2 (6.1%) did not (Table 2). Those

**Table 1.** The patient characteristics

| Characteristics | No of patients (%) |
|---|---|
| Total | 33 |
| Age, year (range) | 52 (33-76) |
| **Age range, n (%)** | |
| <50 | 14 (42.4%) |
| 50-60 | 9 (27.3%) |
| >60 | 10 (30.3%) |
| Gender (F/M) | 10/23 |
| **Complaint of admission, n (%)** | |
| B symptom | 10 (30.2) |
| Abdominal pain | 9 (27.3) |
| Bleeding | 2 (6.1) |
| Flu-like symptoms | 2 (6.1) |
| Fever | 1 (3) |
| No symptom | 9 (27.3) |
| Hemoglobin, g/dl (range) | 9.7 (6.5-15) |
| White blood cell count, x10$^3$/mm$^3$, (range) | 2400 (600-10700) |
| Neutrophil count, x10$^3$/mm$^3$, (range) | 560 (100-2800) |
| Monocyte count, x10$^3$/mm$^3$, (range) | 100 (0-2300) |
| **Splenomegaly, n (%)** | |
| Present | 32 (97) |
| **Splenectomy, n (%)** | |
| Present | 6 (18.2) |

F: Female, M: Male

**Table 2.** The treatment characteristics

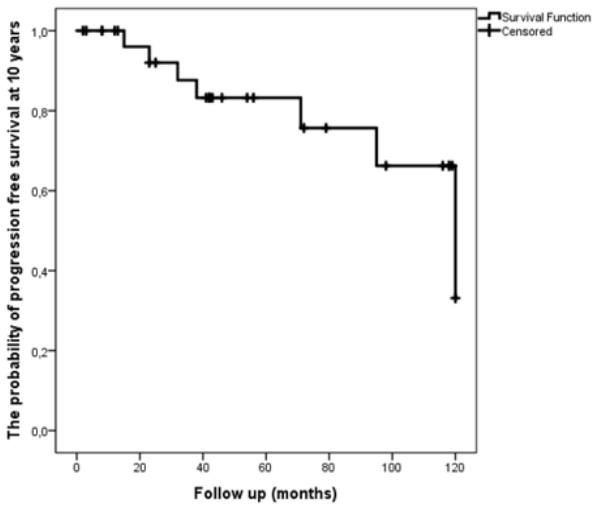
| | n=33 |
|---|---|
| **First-line treatment, n (%)** | |
| Cladribine | 27 (81.8) |
| R-cladribin | 2 (6.1) |
| Interferon | 1 (3) |
| Only Splenectomy | 3 (9.1) |
| **Response to the first line treatment, n (%)** | |
| Response | 31 (93.9) |
| Non-response | 2 (6.1) |
| **Progression after first line treatment, n (%)** | |
| Present | 8 (25.8) |
| Absent | 23 (74.2) |
| **Second line treatment, n (%)** | |
| Rituximab | 2 (20) |
| Cladribin | 1 (10) |
| R-cladribin | 4 (40) |
| No treatment | 3 (30) |

R-cladribine: Rituximab-cladribine

2 patients had been treated with cladribine. One of the non-responding patient had massive splenomegaly with the size of 32 cm. He underwent splenectomy followed by rituximab-cladribine treatment. And he is now in complete remission. The other patient was retreated with only rituximab and partial reponse was obtained

The median follow-up duration was 43 months. The progression was observed in 8 (25.8%) of 31 responding patients. Seven patients who progressed after the first line treatment, had been treated with cladribine and 1 had been treated with only splenectomy in the first line. After prgression; 3 patients did not get second line treatment voluntarily, 2 (20%) patients were applied only rituximab, 1 (10%) patient was applied cladribine, and 4 (40%) patients were applied rituximab-cladribine (Table 2). The probability of progression free survival (PFS) at 10 years was 33% (95% CI:119 (76.7-161.2)) (Figure 1). When the data is analysed according to the age groups of <50 y, 50-60 y and >60 y, the probability of PFS was 42.9%, 83.3%, 31.3%, respectively (p=0.096) (Figure 2). Also the patients were grouped

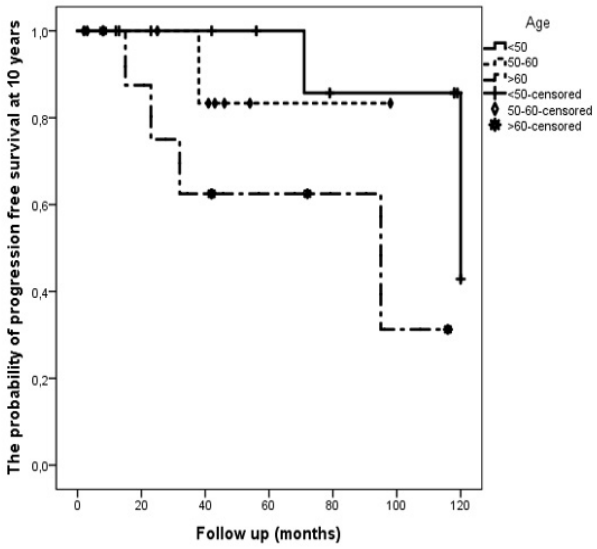
according to the age ≤60 y and >60 y; and the probability of PFS at 10 years were 40.8% v.s 31.3% (p=0.034) (**Figure 3**). The univariate analysis of the effect of age on PFS was not significant (p=0.057, OR: 0.192, 95% CI, 0.035-1.050) All the patients were alive at the end of follow up period, so median OS was not reached.




Number at risk

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 31 | 24 | 19 | 11 | 8 | 6 | 2 |
| | 0 | 20 | 40 | 60 | 80 | 100 | 120 |

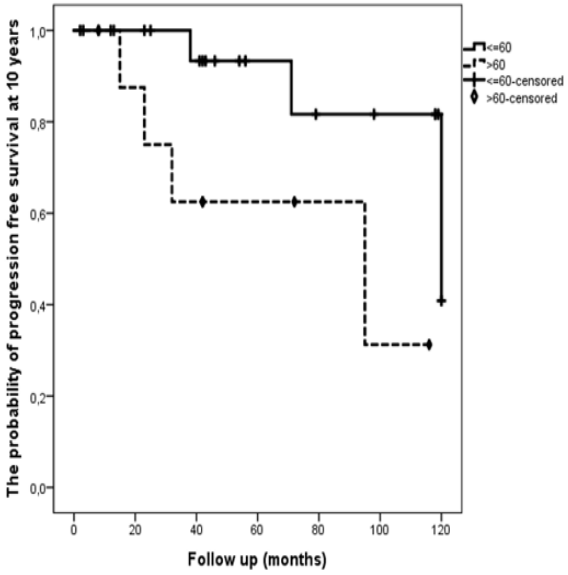
**Figure 1.** The probability of progression free survival of the patients at 10 years




Number at risk

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Age<50y | 13 | 10 | 9 | 7 | 5 | 5 | 2 |
| Age 50-60y | 9 | 7 | 5 | 1 | 1 | 0 | 0 |
| Age>60 y | 9 | 7 | 5 | 3 | 2 | 1 | 0 |
| | 0 | 20 | 40 | 60 | 80 | 100 | 120 |

**Figure 2.** The probability of progression free survival of the patients with age <50 y, 50-60 y and >60 y (p=0.096)




Number at risk

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Age ≤60y | 22 | 17 | 14 | 8 | 6 | 5 | 2 |
| Age>60 y | 9 | 7 | 5 | 3 | 2 | 1 | 0 |
| | 0 | 20 | 40 | 60 | 80 | 100 | 120 |

**Figure 3.** The probability of progression free survival of the patients with age ≤60y and age >60 y (p=0.034)

## DISCUSSION

Despite the enormous developments in targeted and immunotherapies in malignant disorders, PNAs has remained the mainstay of HCL treatment for a long while.[6-13] In this cohort as well, the majority of the patients (88%) were applied cladribine in the first line and additonally rituximab was added to the regimen in two of these patients. The response rate was over 90% in patients who took only cladribin that is in consistent with the previous literature.[6-13] However, the progression was observed in 25.8% of the patients, 7 of whom treated solely by cladribine. Moreover, PFS at 10 years was 33% which could not be ignored. The response rates to cladribin are fairly well which retains its priority in HCL treatment. However progression is the major concern in HCL patients treated by just cladribine.[6-8,10-13] Else et al.[6] focused on the favorable effects of obtaining CR on the relapse free survival. Also Broccoli, et al.[9] and Else et al.[13] showed that time to next treatment was better in patients achieving CR compared to patients with PR. Furthermore, achievement of MRD negativity after first line treatment was found to be related to longer relapse free and treatment free survival in HCL patients.[4,5,14] Hereby, first line treatment should be started with the intention of attainment deepest response. In recent years, addition of rituximab to PNA in the first line has provided the desired improvement in sustained responses in HCL.[2-5] The activity of rituximab was first tested as monotherapy in relapse setting however resulting in a modest efficacy.[15-17] Subsequently, rituximab was combined with PND in the treatment of relapsed HCL patients and demostrated to be more effective.[18,19] Eventually, rituximab-cladribine combination was given in the first line treatment of HCL providing more prononcued disease free survival which was an issue to be solved in HCL patients.[20-23] At this

point rituximab can be used concurrently or delayed after cladribine. Chihara et al.[22] demonstrated that concurrent use of rituximab with cladribine provided durable response compared to the delayed use of rituximab after cladribine. In our clinics, we started to apply rituximab and cladribine in the first line recently because of the health insurance payment terms.

In this cohort a notworthy point is the age distrubution of the patients that is, a significant portion of the patients (42.4%) were under 50 years and 30.3% were over 60 years. We also exhibited different PFS according to the age groups which was inferior in young and especially in older patients. Rosenberg et al.[12] investigated the outcomes of cladribine treatment in young HCL patients and found high rates of CR with durable responses. Hermel et al.[24] studied on elderly HCL patients and showed similar results of high CR rates with durable responses. However both studies did not have any other group as control opposite the age group they chose. It would make more sense to compare the treatment outcomes of young, old and middle age groups.

### Limitations

This study was retrospective with a relatively low number of patients which caused a remarkable limitation. Also, lack of adequate data about the bone marrow biopsies after treatment, encumbered to evaluate the CR rates.

## CONCLUSION

As a resut, cladribine was verified to be an effective treatment modality in HCL with high response rates. But, PFS was quite low at long term. With the introduction of rituximab-cladribine combination in the first line treatment of HCL, the real world data is required particularly for long term results. Another important point is the differences regarding PFS between age groups, exclusively poor results in older patients. From this point of view, when investigating the efficacy of a treatment modality in HCL, it would be more appropriate to evaluate the durability of response according to the age groups. Thus, administration of a treatment without a durable response would be prevented in elderly patients who are more fragile and prone to the toxicity of drugs.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

This study was approved by the Scientific Researches Ethics Committee of Adana City Training and Research Hospital (Date: 15.01.2026, Decision No: 983).

### Informed Consent

This retrospective study used pre-existing anonymized patient data. No additional intervention was performed, and there was no direct patient contact. The study was approved by the Ethics Committee, and the requirement for written informed consent was waived by the ethics committee.

### Peer Review Process

This manuscript was subject to external peer review.

### Conflict of Interest

The authors declare no conflicts of interest related to this study.

### Financial Disclosure

The authors received no financial support for the conduct or publication of this research.

### Author Contributions

Concept: ES; Design: ES; Control: ES, DD; Resources: NB; Materials: NB; Data Collection and/or Processing: ES, DD, BA, DYA, ZTK, ÇÜ, NB; Analysis and/or Interpretation: ES; Literature Review: ES, DD, BA, DYA, ZTK, ÇÜ, NB; Writing the Article: ES, DD; Critical Review: ES, DD, BA, DYA, ZTK, ÇÜ, NB.

## REFERENCES

1. Falini B, Martino G, Lazzi S. A comparison of the International Consensus and 5th World Health Organization classifications of mature B-cell lymphomas. *Leukemia*. 2023;37(1):18-34. doi:10.1038/s41375-022-01764-1
2. Troussard X, Maître E, Paillassa J. Hairy cell leukemia 2024: update on diagnosis, risk-stratification, and treatment-annual updates in hematological malignancies. *Am J Hematol*. 2024;99(4):679-696. doi:10.1002/ajh.27240
3. Grever MR, Abdel-Wahab O, Andritsos LA, et al. Consensus guidelines for the diagnosis and management of patients with classic hairy cell leukemia. *Blood*. 2017;129(5):553-560. doi:10.1182/blood-2016-01-689422
4. Mendez-Hernandez A, Moturi K, Hanson V, Andritsos LA. Hairy cell leukemia: where are we in 2023? *Curr Oncol Rep*. 2023;25(8):833-840. doi:10.1007/s11912-023-01419-z
5. Levy Yurkovski I, Tadmor T. Approach to hairy-cell leukemia in the new therapeutic era with special emphasis on age and comorbidities. *Acta Haematol*. 2026;149(4):477-486. doi:10.1159/000547722
6. Else M, Dearden CE, Catovsky D. Long-term follow-up after purine analogue therapy in hairy cell leukaemia. *Best Pract Res Clin Haematol*. 2015;28(4):217-229. doi:10.1016/j.beha.2015.09.004
7. Zahid MF, Mehdi MQ, Ali N. Outcome of hairy cell leukemia patients treated with cladribine - a 10-year single-center experience in Pakistan. *Hematol Transfus Cell Ther.* 2019;41(2):134-138. doi:10.1016/j.htct.2018.08.006
8. Biglari M, Kamranzadeh Foumani H, Bagherian M, Chahardouli B, Ghavamzadeh A. Retrospective evaluation of hairy cell leukemia patients: analysis of a long-term single center data. *Int J Hematol Oncol Stem Cell Res*. 2022;16(4):209-216. doi:10.18502/ijhoscr.v16i4.10878
9. Broccoli A, Argnani L, Nanni L, et al. The treatment of hairy cell leukemia with a focus on long lasting responses to cladribine: a 30-year experience. *Am J Hematol*. 2021;96(10):1204-1210. doi:10.1002/ajh.26287
10. Yılmaz F, Atilla D, Akkaş N, et al. Retrospective analysis of hairy cell leukemia patients treated with different modalities as first line: real-life experience over 20 years. *Indian J Hematol Blood Transfus*. 2019;35(4):692-698. doi:10.1007/s12288-019-01132-7
11. Dehghani M, Kashkooe A, Namdari N, et al. Long-term follow-up of patients with hairy cell leukemia in the south of *Iran*. *Expert Rev Hematol*. 2023;16(4):289-295. doi:10.1080/17474086.2023.2174520
12. Rosenberg JD, Burian C, Waalen J, Saven A. Clinical characteristics and long-term outcome of young hairy cell leukemia patients treated with cladribine: a single-institution series. *Blood*. 2014;123(2):177-183. doi:10.1182/blood-2013-06-508754
13. Else M, Dearden CE, Matutes E, et al. Long-term follow-up of 233 patients with hairy cell leukaemia, treated initially with pentostatin or cladribine, at a median of 16 years from diagnosis. *Br J Haematol*. 2009;145(6):733-740. doi:10.1111/j.1365-2141.2009.07668.x
14. Ravandi F, Kreitman RJ, Tiacci E, et al. Consensus opinion from an international group of experts on measurable residual disease in hairy cell leukemia. *Blood Cancer J*. 2022;12(12):165. doi:10.1038/s41408-022-00760-z
15. Nieva J, Bethel K, Saven A. Phase 2 study of rituximab in the treatment of cladribine-failed patients with hairy cell leukemia. *Blood*. 2003;102(3):810-813. doi:10.1182/blood-2003-01-0014
16. Leclerc M, Suarez F, Noël MP, et al. Rituximab therapy for hairy cell leukemia: a retrospective study of 41 cases. *Ann Hematol*. 2015;94(1):89-95. doi:10.1007/s00277-014-2175-0
17. Zenhäusern R, Simcock M, Gratwohl A, et al. Rituximab in patients with hairy cell leukemia relapsing after treatment with 2-chlorodeoxyadenosine (SAKK 31/98). *Haematologica*. 2008;93(9):1426-1428. doi:10.3324/haematol.11564

18. Else M, Osuji N, Forconi F, et al. The role of rituximab in combination with pentostatin or cladribine for the treatment of recurrent/refractory hairy cell leukemia. *Cancer*. 2007;110(10):2240-2247. doi:10.1002/cncr.23032
19. Else M, Dearden CE, Matutes E, et al. Rituximab with pentostatin or cladribine: an effective combination treatment for hairy cell leukemia after disease recurrence. *Leuk Lymphoma*. 2011;52 Suppl 2:75-78. doi:10.3109/10428194.2011.568650
20. Ravandi F, O'Brien S, Jorgensen J, et al. Phase 2 study of cladribine followed by rituximab in patients with hairy cell leukemia. *Blood*. 2011;118(14):3818-3823. doi:10.1182/blood-2011-04-351502
21. Chihara D, Kantarjian H, O'Brien S, et al. Long-term durable remission by cladribine followed by rituximab in patients with hairy cell leukaemia: update of a phase II trial. *Br J Haematol*. 2016;174(5):760-766. doi:10.1111/bjh.14129
22. Chihara D, Arons E, Stetler-Stevenson M, et al. Randomized phase II study of first-line cladribine with concurrent or delayed rituximab in patients with hairy cell leukemia. *J Clin Oncol*. 2020;38(14):1527-1538. doi:10.1200/JCO.19.02250
23. Marvin-Peek J, Jen WY, Kantarjian HM, et al. Long-term results of the sequential combination of cladribine and rituximab in hairy cell leukemia. *Leuk Lymphoma*. 2024;65(9):1325-1334. doi:10.1080/10428194.2024.2349700
24. Hermel DJ, Cheng B, Bhangoo MS, Burian C, Waalen J, Saven A. Long-term outcomes of elderly hairy cell leukemia patients treated with cladribine. *Ann Hematol*. 2022;101(5):1089-1096. doi:10.1007/s00277-022-04800-3